



Mid-term evaluation of the Global Strategy to Eliminate Yellow Fever Epidemics (EYE)

2017 - 2026



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2. Abbreviations and acronyms

AFR	WHO African Region
AFRO	WHO Regional Office for Africa
BMGF	Bill and Melinda Gates Foundation
CAR	Central African Republic
CDC	Centers for Disease Control and Prevention
COVID-19	Coronavirus disease 2019
CSO	Civil society organization
DRC	The Democratic Republic of the Congo
EHG	Euro Health Group
ELISA	Enzyme-linked immunosorbent assay
EMRO	WHO Regional Office for the Eastern Mediterranean
EPI	Essential Programme on Immunization
EQ	Evaluation question
EYE	The global strategy to Eliminate Yellow fever Epidemics 2017–2026
EYE.Ops	EYE operations team
FCV	Fragile, conflict-affected, and vulnerable
FGD	Focus group discussion
Gavi	Gavi, the Vaccine Alliance
GE+HR	Gender, equity and human rights
GESI	Gender, equity and social inclusion
GHS	Ghana Health Services
GLAI	Global Arbovirus Initiative
GNI	Gross national income
GPEI	Global Polio Eradication Initiative
HQ	Headquarters
HR	Human resources
HPV	human papillomavirus
IA2030	Immunization Agenda 2030
ICG	International coordinating group (on vaccine provision)
IFRC	International Federation of the Red Cross
IgM	Immunoglobulin M
IHR	International health regulations (2005)
IVB	Immunization, Vaccines, and Biologicals Department (WHO)
KI	Key informant
KII	Key informant interview
LAC	Latin America and Caribbean Region
LG	Leadership group (for the EYE strategy)
LTA	Long-term agreement
M&E	Monitoring and evaluation
MCV	Measles containing vaccine

MIC	Middle-income countries
MoH	Ministry of Health
MSF	Médecins Sans Frontières
MTE	Mid-term evaluation
NGO	Nongovernmental organization
NHP	Non-human primates
PAHO	Pan American Health Organization/ WHO Regional Office for the Americas
PCR	Polymerase chain reaction
PMG	Programme management group (of the EYE strategy)
PMVC	Preventive mass vaccination campaigns
PPE	Personal protective equipment
PRNT	Plaque reduction neutralization test
RAWG	Risk analysis working group
RfP	Request for proposal
RI	Routine immunization
RRL	Regional reference laboratory
RT-PCR	Reverse transcription polymerase chain reaction
RVC	Reactive vaccination campaigns
SAGE	Strategic Advisory Group of Experts on Immunization
SDGs	Sustainable Development Goals
SOP	Standard operating procedure
SWOT	Strengths, weaknesses, opportunities and threats
TAG	Technical advisory group
ToC	Theory of change
ToR	Terms of reference
UHC	Universal Health Coverage
UN	United Nations
UNAIDS	Joint United Nations Programme on HIV/AIDS
UNFPA	United Nations Population Fund
UNICEF	United Nations Children’s Fund
VPD	Vaccine-preventable disease
YF	Yellow fever
VDWG	vaccine delivery working group
WG	Working group
WHE	Health Emergency Programme (WHO)
WHO	World Health Organization
WS	workstream
WUENIC	WHO/UNICEF estimates of national immunization coverage
ZD	Zero-dose
ZIP	Zero-dose Immunization Programme

3. Executive summary

Background

In 2016, a widespread yellow fever outbreak in Angola, also affecting the capital city, caused unprecedented spread, affecting neighbouring countries with an urban outbreak in Kinshasa (in the Democratic Republic of the Congo) and viraemic travellers to Asia. The following year, yellow fever spread to coastal areas in Brazil including large urban centres that had not seen yellow fever outbreaks in several decades. In response to these outbreaks and the threat of international spread, the WHO, Gavi and UNICEF developed a comprehensive multi-partner global strategy to Eliminate Yellow fever Epidemics (EYE) 2017-2026. The EYE strategy has three overall strategic objectives, to:

- protect at risk populations;
- prevent international spread; and
- contain outbreaks rapidly.

Forty countries considered high risk for yellow fever outbreaks are targeted under the EYE strategy. This includes 27 countries in Africa and 13 countries in the Americas.

Purpose, objectives and methodology

The mid-term evaluation was included as a milestone in the EYE strategy, and in the WHO evaluation workplan 2022–2023 which was approved by the WHO Executive Board at its 150th session in January 2022. Undertaken in collaboration with GAVI and UNICEF by the WHO Evaluation Office working with the Regional Offices for Africa and the Americas, the evaluation was commissioned to a competitively selected independent company, Euro Health Group, in May 2022. The purpose of the mid-term evaluation was to assess the relevance, coherence, effectiveness, efficiency and sustainability of the strategy implementation to date and to review inclusion of gender, equity and human rights considerations. This included programme delivery aspects as well as strategy management and governance aspects.

The main objectives of the evaluation were to:

- document key achievements, best practices, challenges, gaps, and areas for improvement in the design and implementation of the strategy;
- identify the key contextual factors and changes that are affecting yellow fever spread and transmission risk profile, and influencing programme implementation; and
- make recommendations as appropriate on the way forward to improve performance and implementation, and to ensure sustainability in the future beyond 2026.

The overall approach to the evaluation was theory-based and included developing a theory of change for the EYE strategy. The theory-based evaluation was combined with a process evaluation, to look in detail at the implementation of the strategy to date.

This report presents findings for five high level evaluation questions (and 15 sub-evaluation questions) and related conclusions and recommendations based on a review of comprehensive datasets and more than 250 documents, 61 key informant interviews carried out at a global, regional and country level; and through a survey of 118 country level key stakeholders across 40 yellow fever high risk countries. In addition, several focus group discussions were undertaken as part of the evaluation (a theory of change workshop, a “strengths, weaknesses, opportunities and threats” analysis, and smaller group discussions with key stakeholders). To further document best practices and lessons learned for strategic actions under the EYE strategy, two country case studies were conducted with missions to Brazil and Ghana.

Analytical approaches comprised: triangulation of data (both across and within categories of data sources); thematic analysis (thematic coding and analysis of secondary documents, key informant interviews and focus group discussion notes); statistical analysis of key EYE M&E indicators and results of the online survey and contribution analysis.

The evaluation methodology was broadly implemented as proposed in the evaluation inception report, with no significant departures from the terms of reference. The timing of the data collection period - over the main holiday season (June-August 2022) - caused challenges related to availability of key informants and online survey respondents. Another limitation was related to the EYE M&E framework, data quality concerns and data gaps with few mid-term targets, missing baseline values, and unavailability of data from the Americas at the EYE secretariat level on several EYE strategic indicators.

Baseline data were reconstructed by the evaluation team using 2017 data from validated EYE data sources where available, and the evaluation relied on projections up to 2026 to establish mid-term targets. Examples of unavailable data and/or data quality concerns have been highlighted throughout the report where applicable. For the results/effectiveness evaluation question, the mid-term evaluation mainly considered progress on the 16 indicators prioritized by the EYE partnership as strategic indicators for the strategy. The evaluation did not consider performance across yellow fever medium- or low-risk countries because the EYE strategy implementation specifically targets the yellow fever high-risk countries.

Key findings

This section describes key evaluation findings structured according to the five high-level evaluation questions.

Evaluation question 1: How relevant was the EYE strategy at design phase and does it continue to be relevant? (Relevance)

Design

EYE was designed at a time of great urgency with large scale yellow fever outbreaks in Angola and the Democratic Republic of the Congo. The evaluation found the EYE structure, the EYE partnership and strategic objectives to be overall appropriate to the yellow fever context when EYE was designed in 2017. The strategic focus on achieving high immunity for yellow fever through preventive mass vaccination campaigns and routine immunization, promotion of vaccine availability/laboratory/diagnostics and surveillance and prevention of international spread were all relevant to the overall needs of countries to eliminate yellow fever epidemics. There is, however, scope to consider including approaches to embed and consolidate ownership at country level, and to identify actions to enhance gender, equity and social inclusion/human rights aspects, including targeted approaches for reaching vulnerable and high-risk populations.

The EYE M&E framework was extensive by first design and was modified over the first years to focus on fewer indicators. Yet, the evaluation noted limitations in relation to availability of data, particularly on strategic objective 2, for which key activities are yet to begin. The evaluation also noted limited monitoring by the EYE secretariat of data from the Americas on the 16 strategic EYE indicators as well as limited monitoring of disaggregated data. Overall, several M&E framework baseline values were missing, and some targets seem too aspirational. Milestones on M&E framework indicators and/or mid-term targets have generally not been defined. Moreover, the evaluation team noted some degree of uncertainty among key informants on what “eliminate yellow fever epidemics” exactly entails.

Costing

The EYE design included costing by strategic objective with clear assumptions, though, costing for human resources and communication appeared insufficient at only 1% of the total EYE budget. Key informants revealed that human resources for EYE implementation and communication products were relying mostly on in-kind support of partner organizations at all levels.

Involvement and endorsement

The strategy builds on a strong and comprehensive partnership with inputs of technical experts, vaccine producers and involvement of regions and selected countries, and the EYE strategy was endorsed early by relevant partners. However, the detailed roadmap to implement EYE in the Americas has not yet been endorsed and full involvement and ownership by high-risk countries and civil society organizations was less evident.

Adaptability

EYE requirements for flexibility and adaptability to a changing context were built into the design. To that extent, EYE governance structures were refined in 2019 and the M&E Framework was adjusted in 2020/2021. In addition, the partnership has evolved and improved with examples of enhanced alignment across disease areas. Operational changes and adaptations have also been implemented through various implementation framework documents, workplans, standard operating procedures, guidelines, and country toolkits developed to support implementation.

Nevertheless, the proposed actions and objectives of the EYE strategy document have not changed since 2017, and targets have remained the same, despite COVID-19 pandemic disruptions. New research findings are being monitored but have not yet been reflected in EYE core documents. Countries currently categorized as “moderate-risk” or “low-risk” for yellow fever have not recently been assessed for yellow fever risk levels, and the 40 high-risk target countries have not changed since 2017. With the mosquito vector spreading, climate change and outbreaks occurring, and with Gavi eligibility criteria affecting countries and their ability to fund yellow fever vaccines, there may be a need to re-assess risk levels of low- and moderate-risk countries, and to re-examine the prioritization of targeted high-risk countries in future design and funding decisions.

Evaluation question 2: To what extent was the EYE strategy implemented efficiently and coherently to maximize public health gains? (Efficiency and Coherence)

Management

The EYE strategy is managed through a multi-partner governance structure with clear articulation of global coordination/implementing bodies and their specific roles. The EYE governance entities (e.g., the EYE leadership group, the programme management group, the EYE secretariat and the various EYE working groups) have enabled good coordination of partner efforts and are well-functioning overall. However, there is scope to promote the leadership group as an actual decision-making forum. While there is a strong EYE governance structure at the global level, challenges at the regional level were observed as well as limited engagement from country level in governance structures and working groups. The lack of country engagement and their influence within the governance structure can be seen as a limiting factor in ownership, understanding, and commitment to the EYE strategic objectives at the country level.

EYE entities and partners have provided substantial coordination, technical assistance and direct support to the implementation of the EYE strategy, which has been well received by national governments in high-risk countries. Advocacy efforts, annual partners’ meetings and numerous communication products, including an impressive podcast series, have given more visibility to yellow fever, yet with room for broader dissemination of communication products, increased activity on social media and a perceived need to rejuvenate the commitments to the EYE strategy.

Scarcity of human resources at all levels was identified as the main impediment to successful implementation of the EYE strategy: e.g., at present there is a small, not fully equipped, EYE team composed of three full time staff in the EYE secretariat and three full time staff in the African region. Several EYE working group members are in full time positions with EYE engagement, adding to that workload. Gaps were noted on expertise related to gender, equity and human rights in the EYE secretariat. Despite this, the evaluation found appreciation of the efforts of a small but very dedicated EYE secretariat, as well as efforts of the EYE programme management group and working groups to drive strategy implementation forward.

At the regional level, in Africa and PAHO, the challenge of understaffing was even more pronounced, which limited their mandate to support countries for EYE implementation as the key link/bridge from global to the country level. Competing priorities for staff at the country level was further a limitation to timely implementation of the EYE strategy. Human resources challenges were exacerbated by the fact that only WHO have had dedicated external funding for human resources for EYE implementation, yet protracted recruitment processes for funded positions have been observed within WHO at the regional level. This under-resourcing of human resources affects both efficiency and effectiveness of implementation and have resulted in implementation delays.

EYE workplans are developed on an annual basis but with some delays in their approval and thus delayed onset of activities in the beginning of each year. EYE workplans are comprehensive and to some extent considered too ambitious given the human resources available to support their implementation.

Resource mobilization efforts have resulted in 19% of the total costs of EYE implementation for the period 2017-2026 being realized at mid-term. Although the cost of implementing the strategy was clearly spelled out and the realized contributions for EYE implementation by different international EYE partners have been documented, the levels of in-kind support required/invested have not been tracked. Tracking programmatic expenditures was also not prioritized. As a result, the evaluation team was not able to undertake concrete analyses of any duplication of efforts nor efficiency gains realized due to collaborative efforts among the EYE partners and other actors involved in immunization (including country governments).

Monitoring

Progress of EYE is being monitored closely with frequent updates to the EYE leadership group and the programme management group. Whereas updates to the programme management group have generally been detailed and presented trend data and country disaggregated data, information of progress presented to the leadership group (presentations and reports) are mostly in aggregate snapshot form or presenting activity status, thus limiting the mandate of the leadership group to perform due oversight and provide strategic direction to the programme management group.

Investments have been allocated to develop an EYE dashboard with impressive data visualization elements. However, the EYE dashboard and its prototype country profiles are not publicly available, which limits usability by country government stakeholders. Furthermore, documenting and disseminating best practices and lessons learned have not been prioritised sufficiently during the first six years of EYE implementation. That said, the EYE secretariat is working on a learning strategy which is anticipated to address this concern.

Partnerships, coherence and complementarity

The EYE partnership brings together strong international experts and partners with complementary skills, capacities, and experiences, but there have been limited opportunities, and in some cases a lack of capacity, to ensure or engage sufficiently in linkages and synergies with other programmes (for example to vector surveillance and control programmes, other vaccine-preventable disease programmes, health system strengthening efforts, international health regulations).

The March 2022 launch of the WHO Global Arbovirus Initiative notes complementarity with the EYE strategy, and EYE has been a contributor to the Global Arbovirus Initiative core team since its early inception phase. Alignment, cooperation, and efficiencies in joint working between IA2030 and implementation of the EYE strategy have been initiated. Despite integration efforts, yellow fever is still largely viewed as a vertical programme at global level with insufficient bonds to other relevant programmes/departments/initiatives and there is scope to improve coherence and collaboration to strengthen efficiency and maximize public health gains. This includes improving sense of ownership and entrusting accountability of various aspects and targets of the EYE strategy to such departments/initiatives/partners.

Several missed opportunities of fully synergising with the Immunization, Vaccines and Biologicals department of WHO and other vaccine-preventable disease programmes/ initiatives have been identified and include limited EYE presence in relevant IA2030 working groups; vaccination campaigns (including catch-up vaccination activities) for polio, measles and other vaccine-preventable diseases. This currently represents an underutilized platform for integrating yellow fever vaccination and “siloes” responses which could be leveraged for broader surveillance and vaccination activities.

It was found that Gavi does not cover additional operational costs for conducting multiantigen campaigns which may create a perverse incentive to conduct separate single-antigen campaigns since countries would then be entitled to operational costs for two campaigns. In addition, insufficient systems for sharing of data between related programmes/diseases persist. Recently, an ad-hoc EYE/IA2030 task team was formed to look at opportunities for improved integration of EYE within IA2030. The report from 2021 summarises several clear opportunities to be prioritized for implementation.

The evaluation also found inadequate efforts in terms of working across sectors (beyond the health sector), but opportunities exist which could be particularly relevant in humanitarian/ conflict situations. A significant number of yellow fever high-risk countries are experiencing some degree of conflict and/or fragility. Within such contexts, the risk of yellow fever outbreaks is elevated, but EYE activities addressing these challenges have been inadequate so far. The EYE partnership at global level has further only minimally engaged with civil society organizations and not yet engaged with extractive industries and other relevant sectors (such as the oil and mining industries, construction, agricultural and forestry sectors). This engagement was initially planned but due to limited human resource capacity these efforts have not yet been prioritized. Building working links at all levels with civil society organizations involved in vaccine/routine immunization activities or with hard-to-reach communities/conflict/humanitarian settings will strengthen reaching the last mile and improve efficiency as well as effectiveness. Engaging more with the private sector will further access to high-risk workers and enable tapping into corporate social responsibility efforts.









Evaluation question 3: What results have been achieved by the EYE partnership in the implementation of the strategy? (Effectiveness)









The threat of yellow fever outbreaks continues to affect countries in Africa and the Americas. As of August 2022, twenty-two yellow fever large disruptive outbreaks have been reported in the period 2017-2021¹ across 11 countries (9 in Africa and 2 in the Americas) of which some were in close proximity to urban centres with the inherent risk of international spread. Ongoing pockets of unimmunized vulnerable groups exist - even in contexts achieving high yellow fever coverage of vaccination efforts through routine immunization and campaigns. These vulnerable and high-risk groups include forestry, agricultural, mining and migrant workers, urban slum dwellers, mobile populations and residents of security compromised communities. Almost all recent yellow fever cases

¹ Non-consolidated data

from the Americas were found among male agricultural workers or those active in resource/extractive industries, whereas cases in African countries were more equally distributed across males/females and more cases were observed among infants in Africa than in the Americas.

A status overview by mid-term on the 16 strategic EYE M&E indicators is provided in the table below and subsequently briefly explained. It should be noted that large country variations were observed on almost all EYE strategic indicators as presented in the main report, thus warranting close monitoring of country disaggregated performance data by the EYE secretariat and regional structures.

Strategic indicators	Baseline	Status at mid-term	Target for 2026	Source	On-track status at mid-term
Strategic Objective 1- Protect at-risk populations					
1.1 Proportion of people vaccinated through PMVCs and RVCs in YF high risk countries (only African high-risk countries)	N/A	39%/185 M (2022)	100%/478 M	EYE dataset Aug 22	
1.2 Proportion of YF high risk countries achieving at least 80% routine vaccination coverage of the annual child cohort with YF vaccine*	Africa: 19% Americas: 50% (2017)	Africa: 22% Americas: 25% (2021)	100%	WUENIC 2021	
1.3 Proportion of YF high risk areas (Admin1) achieving at least 80% coverage via campaign completion	80% (2018)	43% (2021)	100%	Post campaign coverage surveys for PMVCs	
1.4 Proportion of YF high risk countries with multi-year national plan that includes YF activities	N/A	57%** (8 of 14) 86%	100%	EYE internal tracking files	
1.5 Proportion of YF high risk countries with a difference in immunization coverage between YF vaccine and MCV1 lower than 5%*	47% (16 countries of 34) (2017)	63% (22 countries of 35) (2021)	100%	WUENIC 2021	
Strategic Objective 2- Prevent international spread					
2.1 Proportion of relevant major industry employers engaged and implementation of YF industry guidance	N/A	N/A	100%	EYE internal tracking file	
2.2. Proportion of high-risk countries carrying out entry screening for YF vaccination proof on main airports and seaports, on travellers coming from endemic countries	36/40 (all but Argentina, Ecuador, Peru, South Sudan) (2017)	37/ 40 (all but Argentina, Brazil, Peru) (2021)	100%	ITH country list 2022	
2.3 Proportion of high-risk countries which have engaged IHR focal points to strengthen YF IHR capacity	N/A	N/A	40 (100%)	EYE internal tracking file	

2.4 Proportion of YF high-risk countries with yellow fever measures included in their preparedness, readiness, and response plans.	N/A	N/A	40 (100%)	EYE internal tracking file	
Strategic Objective 3 - Contain outbreaks rapidly					
3.1 Proportion of YF cases investigated within 2 weeks of index case notification	85% (2017) AFR only	89% (2021) AFR only	100%	AFR YFLN datasets	
3.2 Proportion of samples transported within 14 days from local level to national reference laboratory	97% (2017) AFR only	81% (2021) AFR only	100%	AFR YFLN datasets	
3.3 Proportion of IgM test results reported by national reference laboratories in YF high-risk countries within 7 days after receipt of blood specimen	41% (2017) AFR only	79% (2021) AFR only	100%	AFR YFLN datasets	
3.4 Proportion of samples transported within 5 days from national reference laboratory to regional reference laboratory	N/A	81% (2022)	100%	EYE Ops	
3.5 Proportion of positive YF cases referred for confirmation at regional reference laboratory (RRL) with results made available within 28 days from receipt of specimen (by RRL)	N/A	91% (2021)	100%	AFR YFLN	
3.6 Proportion of months during which the YF emergency stockpile is full	100% (2017)	100% (2021)	100%	ICG secretariat	
3.7 Proportion of YF outbreaks with RVCs starting within 86 days from onset of symptoms of first case	67% (2017)	50% (2021)	100%	EYE internal tracking files	

Abbreviations: YF: yellow fever; N/A: Not applicable; PMVC: Preventive mass vaccination campaign; RVC: reactive vaccination campaigns; AFR YFLN: African yellow fever Laboratory Network; M: million, MCV1: measles containing vaccine 1st dose; RRL: regional reference laboratory; IgM: Immunoglobulin M; IHR: International Health Regulations (2005); ICG: International coordinating group (on vaccine provision).

*Considering only countries that have introduced YF in RI, and French Guyana did not report in 2021

**Source: EYE internal tracking files

Notes:

Red, amber, green colour coding refers to a collected evaluation of progress to date on each indicator vis-a-vis baseline for 2017 and targets for 2026.

Baseline data was missing for almost all indicators in the EYE M&E framework, data has been added for 2017 according to analysis undertaken by the MTE.

Key achievements

Since inception of the EYE strategy in 2017, significant progress on some key EYE M&E indicators have been observed with 185 million people across African high-risk countries vaccinated for yellow fever by August 2022. Despite the pandemic, the milestone for 2022 is within reach if planned vaccination campaigns for 2022 materialise. In addition, through the EYE implementation period, the supply of vaccines for Gavi eligible countries increased by approximately 75% and less yellow fever vaccine stock outs have been reported at peripheral country levels. The International Coordinating Group (on

vaccine provision) emergency stockpile of yellow fever vaccine has further been maintained at 6 million doses since 2016 ensuring vaccines for outbreaks.

The gap between yellow fever vaccine and measles containing vaccine coverage through routine immunization programmes seems to be narrowing indicating that suboptimal coverage for yellow fever relates not as much to issues specific to yellow fever vaccination, but rather represents challenges associated to a weak health system and inferior general routine immunization programmes.

Major progress was noted in the African region on the time from onset of disease/suspected case to confirmatory results due to strengthened laboratory capacity, and a well-functioning international sample shipment transportation system (EYE.Ops, the operational arm of the EYE secretariat). In 2018, the average time from when the yellow fever specimen was prepared and until it was sent to regional referral laboratories was 79 days. In 2020, this had reduced to 18 days. Ongoing efforts at global level to enhance and simplify yellow fever diagnostics were also noted and could become “game changers” in the strive to eliminate yellow fever epidemics going forward.

Brazil has demonstrated rapid outbreak responses building on multifaceted surveillance systems (zoological, epidemiological and entomological surveillance) and successful coordination. There are further positive examples of studying and tailoring approaches to reach vulnerable populations and using community-based approaches from Ghana.

During the period of EYE implementation, no confirmed yellow fever case has been exported from yellow fever high-risk countries to non-endemic areas causing local transmission.

Key challenges and gaps

Despite the improvements stated above, several EYE M&E indicators are not on-track at mid-term. Below is a presentation of challenges and gaps organised per strategic objective.

Strategic objective 1. Protect at-risk populations

Persistent suboptimal routine immunization coverages for yellow fever vaccine, amongst other vaccine-preventable diseases, have been observed for several yellow fever high-risk countries since EYE inception (and decades before), and in many countries coverage rates worsened during the COVID-19 pandemic. These suboptimal coverage levels lead to growing immunity gaps and vulnerability to outbreaks. In addition, two yellow fever high-risk countries have not yet included yellow fever vaccine into routine immunization (Ethiopia and South Sudan) despite the urgency and several years of planning towards this. Kenya is also pending a scale-up of routine immunization to nationwide level. Funding availability, human resource capacity, inaccessible/hard to reach populations, COVID-19, data quality and community engagement/mobilization were identified as continuing challenges for general routine immunization programmes at country levels. Large country variations are however observed, and coverage rates have been further affected by a rapid population growth over the same period.

Several planned yellow fever preventive mass vaccination campaigns have been delayed. Such campaigns have reportedly been deprioritized due to other competing public health priorities, including COVID-19. Delays in their implementation were furthermore explained by: a lack of financial resources/funding and limited political commitment at country level, as well as (a fear of) lack of vaccines at country level. Additionally, funding proposal submissions to Gavi to support such campaigns have been pending for several high-risk countries including for Ethiopia, which in this case related to limited country commitments to Gavi co-financing requirements (for yellow fever vaccines in routine immunization programmes).

Post campaign coverage surveys of preventive mass vaccination campaigns indicate declining coverage levels, with vastly less campaigns reaching the target of 80% coverage since 2020. The COVID-19 pandemic is largely considered to have affected this deterioration. Over the last two years,

multiantigen campaigns (yellow fever vaccine combined with another antigen vaccine) have been implemented at scale in several high-risk countries, albeit with limited global/regional guidance and sharing of lessons learned between countries. Multiantigen campaigns might have contributed to the observed declining coverage levels as compared to single-antigen campaigns, however, an in-depth analysis is required to confirm this as well as determining aspects of data quality of the surveys over time.

The expected vaccine price increases, coupled with the limited number of pre-qualified vaccine suppliers, and a lengthy vaccine production, this warrants careful mitigation planning and forecasting by EYE. High wastage rates for lyophilized vaccines (which do not contain preservatives and need to be thrown away soon after opening according to the multi-dose open vial policy of WHO), were noted with examples found also for yellow fever vaccines.

Strategic objective 2- Prevent international spread

There has been little progress so far on planned EYE activities related to strategic objective 2 which includes strengthening international health regulations for yellow fever, engaging major industries/targeting at-risk workers, and developing urban readiness plans. The delayed start of these activities was mainly caused by inadequate human resources to support their implementation at all levels. The evaluation documented that porous borders, informal land-crossings, urbanization and increased human mobility/traveling all pose significant risks for international spread/exportation of yellow fever. The evaluation also noted that Argentina, Brazil and Peru do not require a yellow fever vaccination certificate from incoming travelers from endemic countries (as reported in 2021).

Strategic objective 3: Contain yellow fever outbreaks rapidly

While the proportion of outbreak response vaccination campaigns starting within 86 days has seen an increase since 2018 (but a decrease since 2017), the average number of days between index case and campaign start had increased. Further analysis found that a few countries with significant delays vastly contributed to this latter increase in the number of days to respond to an outbreak. Response delays noted during recent outbreaks mostly attributed to the time period from a notified yellow fever case until a request was submitted to the International Coordinating Group (on vaccine provision). Submitted requests were often of poor quality and several revisions of the requests were needed before they could be approved, which have contributed to these delays. Moreover, insufficient capacity of health care workers to identify yellow fever suspect cases, limited community-based surveillance and lack of point-of-care based testing remain a challenge to yellow fever detection and rapid containment of outbreaks and it is expected that many yellow fever cases may still go undetected. Furthermore, the average number of days between collection of specimen and receipt in the national laboratory had increased since 2017, with infrastructure for local sample transportation presenting major challenges in many countries. The most frequently cited obstacles to yellow fever surveillance included: funding challenges, insufficient supply of commodities, limited human resource capacity, inaccessible or hard-to-reach communities, and limited community engagement. Complex confirmatory diagnostic processes still cause delays in rapid detection and response in Africa, but new diagnostic tools in the pipeline are promising.

Contextual factors/changes that affected yellow fever spread and influenced programme implementation

Several externalities have affected EYE implementation. Hindering external factors for implementation of the EYE strategy included: competing public health priorities (in particular COVID-19), pre-existing weak and fragile health systems, insecurity and conflicts, climate change, large population sizes and population movements, urbanization, and decreasing funding for vaccine-preventable disease control in several countries from international donors. Enabling external factors for EYE implementation included pre-existing robust health systems, non-human primate “early warning system” (in the Americas), COVID-19 resources/infrastructure and the related global improved attention to threats of health emergencies.

Evaluation question 4. Has the EYE strategy developed plans/ identified a framework to secure funding or to otherwise ensure sustainability of achievements post-2026? (Sustainability)

The mid-term evaluation notes the absence of a substantial framework to ensure funding and sustainability of yellow fever/EYE achievements beyond 2026. Significant reliance on external support for the yellow fever response (especially in Africa) remains and threatens sustainability of ongoing efforts. At the same time the current EYE engagement strategy (funding and advocacy strategy) does not spell out a mechanism for sustaining gains through domestic financing and exiting from external finance over the long term. There are good examples from the Americas on increased domestic resource allocation for yellow fever interventions and a trend of increased co-financing of Gavi-supported vaccines was noted in Africa with several yellow fever high-risk countries planning to transition out of Gavi support in the near future. Yet few EYE countries have resource mobilization plans for yellow fever interventions in place and there are overall uncertain prospects of funding for yellow fever interventions from international development partners. Limited prioritization to track EYE expenditures compromises the ability to demonstrate efficiency and in turn determine the sustainability of efforts beyond 2026.

It has proved difficult to sustain momentum for implementation of the EYE strategy over the first six years, especially during COVID-19 and other recent external shocks. The evaluation found a general low prioritization of yellow fever interventions versus other competing priorities and limited political will for yellow fever - not least reflected in limited commitments towards domestic resource mobilization and postponement of planned preventive mass vaccination campaigns in many high-risk countries due to competing priorities. Evidence also indicated a lower-than-expected level of risk perception (for yellow fever outbreaks) among national health authorities and a tendency to focus on yellow fever mainly when outbreaks happen. More emphasis on prevention and sustainable strategies at country level is warranted in combination with enhanced communication of the risks related to yellow fever outbreaks and the cost-effectiveness of preventive yellow fever interventions.

The evaluation further found that as much as primary health care/system strengthening is the basis for IA2030, this emphasis is not as clear in the EYE strategy and its implementation. Furthermore, the EYE strategy and priorities are not yet represented in other comprehensive planning initiatives at global, regional, and national level (including clear alignment with Gavi 5.0 and focus on zero-dose and missed communities). EYE implementation linkages to WHO Urban Health Initiative, the International Health Regulations secretariat and the Global Arbovirus Initiative also need more exploration and specific activity descriptions. Such aspects are important issues to address for improved sustainability.

Introduction of yellow fever within routine immunization programmes in the remaining two yellow fever high-risk countries is also deemed crucial to sustainability. At present, Gavi has co-financing requirements only for routine immunization, and not for preventive mass vaccination campaigns. This may present as a disincentive for including yellow fever into routine immunization programmes for the few countries that have not yet introduced this. Additionally, chronic suboptimal coverage rates of routine immunization programmes across the majority of yellow fever high-risk countries threaten the gains of conducting large-scale yellow fever preventive vaccination campaigns. Catch-up vaccination activities are at present not systematically supported, but increasingly important due to re-emergence of yellow fever outbreaks in areas that previously benefitted from large-scale campaigns. Such catch-up activities could potentially benefit from an integrated approach with other antigens to establish platforms for more sustainable and coherent approaches.

Ensuring full engagement of communities and civil society in the implementation of the EYE strategy will further be important for sustainability, with good country level examples available under EYE

(e.g., from Ghana). Good examples also exist on integrating and synergizing with other disease programmes, and there is growing interest on integration aspects across the partnership.

Evaluation question 5. To what extent has the EYE strategy included and addressed gender, equity and human rights concerns to ensure that activities are consistently and meaningfully informed by considerations of overall equity?

There is limited explicit gender, equity and human rights narrative or sensitivity to such issues in the EYE strategy itself, yet wide acknowledgement by EYE partners that reaching 'vulnerable and marginalized populations' is a major challenge in implementation of the strategy. The design of the EYE strategy was not sufficiently informed by these issues despite such expertise existing within the EYE partnership (for example in the Immunization, Vaccines and Biologicals department in WHO with a gender focal point, and Gavi with a strategic focus on zero-dose communities and a specific gender strategy). In addition, the first and subsequent iterations of the EYE M&E framework also have little focus on such issues. Such lack of attention stands in contrast to many other immunization strategies and programmes developed at the same time as the EYE strategy.

Evaluation evidence suggests that equity is perceived as being primarily addressed through EYE implementation focus on high-risk countries and strategic objective 2. But there has been limited efforts, or not well-documented efforts, since EYE inception, to develop tailored strategies to reach highest risk and vulnerable populations with information, surveillance and vaccination services. This, despite the fact that recent yellow fever outbreaks have generally been observed in populations with existing immunity gaps (populations that had not been reached by large-scale vaccination campaigns/routine immunization services, people living in areas with compromised security, urban slums, and among hard-to-reach and mobile populations). A few exemptions at the global level include selected country tool cards developed by the EYE secretariat and the subnational risk assessment tool (full roll-out and scale-up still pending).

At country level, more experience and attention has been paid to gender, equity and human rights concerns – especially after recognizing immunity gaps. In Ghana for instance, implementation research on nomadic communities and their movement patterns, attitudes and barriers towards yellow fever vaccination and potential entry points for vaccination campaigns have provided important insights. Other country-level evidence of subnational campaigns and national actions that focus on high-risk groups/ hard-to-reach populations also exist. Yet, EYE partners are not optimally sharing data and documenting and disseminating best practices on reaching the last mile or working in complex environments. The implemented actions at country level provide entry points for course correction, and it will be important to integrate such actions and systematically apply a gender, equity and human rights focus in the implementation of the EYE strategy towards 2026. It will further be important for EYE to leverage fully on related initiatives of partners, for instance the Gavi Zero-dose Immunization Programme which aims to reach operationally complex contexts in eight yellow fever high-risk countries across the African region.

Conclusions

The above key findings have led to the formulation of 11 overall conclusions. Conclusions are grouped, using the evaluation criteria that underpin the five evaluation questions, in order to make clear how conclusions flow from the findings presented above.

Relevance

1. The EYE strategy and its planned actions were designed in a way that was overall appropriate and relevant to the needs, and with proper and comprehensive high-level and technical engagement and endorsement, yet with some identified gaps particularly related to gender, equity and human rights sensitivity, integrated approaches, targeted approaches to reaching

marginalized and vulnerable populations and the M&E framework, which need attention as the strategy moves forward.

2. The design of the EYE strategy incorporated a significant number of features and mechanisms allowing for course correction and adaptation to changing conditions. In practice, these mechanisms have been useful and facilitated operational changes. However, at a strategic level the EYE design and core documents have not adapted to emerging development with the same level of flexibility. Reflecting on needed adjustments/flexibilities in core documents of the strategy will be important. Adjustments should also consider re-examination of the prioritization of high-risk countries taking into consideration changing environmental and contextual factors coupled with future funding prospects from Gavi.

Efficiency and coherence

3. The EYE governance structure is strong at global level, however, full involvement and ownership of the strategy at the regional and country levels were less evident. Opportunities to relaunch the strategy and improve ownership and accountability prevail. Human resource challenges, including in governance structures, have severely constrained efficient implementation of the EYE strategy at all levels (global, regional, country) and there is compelling evidence to support revisiting human resource requirements for implementation of the strategy and scaling up staff at all levels for the remaining period of the EYE strategy.
4. EYE is built on a strong and comprehensive partnership, with inputs of technical experts, vaccine producers and involvement of regions and selected countries. EYE partners have complemented each other well and provided substantial coordination and technical assistance to support implementation of the EYE strategy. Despite collaboration and integration efforts, yellow fever is still largely viewed as a vertical programme at global level with insufficient bonds to other relevant programmes. Improved complementarity and synergy would be required with organisations, departments and teams working on vaccine-preventable diseases, urban health, health system strengthening, vector surveillance and control, and international health regulations to maximise effective use of resources. Stronger representation of civil society and the private sector in the EYE partnership would further enhance strategy efficiency and impact. At country level, integrated approaches are being implemented and several good practices exist.
5. Monitoring and reporting of the progress on strategic M&E indicators could be strengthened for improved oversight and enhanced accountability, which would also entail disseminating and discussing lessons learned and good practices more effectively for necessary course corrections.

Effectiveness

6. During the first six years of implementation, concerted efforts to address challenges and yellow fever risks including low population immunity levels, vaccine availability, diagnostic commodities and processes/capacity, yellow fever laboratory networks and international sample transportation have been undertaken successfully with important achievements observed at mid-term. However, yellow fever outbreaks continue to affect countries in Africa and the Americas, despite advances with EYE strategy implementation. Almost all recent yellow fever cases were found in high-risk workers or among vulnerable, mobile or hard-to-reach populations. Lack of vaccination and surveillance among these groups leads to accumulated risk of outbreaks and potential international yellow fever spread.
7. The identified challenges point to the urgent need to rolling out subnational risk assessments, conducting immunization gap analyses, and establishing guidance and funds for catch-up activities to reach high-risk and vulnerable populations (including adults) in the Americas and Africa and to strengthen routine immunization activities in general. Campaign surveys and

their quality also need attention as well as risk mitigation planning for a potential future supply stress of yellow fever vaccines. Strengthening of international health regulations at all borders and land-crossings, fast-tracking development of urban readiness plans and priority to targeting peri-urban and urban areas for risk-reduction services are deemed critical interventions for global health security. To ensure rapid containment of outbreaks, EYE should ensure: expanded use of community-based surveillance; simplified diagnostics in Africa; and multifaceted yellow fever surveillance systems (zoological, epidemiological and entomological surveillance) where applicable.

8. A number of cross cutting challenges to effective implementation of strategy activities further need to be addressed over the next four years. These include: human and financial resource gaps; low prioritisation of yellow fever interventions versus other competing priorities; limited community engagement; and data quality concerns.

Sustainability

9. Strengthening routine immunization programmes needs urgent attention and collaborative efforts across all EYE partners and beyond to ensure sustainable results and returns on the heavy investments of preventive mass vaccination campaigns.
10. Insufficient prospects of sustainable financing for yellow fever interventions threaten the gains achieved. In Africa, significant reliance on external support for the yellow fever response remains and attention to development and realization of resource mobilization plans for yellow fever interventions during the remainder of the strategy is critical. In addition, the uncertainty of commitments by international development partners (including the transition trajectory affecting some of the high-risk countries), places future yellow fever efforts in a complex position.
11. It should be possible to phase out the EYE strategy as planned by the end of 2026 if certain conditions are met. Such conditions include: i) expected targets on the number of people vaccinated for yellow fever in Africa achieved by the end of 2026, ii) substantial (human) resource allocation over the next four years, iii) investments into a strong advocacy push for increased country ownership and accountability, iv) mid-term evaluation recommendations to increase coverage levels of vaccination campaigns, reaching missed communities and maximizing on synergies/complementarity are successfully addressed, v) detailed preparation and identification of specific programmes/teams/ departments/partners/donors that could further support and integrate some of the EYE activities.

Recommendations

In total, eight high-level recommendations and related sub-recommendations are proposed based on evaluation findings and conclusions. A suggested prioritized list of specific recommended activities as well as more detailed sub-recommendations are provided under the recommendations section.

The first recommendation (human resources) is critical and urgent to address, because all following recommendations will depend on advances in addressing this recommendation. In the event this first recommendation is not addressed fully or timely, the evaluation team would recommend a complete revisiting of EYE targets (assessing if “elimination of yellow fever epidemics” would still be feasible at all), reducing EYE scope to focus on fewer countries and/or adjusting timeframes for EYE.

Recommendation 1: Address critical capacity requirements for effective implementation of the EYE strategy by reviewing resources available at all levels (global, regional and country) based on the experience of implementation up to the mid-term and engage in joint (WHO/PAHO, UNICEF, Gavi) resource mobilization efforts.

Sub-recommendations:

- a) Review human resource requirements and accelerate approval/recruitment processes
- b) Develop joint resource mobilization proposals for human resources to ensure dedicated funding for staff from all partner organizations (WHO/PAHO, UNICEF, Gavi) at all levels
- c) Ensure that gender, equity and human rights expertise is made available to the EYE secretariat.
- d) Expand regional implementation support teams in Africa and the Americas with potential support from Gavi senior country managers and other partners (Africa CDC, civil society organizations, etc.) as applicable.
- e) Streamline/integrate yellow fever into other work with related programmes/funding sources (for example, related to vaccine-preventable diseases, health emergencies, PHC, urban health, vector control) at country levels as applicable to the context, while ensuring clear staff performance indicators related to yellow fever for all relevant staff at the country level
- f) Track expenditures of EYE activities and human resources, and to the extent possible track domestic financing.
- g) Prioritize key interventions for the next two years of EYE implementation.

Recommendation 2: Relaunch the EYE strategy for renewed political commitment and increased attention from all stakeholders to YF and Global Health Security by developing strong business cases, organizing high-level events and disseminating advocacy and communication materials more broadly.

Sub-recommendations:

- a) Develop strong business cases for yellow fever interventions ideally in collaboration with other vaccine-preventable diseases/ vector control programmes etc.
- b) Engage in global/regional relaunch event(s) of the EYE strategy, building on lessons learned over the first six years of implementation to renew visibility to yellow fever.
- c) Disseminate developed EYE communication materials (podcasts, videos, EYE website etc.) more broadly and with targeted dissemination in PAHO.
- d) At the country level, conduct high-level advocacy efforts using the communication products and developed business cases (mentioned under a) above) to communicate the importance/urgency of yellow fever and to build country buy-in and political commitment while ensuring engagement of civil society organizations
- e) Engage, as an urgent step, Ethiopia and South Sudan to integrate the yellow fever vaccine into routine immunization by conducting high-level multi-partner (WHO/IVB, UNICEF, Gavi) advocacy efforts.
- f) Encourage yellow fever high-risk countries to include EYE strategy activities in their multi-year health sector plan and national immunization plan as well as their emergency preparedness plans/urban resilience plans (in contrast to developing a stand-alone plan for yellow fever).
- g) Explore engagement with municipalities for improved accountability for yellow fever interventions in urban centres/urban readiness plans.

Recommendation 3: Expand and diversify the EYE governance structure (coordination and decision-making bodies) and the EYE partnership for improved ownership, effectiveness and efficiency.

Sub-recommendations:

- a) Revisit the existing governance structures of the EYE leadership group, the programme management group and the working groups to include representatives of yellow fever high-risk countries as permanent members.
- b) Make better use of the leadership group as a strategic decision-making forum.
- c) Ensure inclusion across relevant working groups of relevant expertise on IHR, urban health, vector surveillance and control and gender, equity and human rights.
- d) Explore whether some of the existing EYE working groups would better fit under IA2030 working groups.
- e) Expand the EYE partnership to include additional private sector relevant partners/organizations.
- f) Expand the EYE partnership to further include/engage civil society at all levels.

Recommendation 4: Scale up the use of subnational risk assessments, conduct immunization gap analyses and implementation research of hard-to-reach communities and develop tailored outreach strategies to improve targeting of underserved, high-risk and vulnerable populations.

Sub-recommendations:

- a) Support the scale up of subnational risk assessments.
- b) Promote sharing of data and lesson learned between programmes.
- c) Engage in immunization gap analyses and support implementation research.
- d) Develop tailored gender and equity-responsive communication and outreach strategies and implement catch-up vaccination (including for adults) at the country level.
- e) In Africa, ensure alignment with and leveraging fully on the Gavi Zero-dose Immunization Programme (ZIP).
- f) Increase priority to targeting peri-urban and urban areas for urban preparedness planning and other risk-reduction efforts.
- g) Introduce a specific standing agenda/session on gender, equity and human rights aspects at annual EYE partners meetings.

Recommendation 5: Improve integration and synergies for maximum impact by: ensuring EYE representation in IA2030 structures; capitalizing on broader vaccine-preventable disease surveillance and vaccination efforts; and, at the same time, increasing linkages to vector control programmes and mapping other opportunities for multisectoral approaches.

Sub-recommendations:

- a) Implement identified opportunities from the recent EYE IA2030 task team report.
- b) Ensure that yellow fever is integrated in all relevant IA2030 and Gavi 5.0 implementation efforts and roadmaps.
- c) Review routine immunization normative guidance, standard operating procedures, health worker trainings, vaccine stocks etc. for strengthening yellow fever in routine immunization programmes in countries with low coverage of routine immunization or a coverage gap between measles-containing vaccine and yellow fever vaccine.
- d) Capitalize on activities and achievements of EYE strategy implementation for strengthening routine immunization.
- e) Leverage catch-up vaccination efforts by partners to close yellow fever immunity gaps.
- f) Gather and analyse data and lessons learned from conducting preventive mass vaccination campaigns and multiantigen campaigns, investigate reasons for declining coverage trends, and develop country guidance/toolkits on multi-antigen campaigns.
- g) Capitalize on broader vaccine-preventable disease surveillance and outbreak responses

- h) Tap into experience from the Americas and the Global Arbovirus Initiative including research on vector surveillance and control and modelling.
- i) Ensure strong linkages and synergies to the newly launched Global Arbovirus Initiative by ensuring EYE representation in governance structures of the Global Arbovirus Initiative.
- j) Investigate opportunities of working across sectors, further integrating yellow fever vaccination campaigns with humanitarian interventions.
- k) Consider investments in innovations including electronic immunization registries and strengthen implementation of international health regulations at land crossings and seaports.

Recommendation 6: Continue efforts to ensure robust supply chains, including clear mitigation plans to address risk of inadequate vaccine supply, and improve attention to surveillance and coordination for improved detection and faster response to outbreaks.

Sub-recommendations:

- a) Develop mitigation plans for a continued steady supply of yellow fever vaccines through 2026 and beyond.
- b) Focus on continued barriers to rapid detection and response (in-country transportation of samples, complex diagnostic processes in Africa etc.)
- c) Enhance integration efforts for supply chain improvements by building synergies with other programmes/strategies.
- d) Scale up community-based surveillance and coordinated multifaceted surveillance systems (human, epizootic, and entomological surveillance) where applicable.
- e) Assure good complementary actions and coordination between the EYE secretariat, regional offices, outbreak countries and outbreak response mechanisms of the International Coordinating Group (on vaccine provision).

Recommendation 7: Revise the EYE M&E framework and its monitoring approach before mid-2023 and address new research findings to guide and adapt implementation.

Sub-recommendations:

- a) Revise the M&E framework ideally before mid-2023, to include relevant, appropriately disaggregated targets, milestones and indicators with adjusted targets based on mid-term progress, and annual milestones.
- b) Finalize the suggested theory of change for EYE within the EYE partnership (proposed theory of change is available in Volume II – Annex 3) and align with the M&E framework.
- c) Ensure data from the Americas is monitored through the selected EYE strategic indicators in the EYE dashboard.
- d) Present M&E trend data systematically to EYE governance structures.
- e) Refine the M&E EYE dashboard to show progress against strategic EYE indicators in the existing prototype country dashboards and ensure public access.
- f) Ensure that M&E data drives action.
- g) Finalize and disseminate the EYE learning strategy.
- h) Monitor technical/scientific research findings closely and continuously consider any technical amendments/adaptations to the EYE strategy design, interventions and targets.

Recommendation 8: Develop a three-year “EYE transition and sustainability framework” for the period 2024-2026 to prepare for the end of the EYE strategy by 2026.

To effectively plan for this transition, it is recommended that a three-year “EYE transition and sustainability framework” be developed for the period 2024-2026. The framework should:

- a) Include a resource mobilization plan for yellow fever interventions through 2026
- b) Embed relevant yellow fever activities (for example, surveillance, vaccination campaigns, trainings, routine immunization) within IA2030.
- c) Prepare for integration of additional EYE activities into other initiatives
- d) Assess the possible need and resource implications for an EYE “lite” strategy beyond 2026 (or dedicated yellow fever prevention and control activities).
- e) Sharpen country planning and forecasting to address the increasing number of yellow fever high-risk countries that will transition out of Gavi support over time.
- f) Develop strategies to consolidate ownership of yellow fever interventions at the country level.
- g) Consider incentives to accelerate the completion of planned preventive mass vaccination campaigns before 2026.
- h) Revisit the list of the 40 yellow fever high-risk countries.

4. Introduction

4.1 Background

A little more than a century ago, yellow fever killed hundreds of thousands in the Americas, Africa and Europe. In the 19th century, mosquitoes were identified as the source of yellow fever transmission, and vector control programmes were introduced. Finally, in the mid-20th century a highly effective vaccine was developed. This vaccine is still used today and requires only one shot to achieve lifelong immunity.^{2, 3} Despite the availability of safe and effective yellow fever vaccines, yellow fever outbreaks are estimated to result in 109 000 severe infections and 51 000 deaths annually.⁴ Most cases of yellow fever however are mild and asymptomatic and will most likely go undetected.

In the early 2000s, an increase in outbreaks in West Africa led to the launch of the Yellow Fever Initiative.⁵ This initiative included the introduction of the yellow fever vaccine into routine childhood immunization programmes in endemic countries, mass preventive campaigns in at-risk areas, and the establishment of a global vaccine stockpile to permit rapid emergency mass campaigns in response to outbreaks. The initiative successfully eliminated yellow fever outbreaks in West Africa.

In 2016, a yellow fever outbreak in Angola caused unprecedented spread, affecting neighbouring countries with an urban outbreak in Kinshasa (in the Democratic Republic of the Congo (DRC)) and viraemic travellers to Asia. The following year, yellow fever spread to coastal areas in Brazil including large urban centres that had not seen yellow fever outbreaks in several decades. In response to these outbreaks and the threat of international spread, the World Health Organization (WHO), the Vaccine Alliance (Gavi) and United Nations Children’s Fund (UNICEF) developed a comprehensive multi-partner global strategy to Eliminate Yellow fever Epidemics (EYE) 2017-2026.⁶ The EYE strategy has three overall strategic objectives, to:

- protect at-risk populations;
- prevent international spread;
- contain outbreaks rapidly.

The EYE strategy includes a focus on implementing and strengthening coverage rates of childhood yellow fever vaccination, conducting yellow fever preventive mass vaccination campaigns (PMVCs), implementing yellow fever catch-up campaigns to close immunity gaps across under-protected age groups (including adults when relevant), and maintaining a yellow fever vaccine stockpile for reactive campaigns. In addition to recommending vaccination activities, the EYE strategy calls for building resilient urban centres, planning for urban readiness, strengthening the application of the International Health Regulations (IHR) (2005), monitoring risk profiles, and adapting to a changing yellow fever epidemiology. An efficient surveillance system and the control of international dissemination are essential pillars complementing population protection.⁷

² [Eliminate Yellow fever Epidemics \(EYE\) 2017 – 2026](#). Geneva: EYE Partnership; 2018.

³ [Staples JE, Bocchini JA, Rubin L, Fischer M](#). Yellow fever vaccine booster doses: recommendations of the advisory committee on immunization practices. *Morbidity and Mortality Weekly Report*. 2015; 64:647.

⁴ Gaythorpe K, Hamlet A., Jean K., Ramos D, Cibrelus L., Grske T. et.al. The Global Burden of Yellow Fever. *Elife*. 2021; 10:64670. doi: <https://doi.org/10.7554/elife.64670>

⁵ [Yellow fever initiative: providing an opportunity of a lifetime](#). World Health Organization; 2010.

⁶ [Eliminate Yellow fever Epidemics \(EYE\) 2017 – 2026](#). Geneva: EYE Partnership; 2018.

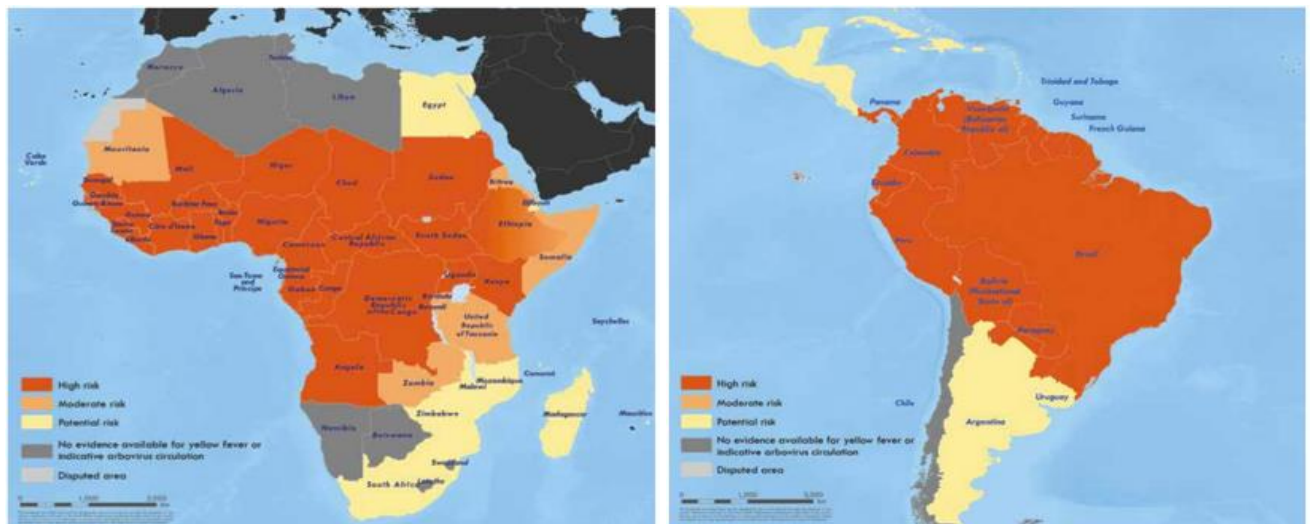
⁷ [Eliminate Yellow fever Epidemics \(EYE\) 2017 – 2026](#). Geneva: EYE Partnership; 2018.

The EYE strategy will only be successful if core activities are initiated immediately to provide cross-cutting support to the three strategic objectives achieved through strong partnerships and collaboration across agencies, disciplines and sectors. The strategy thus aims at building a global coalition of countries and partners to tackle the increased risk of yellow fever epidemics in a coordinated manner. These competencies of success are identified as follows in the EYE strategy:⁸

1. affordable vaccines and sustained vaccine market;
2. strong political commitment at global, regional and country levels;
3. robust governance of the project with strong partnerships;
4. synergies with other programmes and sectors;
5. research and development for better tools and practices.

Forty countries considered high risk for yellow fever outbreaks are targeted under the EYE strategy. This includes 27 countries in Africa and 13 countries in the Americas^{9, 10} (see Figure 1 below).

Figure 1. Yellow fever risk classification Africa and the Americas



Source: [Eliminate Yellow fever Epidemics \(EYE\) 2017 – 2026](#). Geneva: EYE Partnership; 2018.

A framework for implementing the EYE strategy in the WHO African Region (AFR) was endorsed by the WHO Regional Committee for Africa in 2017,¹¹ while a framework for implementation in the Region of the Americas was endorsed by the Pan American Health Organization (PAHO) technical advisory group (TAG) on vaccine-preventable diseases in 2017.¹²

⁸ [Eliminate Yellow fever Epidemics \(EYE\) 2017 – 2026](#). Geneva: EYE Partnership; 2018.

⁹ [A global coalition to protect 1 billion people against yellow fever](#). World Health Organization; n.d.

¹⁰ The 27 high-risk countries in Africa are: Angola, Benin, Burkina Faso, Cameroon, Central African Republic, Chad, Congo, Cote d'Ivoire, the Democratic Republic of the Congo (DRC), Equatorial Guinea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Liberia, Mali, Niger, Nigeria, Senegal, Sudan, South Sudan, Sierra Leone, Togo, Uganda. The 13 high-risk countries in the Americas are: Argentina, Bolivia, Brazil, Colombia, Ecuador, French Guiana, Guyana, Panama, Paraguay, Peru, Suriname, Trinidad and Tobago, Venezuela. ¹⁰ [Eliminate Yellow fever Epidemics \(EYE\) 2017 – 2026](#). Geneva: EYE Partnership; 2018.

¹¹ [Framework for implementing the global strategy to eliminate yellow fever epidemics](#) (EYE) 2017-2026 in the African Region. Brazzaville: WHO Regional Office for Africa; 2017.

¹² [TAG Meeting 2017: XXIV Meeting of the Technical Advisory Group \(TAG\) on Vaccine-preventable Diseases](#). Panama: Pan Health Organization & World Health Organization. 2017.

4.2 Rationale and objectives

The mid-term evaluation (MTE) was included as a milestone in the EYE strategy and in the WHO evaluation workplan 2022–2023¹³ and was approved by the WHO Executive Board at its 150th session in January 2022.¹⁴ Undertaken in collaboration with GAVI and UNICEF by the WHO Evaluation Office working with the Regional Offices for Africa and the Americas, the evaluation was commissioned to a competitively selected independent company, Euro Health Group, in May 2022. The purpose of the mid-term evaluation was to assess the relevance, coherence, effectiveness, efficiency and sustainability of the strategy implementation to date and to review inclusion of gender, equity and human rights considerations. This included programme delivery aspects as well as strategy management and governance aspects.¹⁵

The main objectives of the evaluation were to:

- document key achievements, best practices, challenges, gaps, and areas for improvement in the design and implementation of the strategy;
- identify the key contextual factors and changes that are affecting yellow fever spread and transmission risk profile, and influencing programme implementation; and
- make recommendations as appropriate on the way forward to improve performance and implementation, and to ensure sustainability in the future beyond 2026.

4.3 Scope and evaluation questions

The mid-term evaluation had both a summative component, which assessed progress of the strategy implementation; and a formative component, which focused on the way forward. Being a mid-term evaluation, focus was primarily placed on the formative and forward-looking aspects, aiming to generate learning that can be used to enhance implementation and programme performance, as well as to inform relevant discussions and decisions within the EYE partnership.

The temporal scope covered the period 2017 to mid-2022, and the geographic scope included global, regional and country levels. The country level included the 40 countries identified in the EYE strategy as yellow fever high-risk countries across Africa and the Americas. The evaluation did not consider performance across yellow fever medium- or low-risk countries as the strategy specifically and almost exclusively targets the yellow fever high-risk countries.

The analysis focused on assessing relevance, coherence, effectiveness, efficiency and sustainability of the strategy and its implementation to date as well as reviewing gender, equity and human rights (GE+HR) considerations. For the results/effectiveness evaluation question, the mid-term evaluation mainly considered progress on the 16 indicators prioritised by the EYE partnership as strategic indicators out of the more than 40 indicators of the EYE M&E framework. The technical thematic scope corresponded to the three strategic objectives of EYE and included: yellow fever protection of at-risk populations; prevention of yellow fever international spread; and containment of yellow fever outbreaks.

The five overall evaluation questions (EQs) and evaluation sub-questions are provided in Table 1 below and are addressed through a detailed set of key performance indicators (see full evaluation matrix in

¹³ [Evaluation workplan 2022-2023](#). World Health Organization. 2022.

¹⁴ [150th session of the Executive Board](#). World Health Organization. 2022.

¹⁵ [Evaluation workplan 2022-2023](#). World Health Organization. 2022.

Volume II - Annex 2). Note that evidence and information related to the last evaluation sub-question of each EQ (1.3, 2.3, 3.3, 4.3, 5.3) is used to inform the recommendations.

Table 1: Evaluation questions and sub-questions

EQ 1: How relevant was the EYE strategy at the design phase and does it continue to be relevant? (Relevance)
EQ 1.1 Was the design of the EYE strategy, its strategic objectives and its proposed actions relevant and appropriate to the prevailing needs at the design stage?
EQ 1.2 To what extent did the EYE strategy and its proposed actions adapt to changes over time?
EQ 1.3 Are there any design changes/adaptations that are indicated for the 2023-2026 period?
EQ 2: To what extent was the EYE strategy implemented efficiently and coherently to maximize public health gains? (Efficiency and Coherence)
EQ 2.1 To what extent has implementation of the EYE strategy been managed efficiently by the EYE governance structures (optimal use of resources for maximum impact)?
EQ 2.2 Has the EYE strategy taken advantage of complementarity of interventions and aligned with different global actors and strategies/initiatives to manage implementation efficiently?
EQ 2.3 Have there been any changes/adaptations indicated for the 2023-2026 period to promote efficient management, synergies and complementarity?
EQ 3: What results have been achieved by the EYE partnership in the implementation of the strategy? (Effectiveness)
EQ 3.1 To what extent is the EYE strategy on course to achieving its objectives and results at global level by the end of 2026?
EQ 3.2 Which external factors have influenced implementation of the strategy to date? (external to the EYE partnership)
EQ 3.3 Which potential amendments to the M&E framework and programming are warranted for the period 2023-2026 given the current status and experiences?
EQ 4: Has the EYE strategy developed plans/identified a framework to secure funding or to otherwise ensure sustainability of achievements post-2026? (Sustainability)
EQ 4.1 What are the indications of future financing of yellow fever elimination efforts?
EQ 4.2 What measures are being taken to ensure sustainability, including future integration with country programmes, and coherence with other programmes, disease areas and vaccination campaigns?
EQ 4.3 Which recommendations can be made in terms of increasing the sustainability aspects of yellow fever elimination goals?
EQ 5: To what extent has the EYE strategy included and addressed gender, equity and human rights (GE+HR) concerns to ensure that activities are consistently and meaningfully informed by considerations of overall equity?
EQ 5.1 Did the strategy <i>by design</i> consider and incorporate aspects of gender, equity and human rights?
EQ 5.2 Has attention been given to gender, equity and human rights considerations <i>during implementation</i> of the strategy?
EQ 5.3 Are any adjustments needed to fully address gender, equity and human rights concerns?

4.4 Methods

The overall approach to the evaluation was theory-based and included developing a theory of change (ToC) for the EYE strategy. The theory-based evaluation was combined with a process evaluation, to look in detail at the implementation of the strategy to date. This enabled us to assess relevance, effectiveness, efficiency, coherence, and sustainability aspects of the strategy, including its three strategic objectives, the proposed actions, milestones, outputs and outcomes.

The evaluation was undertaken in a participatory manner that fostered a strong sense of engagement in the process and ownership of the outputs. The entire evaluation was further designed and implemented in gender, equity, and social inclusion responsive manner. In close collaboration with WHO and key stakeholders from the EYE partnership a detailed ToC was developed which was applied

to guide our overall theory-based approach. The ToC was further refined during the evaluation process and the final proposed ToC for the EYE strategy is presented in Volume II- Annex 3.

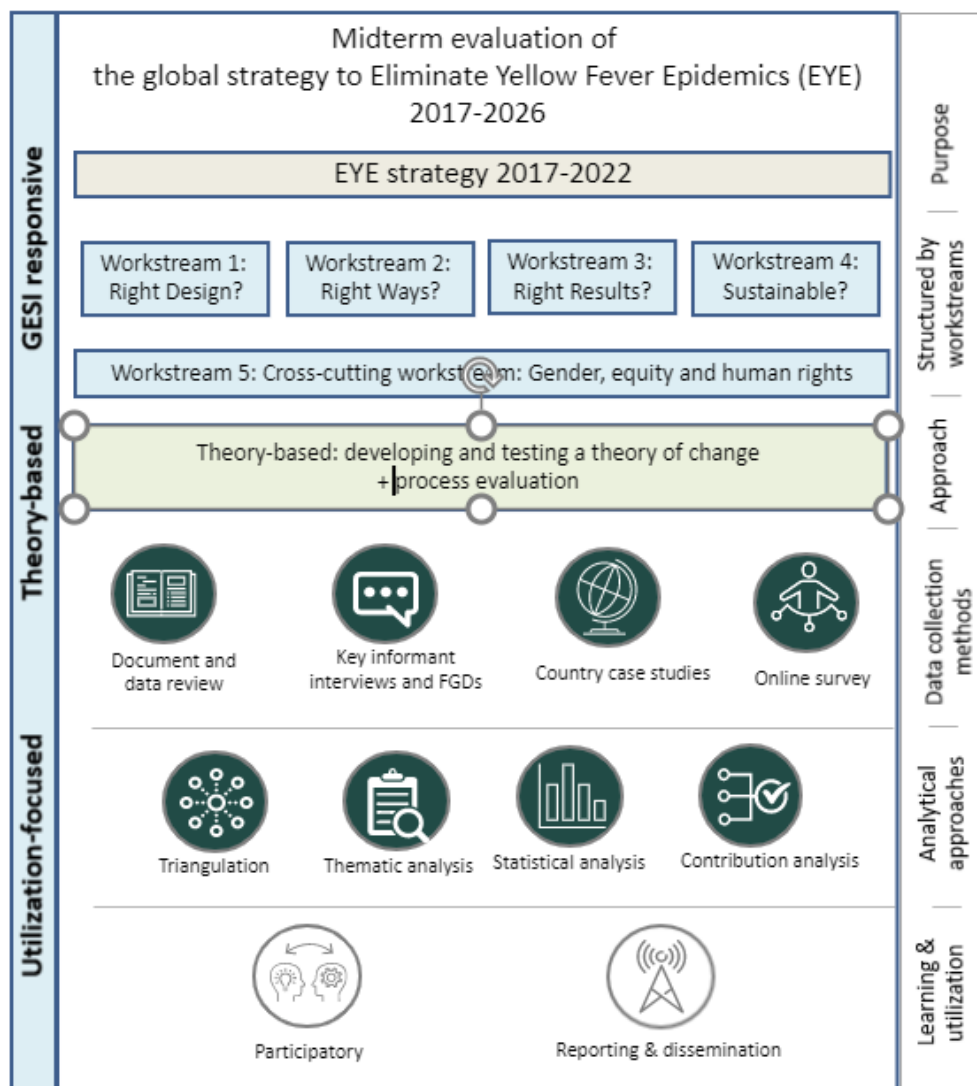
A mixed methods approach was applied combining qualitative and quantitative methods for data collection and analysis.

Data collection methods included: a comprehensive data and document review; key informant interviews and several focus group discussions (including a SWOT analysis, and additional smaller group discussions); country case studies in Brazil and Ghana; and an online survey for key stakeholders across the 40 yellow fever high-risk countries.

Analytical approaches comprised: triangulation of data (both across and within categories of data sources); thematic analysis (thematic coding and analysis of secondary documents, key informant interviews and focus group discussions notes); statistical analysis of key EYE M&E indicators and results of the online survey (applied to identify common patterns, trends and relationships); and contribution analysis (to demonstrate a “plausible association” between an intervention and observed outcomes).

An overview of the evaluation framework, including the overall approach, methods, data collection and analytical approaches is presented in Figure 2 below.

Figure 2. Evaluation approach



Notes to figure: FGD: Focus group discussion, GESI: gender, equity and social inclusion

The evaluation was initiated with a comprehensive secondary document review (more than 250 documents (see Volume II - Annex 8 for a list of reviewed documents) and a review and analysis of existing databases, data sets and data from the EYE M&E dashboard.

The document review was complemented and triangulated by collecting qualitative primary data including through key informant interviews. A stakeholder mapping was drafted during the inception phase to guide the final selection of stakeholders to be included as informants during the evaluation. A total of 79 individuals were invited to partake in the interview process with nominations based on suggestions from all EYE partners, the WHO evaluation office and the evaluation team. In total, sixty-one individuals¹⁶ were interviewed either individually or participated in small group discussions (two to three people) with males representing 72% of respondents and females 28% (proportion of the invited key informants were: 68% male and 32% female). Eight people did not respond to their invitation despite several follow ups, four chose to decline and six individuals did not join for the interview that was scheduled. Interviews were generally conducted virtually. The composition of the

¹⁶ In addition, a total of 19 interviews and 7 focus group discussions were conducted for the two country case studies in Brazil and Ghana

sample is presented below and the complete list of key informants is available upon request to the WHO Evaluation Office.

Additionally, a strengths, weaknesses, opportunities and threats (SWOT) analysis was conducted with key stakeholders from governance bodies of the EYE strategy (results provided in Volume II Annex 7)

Table 2: Overview of key informants interviewed for the mid-term evaluation

WHO				EYE key partner organizations		Other key stakeholders			
HQ	AFR	PAHO	EMR	Gavi	UNICEF	Vaccine manufacturers	Labs	CDC	Donors, academia and CSOs
15	14	7	2	3	6	2	3	1	8

*regional office and country offices in the region

Notes to the table: HQ: headquarters, AFRO: WHO Regional Office for Africa, PAHO: Pan American Health Organization/ WHO Regional Office for the Americas; EMRO: WHO Regional Office for the Eastern Mediterranean; Gavi: The Vaccine Alliance; CDC: Centers for Disease Control and Prevention (US); UNICEF: United Nations Children’s Fund; CSO: civil society organization

The online survey was administered to key yellow fever stakeholders¹⁷ in 40 yellow fever high-risk countries and resulted in 118 responses [43 women, 74 men and 1 other] out of 441 sampled, corresponding to a 27% response rate. Of the online survey respondents, 49% represented national authorities and 51% other agencies (30% WHO, 17% UNICEF, 4% others). Of the respondents, 70% were from the 27 high-risk countries of the African Region and 30% from the 13 countries of the Region of the Americas. The response rate from the Americas (44%) was higher than from African countries (22%). On average, three responses were received per country (ranging from one to six responses per country). In the African Region, the Democratic Republic of the Congo, Ghana, Niger and Nigeria were overrepresented with six respondents from each country. In the Region of the Americas, Brazil and Paraguay were overrepresented with seven and five respondents respectively. Despite the relatively low overall response rate (27%), the online survey provides insights into the views of stakeholders and of note is that almost half of the respondents represented national government institutions, mainly ministries of health (see Volume II - Annex 6 for the online survey questions and results).

Two country case studies with missions to Brazil and Ghana were conducted with the purpose of providing learning and documenting best practices on EYE implementation. The case studies were chosen based on 12 selection criteria (ranging from strong country commitments/ownership, improved surveillance, integrated vaccination campaigns, improved vaccination coverage etc. – Volume II Annex 2 shows the full set of criteria). After extensive input and consultations with key stakeholders, four countries were shortlisted and further discussed before Brazil and Ghana were selected on the premise that key learnings could be drawn from these two countries on important aspects of the strategy while representing two very different contexts. The final learning themes for the two countries were agreed upon through a collaborative process involving key country-level stakeholders. The country case studies included a document and data review, interviews with key informants (mainly face-to-face) and group discussions, as well as site visits to key areas within the countries, including at subnational levels. In total, 19 interviews with key stakeholders (five in Brazil; 14 in Ghana) were conducted, and seven focus group discussions (five in Brazil; two in Ghana) were held - the majority were conducted face-to-face. Reports were produced for each of the countries and are provided in Volume III and Volume IV.

¹⁷ Stakeholders included national health authority or other ministry or agency of government, WHO, UNICEF, other United Nation organizations multilateral or bilateral organization, development partner or foundation, non-governmental organization or civil society organization, other (opportunity for the respondent to indicate another organization, professional body, or institution)

Volume II - Annex 2 provides an elaboration of evaluation methods.

4.5 Limitations

The timing of the data collection period - over the main holiday season (June-August) - caused challenges related to availability of key informants and is assumed to have influenced the relatively low response rate (27%) to the online survey. With close and continuous follow-up, the initial target of interviewing at least 60 key stakeholders was met, with 62% of interviewees representing WHO/PAHO offices.

The online survey targeted a broad variety of stakeholders at the country level, which is also assumed to have compromised the response rate, nevertheless it is noteworthy that 49% of respondents were representing national health authorities. To increase response rates to the survey, Euro Health Group (EHG) sent three reminders and kept the survey open for almost two additional weeks beyond the original deadline. Due to the relatively low response rate, and the related risk of selection bias, quantitative data from the survey should be interpreted with caution. The evaluation team have used such results as indications of trends and perceptions and as triangulation points for other evidence sources.

Another limitation was the fact that there are few mid-term targets in the EYE M&E framework. Therefore, the evaluation relied on projections up to 2026 in most cases. Furthermore, data quality issues, missing baseline values and missing data on the M&E framework were observed. Baseline data were reconstructed by the evaluation team using 2017 data¹⁸ from validated EYE data sources wherever available. The evaluation team relied on the predefined 16 strategic indicators (prioritized by the EYE governance structures for monitoring EYE progress) to track performance, as the remaining M&E indicators had very limited data tracking. While countries of the Americas have detailed epidemiological data for yellow fever, extensive data on yellow fever surveillance and other data on yellow fever-related activities implemented, nine of the 16 EYE strategic indicators are currently not being monitored in their exact formulation for yellow fever high-risk countries in the Americas. This limited the evaluation team from including progress on these specific indicators. Instances of missing data and/or data quality concerns have been highlighted throughout the report where applicable.

Additionally, it is important to note that this evaluation did not make use of randomized sampling throughout data collection. Instead, the evaluation followed a strategy of purposive sampling with informants selected based on their ability to provide rich and diverse opinions and information. Introduction of selection bias was minimized through ensuring a diversity of informants, a relatively large number of informants/respondents, and by ensuring that saturation levels were met with very little new information emerging during the last interviews conducted.

While country case studies provided an opportunity to illustrate best practices and learnings from EYE implementation on specific priority areas in very different contexts, case studies were not intended to present a statistically valid sample and are not representative of all yellow fever high-risk countries.

The evaluation methods applied are generally prone to social desirability bias, by which respondents may distort information to present what they perceive as a more favourable impression. To mitigate the impact of this bias and to stimulate honesty and truthful answers, all informants including survey respondents were guaranteed confidentiality. Furthermore, triangulation was applied during the analysis to minimize this bias by comparing information across different categories of key informants, the document and data review and the survey results.

¹⁸ 2017 was an inception year for the EYE strategy with activities starting mainly in 2018

4.6 Organization of the report

The report is organized in the following way.

- section 4.0 presents the introduction;
- section 5.0 provides the evaluation findings organized by evaluation question and sub-question. For each evaluation sub-question, the key evaluation findings are provided in a summary box format followed by supporting evidence;
- sections 6.0 and 7.0 address sub-questions relating to the way forward and present the conclusions and recommendations of the evaluation.

5. Evaluation findings

The following section presents findings by evaluation question and sub-question derived through analysis and triangulation of various data sources. For each sub-question a summary box of main findings is presented followed by supporting evidence.

EQ1: How relevant was the EYE strategy at the design phase and does it continue to be relevant? (Relevance)

This evaluation question is addressed through two sub-questions. The first evaluation question relates to the relevance of the EYE strategy at design stage and the next sub-question explores the extent to which the strategy remained relevant through proper and timely adaptation.

5.1.1 Was the design of the EYE strategy, its strategic objectives and its proposed actions relevant and appropriate to the prevailing needs at the design stage? (EQ 1.1)

Summary box of key findings – EQ 1.1

- The EYE structure, the EYE partnership and the strategic objectives were overall appropriate to the yellow fever context when EYE was designed in 2017.
- The EYE strategy was designed at a time of great urgency with large-scale yellow fever outbreaks in Angola and the Democratic Republic of the Congo. The strategic focus on achieving high immunity for yellow fever through PMVCs and routine immunization, promotion of vaccine availability/laboratory/diagnostics, improved yellow fever surveillance, timely outbreak response, and prevention of international spread were all relevant actions to the overall needs of countries at design stage.
- The EYE strategy was endorsed at an early stage of implementation by relevant partners. The strategy is built on a strong and comprehensive partnerships, with inputs of technical experts and the involvement of regions and selected countries, yet full involvement and ownership by high-risk countries and civil society organizations (CSOs) was less evident
- By design, the EYE strategy mentioned the importance of synergizing with other programmes (for example, with vector surveillance and control programmes, other vaccine-preventable disease (VPD) programmes, health system strengthening efforts, IHR), however with limited opportunity and capacity to fully operationalize such through implementation.
- From a design point of view there is scope to enhance strategies that increase ownership at the country level as well as addressing gender, equity and social inclusion (GESI)/human rights aspects, including targeted approaches for reaching vulnerable, marginalized and high-risk populations.
- The EYE M&E framework was extensive by first design yet, there significant limitations were noted. Limitations pertain to: availability of data, particularly in relation to strategic objective 2, for which key activities are yet to begin, and limited monitoring of disaggregated data as well as data from the Americas on the 16 selected strategic EYE indicators. In addition, several M&E framework baseline values were missing, some targets were too aspirational, and milestones on M&E framework indicators and/or mid-term targets were generally not defined.
- The evaluation team noted some degree of uncertainty among key informants on what “eliminate yellow fever epidemics” exactly means, and whether one confirmed case can be defined as an “outbreak”. The definition of what constitutes a “yellow fever epidemic” and whether this equals a “large yellow fever disruptive outbreak” is not defined in the EYE strategy nor in the EYE communication strategy.

- The EYE design included costing by strategic objective with clear assumptions but costing for human resources and communication appears insufficient at only 1% of the total EYE budget. Key informants revealed that human resources for EYE implementation and communication products were relying mostly on in-kind support of partner organizations at all levels which were not reflected in the EYE costing exercise.

Involvement of partners and endorsement of the EYE strategy

The EYE strategy was designed at a time of great urgency with large-scale yellow fever outbreaks in Angola and the Democratic Republic of the Congo and imported cases among travellers to China. It was designed through consultations with partners and regions/countries, and with proper endorsement from the regions of Africa and the Americas.¹⁹

The EYE strategy was based on WHO's previous Yellow Fever Initiative of 2006-2014 and designed to target countries assessed to be at greatest risk for outbreaks of yellow fever. The classification of countries' risk was revised to account for criteria associated with the changing epidemiology of the disease such as environmental factors, population density and vector prevalence. In total, 40 countries (27 countries in Africa and 13 countries in the Americas) were considered to be at highest risk for yellow fever. In these countries, large scale access to adequate and potent yellow fever vaccines was deemed critical by partners involved at the EYE design stage to establish and maintain high levels of immunity among adult and childhood populations.²⁰

The strategy is a good example of a cross-agency partnership that has succeeded to some extent to add focus to the yellow fever agenda, especially at the global level. Key informants generally agreed that the EYE strategy was designed as an equal partnership among WHO, UNICEF and Gavi with involvement of other technical partners (for example, the United States' Centers for Disease Control and Prevention (US CDC)), funders (for example, the Bill and Melinda Gates Foundation (BMGF)), global experts, including advisors from the Robert Koch Institute, the Sealy Institute for Vaccine Science, Imperial College London, University of the Witwatersrand, and others. Private sector vaccine and diagnostics providers from affected regions were also involved from the beginning. Key informants working at the global level specifically expressed the view that the EYE strategy has helped partners to "speak with one language and move forward towards shared goals" and is a "joint technical and operational approach".

There was, however, limited evidence of involvement of CSOs in the design of the strategy (and in its governance structures), beyond the role of Médecins Sans Frontières (MSF) and the International Federation of the Red Cross (IFRC) in the International Coordinating Group (ICG) on vaccine provision and the inclusion of Agence de Médecine Préventive at the design stage.²¹ The evaluation team found even more limited evidence of involvement of representatives of national governments of high-risk countries at the EYE strategy design stage. The list of partners in the EYE strategy annex further includes only one national government representative (from the Ministry of Health in Brazil).²²

The EYE strategy was endorsed (before actual implementation started in 2017) by the Strategic Advisory Group of Experts on Immunization (SAGE),²³ and in 2017 the strategy was endorsed by the

¹⁹ [Framework for implementing the global strategy to eliminate yellow fever epidemics \(EYE\) 2017-2026 in the African Region](#). Brazzaville: WHO Regional Office for Africa; 2017.

[TAG Meeting 2017: XXIV Meeting of the Technical Advisory Group \(TAG\) on Vaccine-preventable Diseases](#). Panama: Pan Health Organization & World Health Organization; 2017.

²⁰ [A global strategy to Eliminate Yellow fever Epidemics \(EYE\) 2017 – 2026](#). Geneva: EYE Partnership; 2018.

²¹ CHAI and PATH are engaged at country level to support implementation (e.g., DRC).

²² [A global strategy to Eliminate Yellow fever Epidemics \(EYE\) 2017 – 2026](#). Geneva: EYE Partnership; 2018.

²³ [A global strategy to Eliminate Yellow fever Epidemics \(EYE\) 2017 – 2026](#). Geneva: EYE Partnership; 2018.

technical advisory group on vaccine-preventable diseases (in PAHO), and the WHO African Regional Committee, which designed regional frameworks for its implementation that were overall well-aligned with the EYE strategy.²⁴ There was reportedly general consensus among partners, including UNICEF and Gavi, on the strategic objectives and key actions.

The implementation of the strategy is overseen by the EYE secretariat, housed in WHO's Health Emergency Programme (WHE), with collaboration across other departments (for example, the WHO Immunization, Vaccines, and Biologicals Department (IVB)) and with key partners, particularly Gavi, UNICEF and CDC, participating in EYE working groups (WGs) and with appropriate representation in EYE governance structures.

Focus of the EYE strategy

Foundational documents for the EYE strategy include the global strategy to Eliminate Yellow fever Epidemics (EYE) 2017–2026,²⁵ and the EYE M&E Framework²⁶ (which was revised and finalized in 2020 in alignment with the strategic objectives and to meet emerging needs and requests of partners, reducing and refining the indicators).²⁷ Documents also include those focusing on delineating core partner roles and workplan priority areas,²⁸ the EYE governance structure, and others developed over time during implementation.

The strategy development process led to appropriate strategic objectives²⁹ and priority activities in order to meet the global and country needs to eliminate yellow fever outbreaks at the time. The strategy comprises the following three overall strategic objectives of countries.

1. Protect at-risk populations: (a) where risk is high, vaccinate everyone; (b) vaccinate every child; and (c) evaluate risk to prioritize resources.
2. Prevent international spread: (a) protect high-risk workers; (b) apply the IHR; and (c) build resilient urban centres.
3. Contain outbreaks rapidly: detect early, respond immediately.

The strategy had a strong focus on the African Region, which carries a relatively large burden of disease (reportedly 90% of yellow fever deaths occur in Africa)^{30, 31} and has endeavoured to align with country requirements in the African Region and the region of the Americas to address the need for outbreak response and prevention, inclusion in routine immunization and PMVC.

The programmatic focus of the EYE strategy is largely on yellow fever vaccination³² as the main response and elimination intervention, in line with academic work denoting that “yellow fever vaccination is the mainstay in controlling outbreaks”.³³ The evaluation team notes that more traction

²⁴ [Framework for implementing the global strategy to eliminate yellow fever epidemics \(EYE\) 2017-2026 in the African Region](#). Brazzaville: WHO Regional Office for Africa; 2017.

²⁵ [TAG Meeting 2017: XXIV Meeting of the Technical Advisory Group \(TAG\) on Vaccine-preventable Diseases](#). Panama: Pan Health Organization & World Health Organization; 2017.

²⁶ [A global strategy to Eliminate Yellow fever Epidemics \(EYE\) 2017 – 2026](#). Geneva: EYE Partnership; 2018.

²⁷ EYE Strategic M&E Framework [PowerPoint]. EYE Partnership; 2020.

²⁸ EYE M&E Update April [PowerPoint]. Bader J; 2021.

²⁹ EYE core partner agency roles [PowerPoint]. EYE Partnership; n.d.

³⁰ [A global strategy to Eliminate Yellow fever Epidemics \(EYE\) 2017 – 2026](#). Geneva: EYE Partnership; 2018.

³¹ [Yellow fever vaccine: Supply outlook](#). United Nations International Children's Emergency Fund; 2016.

³² [Yellow Fever](#). Centre for Disease Control and Prevention; 2022.

³³ Jean K, Hamlet A, Benzler J, Cibrelus L, Gaythorpe K, Sall A, et al. Eliminating yellow fever epidemics in Africa: Vaccine demand forecast and impact modelling. *PLoS Negl Trop Dis*. 2020; 14(5). doi: <https://doi.org/10.1371/journal.pntd.0008304>.

³³ Chen L & Wilson M. Yellow fever control: current epidemiology and vaccination strategies. *Trop Dis Travel Med Vaccines [Internet]*. 2020; 6:1. doi: <https://doi.org/10.1186/s40794-020-0101-0>.

in the design and workplans of the strategy have been gained in implementing PMVCs and reactive vaccination campaigns (RVCs) than on efforts to strengthen routine immunization and strengthen linkages with other vaccine-preventable disease programmes, primary health care, urban health and vector control.

The focus on rapidly achieving high immunity for yellow fever through PMVCs, particularly in Africa, is considered relevant given the yellow fever epidemiology, vaccine coverage and yellow fever risks. Implementing PMVCs are highly relevant activities, which, through modelling, studies have shown a substantial reduction in the number of yellow fever cases and related deaths. A recent publication estimated that approximately 10 000 (95% confidence interval: 6 000–17 000) deaths were averted in 2018 due to mass vaccination campaigns across 13 countries³⁴ of West Africa.³⁵

The vaccine availability/laboratory/diagnostics and surveillance components of the EYE strategy are also considered highly relevant due to the obvious needs for improved vaccine availability, surveillance, diagnostic capacity and a functioning lab network to ensure outbreaks are detected early and timely responded to. Prevention of international spread is further a highly relevant strategic objective of the strategy and is presented with clear actions proposed to protect high-risk workers, applying the IHR and building resilient urban centres.

The EYE strategy acknowledges that synergies with other programmes and sectors are key to success (one of five core success criteria of the strategy). Some key informants expressed concern that the strategy had not sufficiently addressed targeted and people-centred approaches for reaching vulnerable and high-risk populations. This presented as a limitation at the strategy design level, which could hamper eventual sustainability. The EYE strategy recommends that strategies are developed to ensure that high-risk workers (from oil and mining industries and other sectors such as construction and forestry) are protected, including by engaging relevant private industries. The EYE strategy, however, only mentions vulnerable populations in one sentence under the routine immunization section: “Special attention must be paid to reaching vulnerable, marginalized populations (for example, street children, displaced populations and refugees) and those living in remote areas.”³⁶ More information, activities or direction is not provided, and reaching these populations is not considered one of the key criteria to success in the strategy.

The initial EYE operational priorities were to resume the large-scale preventive mass vaccination campaigns and Gavi applications that had been on hold for a few years to increase population protection and respond to the increased yellow fever epidemics risk; and to enhance detection and confirmation capacity for faster outbreak response, while increasing and sustaining supply. More time and resources are expected to be dedicated to other critical elements of the EYE strategy such as urban risk and clinical management. There seems, however, to be disagreement within EYE governance structures on the extent to which EYE should prioritize vector surveillance and control activities. A few key informants noted that lately greater attention to vectors and the shifting patterns had been prioritized to enhance risk analysis and prediction of outbreaks, as well as mitigation planning, whereas others felt that this was not yet sufficiently addressed through the EYE strategy implementation. In relation to that, a key informant mentioned: “Patterns have changed, countries don’t even know what vectors they have in their backyard now.” On the other hand, some EYE governance members mentioned that vector surveillance as such should not be a priority for EYE.

Evidence indicates that the EYE strategy inadequately addresses gender, equity or human rights concerns in relation to elimination of yellow fever epidemics. Although the risk-based approach and selection of countries to be targeted for various interventions inherently addresses overall equity

³⁴ Gaythorpe K, Hamlet A., Jean K., Ramos D, Cibrelus L., Grske T. et.al. The Global Burden of yellow fever. *Elife*. 2021; 10:64670. doi:

³⁵ Burkina Faso, Benin, Cameroon, CAR, Cote d’Ivoire, Ghana, Guinea, Liberia, Mali, Nigeria, Senegal, Sierra Leone, Togo

³⁶ [A global strategy to Eliminate Yellow fever Epidemics \(EYE\) 2017 – 2026](#). Geneva: EYE Partnership; 2018.

concerns, the strategy includes only two direct references to equity (of vaccine supply and 'health equity', which remains undefined). There is limited indication of gender, equity and human rights (GE+HR) expertise being applied in the design of the strategy in 2016, yet before that time other global immunization actors had acknowledged and addressed the central importance of working on such issues.³⁷

The ultimate goal of the EYE strategy is to eliminate yellow fever epidemics by 2026. The strategy as such does not aim to eradicate yellow fever, which is not deemed possible due to the animal reservoir. Yet the definition of what constitutes a “yellow fever epidemic” and whether an epidemic equals a “large yellow fever disruptive outbreak” is not clear and is not defined in the EYE strategy nor in the EYE communication strategy. Whereas the phrasing of a “large yellow fever disruptive outbreak”³⁸ is clearly defined, some key informants mentioned that one confirmed yellow fever case can be regarded as an outbreak. In general, there seemed to be some uncertainty among some key informants on what “eliminate yellow fever epidemics” exactly means.

M&E framework for the EYE strategy

Although the EYE M&E framework was extensive by first design and was modified over the first years to focus on fewer indicators, gaps still exist and represents a limitation for the EYE partnership to review and course-correct. Several baseline values and some targets are missing and the large number of indicators (although reduced from initially 70 to 43³⁹) complicates tracking of progress, causes data gaps, and makes oversight of progress a very time-consuming task. In response to these limitations, 16 key strategic indicators were selected by EYE governance structures in 2020 to be monitored more closely. Yet data gaps still exist on these 16 indicators, particularly regarding strategic objective 2, preventing international spread (where planned activities are yet to commence). Moreover, data from high-risk countries in the Americas are only monitored for 7 of the 16 indicators. Most targets of the M&E framework are at 100% for the year 2026, which seems unrealistic for many indicators (see also Section 5.3.1). There were also generally no mid-term targets/milestones established for the EYE M&E framework in the design, except one milestone for 2022. The M&E framework is generally silent on the importance of monitoring disaggregated data, whether by sex, age, or place of residence. (See Section 5.5 for more information on the GESI/HR related aspects). Yet some data is reportedly available (sex, age or place of residency of all cases tested for yellow fever is available in the datasets down to “Admin 2” provided by the labs or as a consolidated file from the Incident Management Support Team) but are not analysed and monitored through the EYE M&E framework strategic indicators thereby making it difficult for EYE to closely track realities on the ground and analyse immunity gaps.

Costing of the strategy

The EYE strategy is clearly costed, linking targets with unit costs and also has clear assumptions⁴⁰. Of the estimated total cost of US\$ 4.704 billion, US\$ 2.284 billion (49% of the total estimated cost) was projected to be spent by the mid-term. Of these estimated costs, 99% was planned to be spent on strategic objectives and 1% on the investments that foster enabling factors (human resources, coordination, communication etc) (Table 3).

Within the strategic objectives, about 65% of the estimated cost (US\$ 1.48 billion) was projected for strategic objective 1: protecting at-risk populations (presumably defined as the general population in

³⁷ [The vaccine goal: Accelerate equitable uptake and coverage of vaccine](#). Gavi; 2019.

³⁸ Definition of a large disruptive outbreak of YF: more than 5 cases confirmed in symptomatic persons from a localized cluster in space and time in a known endemic area necessitating a large-scale reactive vaccination response OR > 1 cases confirmed from probable local transmission in a non-endemic area.

³⁹ EYE Strategic M&E Framework [PowerPoint]. EYE Partnership; 2020.

⁴⁰ EYE strategy costing excel sheet 2018

high-risk yellow fever countries) while 21% of the total cost was projected for strategic objective 2: preventing international spread and another 13% for strategic objective 3: containing outbreaks rapidly (See Table 3).

Table 3: Estimated projected cost of the EYE strategy to the mid-term and the share of priorities from the total cost

Estimated EYE strategy cost (US\$)						
	2017	2018	2019	2020	2021	Total estimated till mid-term
Strategic objectives						
1: Protecting at-risk population	257 854 568	291 484 492	308 910 168	303 720 515	322 535 059	1 484 504 802
2: Prevent international spread	95 645 327	96 228 480	97 543 498	98 135 933	98 732 895	486 286 133
3: Contain outbreaks rapidly	56 929 832	57 901 474	57 730 339	56 059 888	58 074 846	286 696 379
Subtotal	410 429 727	445 614 446	464 184 005	457 916 336	479 342 800	2 257 487 314
Enabling environment						
Staff	3 762 800	3 762 800	3 762 800	3 762 800	3 762 800	18 814 000
Communication and outreach	181 500	126 500	126 500	126 500	126 500	687 500
Activities	1 495 619	1 495 619	1 495 619	1 495 619	1 495 619	7 478 095
Subtotal	5 439 919	5 384 919	5 384 919	5 384 919	5 384 919	26 979 595
Total	415 869 646	450 999 365	469 568 924	463 301 255	484 727 719	2 284 466 909
Estimated EYE strategy cost (% share of strategic objectives and enablers)						
	2017	2018	2019	2020	2021	Total estimated till mid-term
Strategic objectives						
1: Protecting at-risk population	62%	65%	66%	66%	67%	65%
2: Prevent international spread	23%	21%	21%	21%	20%	21%
3: Contain outbreaks rapidly	14%	13%	12%	12%	12%	13%
Subtotal	99%	99%	99%	99%	99%	99%
Enabling environment						
Staff	0.9%	0.8%	0.8%	0.8%	0.8%	1%
Communication and outreach	0.0%	0.0%	0.0%	0.0%	0.0%	0%
Other activities	0.4%	0.3%	0.4%	0.4%	0.4%	0%
Subtotal	1.3%	1.2%	1.1%	1.2%	1.1%	
Total	100%	100%	100%	100%	100%	100%

Source: EYE strategy costing excel sheet 2018, EYE_CO_Costing_SummaryTables_Only_13April2018

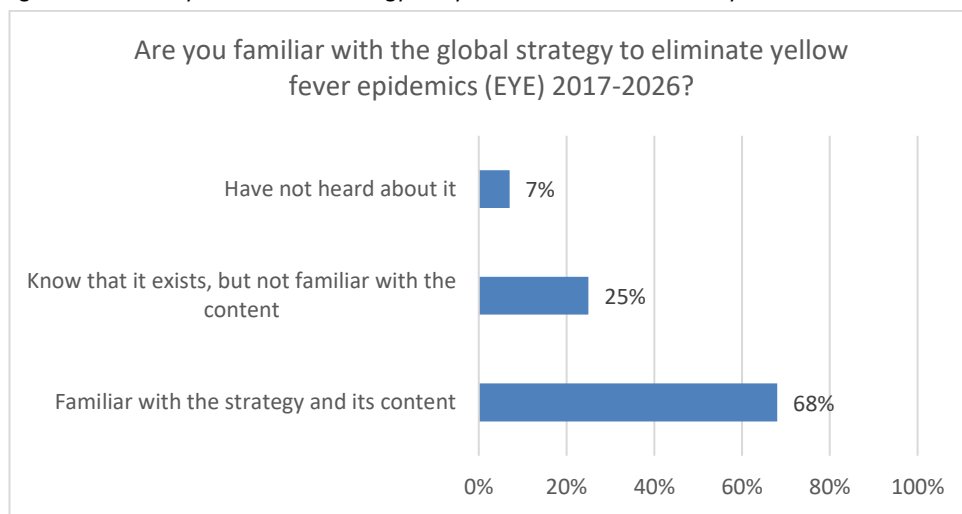
Despite clear costing by strategic objective with relevant budget assumptions, some concerns prevail. The human resources cost component to enable oversight of, and to push forward, EYE implementation appears insufficient with only 1% of total costs dedicated. This is due to the cost estimation method used in which in-kind support from the partnership organizations and at various levels were not included. Human resource capacity and communication efforts for EYE implementation

has to a large extent relied on in-kind support - most often tapping into in-house capacity within the partnership organizations including at country office levels. In addition, governments allocate staff for yellow fever work, and communication activities take place for EYE implementation in high-risk countries. All these carry substantial costs which were not included in the cost estimation.

Awareness and relevance of the strategy at country level

There was a reported lack of country involvement at the design phase, with only a few selected high-risk countries actively engaged in the EYE strategy formulation. The results of the MTE online survey disseminated to key yellow fever stakeholders at country level highlight some potential gaps in the involvement and/or dissemination of the global strategy at country level. Although most respondents - 80 of 118 (68%) – replied that they were familiar with the EYE strategy and its contents, 30 (25%) said they knew the strategy existed, but that they were not familiar with the contents, and 8 (7%) replied that they had never heard of the EYE strategy (Figure 3).

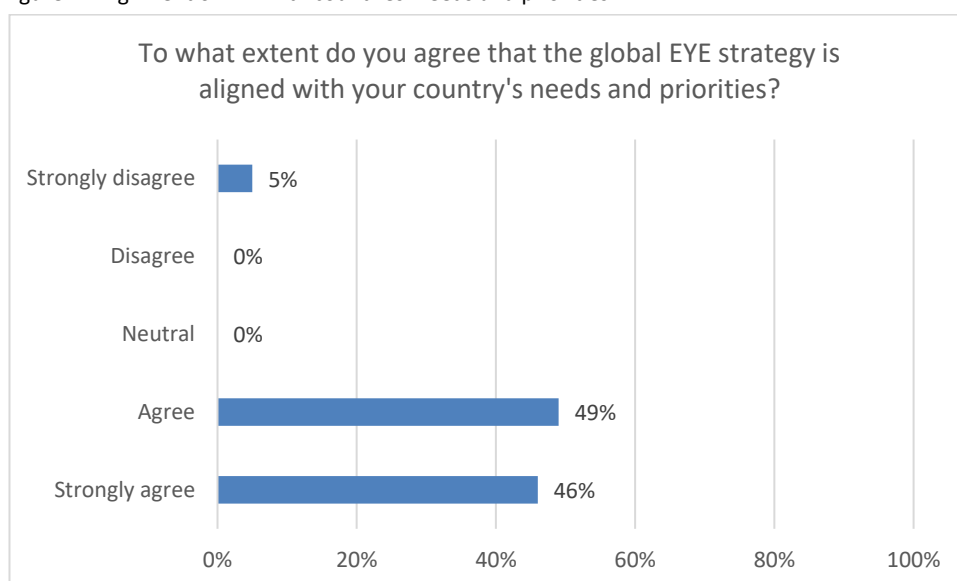
Figure 3: Familiarity with the EYE strategy – key stakeholders at the country level



Source: MTE online survey Q4

Yet, of those respondents who were familiar with EYE content, 75 of 79 (95%) agreed or strongly agreed that EYE was aligned with country needs and priorities, thus generally supporting the finding that the strategy had a good alignment with country needs and priorities. Only 4 of 79 respondents (5%) strongly disagreed with this statement of which two respondents were from the African Region and two from the Region of the Americas (Figure 4).

Figure 4: Alignment of EYE with countries' needs and priorities



Source: MTE online survey Q5

5.1.2 To what extent did the EYE strategy and its proposed actions adapt to changes over time? (EQ 1.2)

Summary box of key findings – EQ 1.2

- The EYE partnership has evolved but not significantly changed in composition since the launch in 2017. EYE governance structures were refined in 2019 and the partnership has evolved and improved, including through work together on the leadership group (LG), working groups and the programme management group (PMG) with examples of enhanced alignment across disease areas. Some members of the EYE partnership see a need for additional partners in the future to bring more funding, diverse experience and human resources to fast-track EYE implementation.
- EYE requirements for flexibility and adaptability to changing context were built into the design which allowed for operational changes and adaptations through various implementation framework documents, workplans, standard operating procedures, guidelines, and country toolkits developed to support implementation and correct course.
- At the more strategic level, less adaptation was observed. The EYE strategy document, its proposed actions and objectives have not changed since 2017. The M&E framework was adjusted in 2020/2021, but targets have remained the same, despite the coronavirus disease (COVID-19) pandemic disruptions. The detailed roadmap to implement EYE in the Americas is still only available in a draft version and new important research findings are being monitored but have not yet been reflected in EYE core documents. Finally, the 40 high-risk target countries have not changed since 2017, although with the mosquito vector spreading and outbreaks occurring, and with Gavi eligibility criteria affecting countries and their ability to fund yellow fever vaccines, there may be a need to re-examine the prioritization of high-risk countries and areas in future design and funding decisions.
- The evaluation identified the following challenges to adapt and correct course: The lack of resource tracking to ensure course corrections were feasible and funded; Insufficient monitoring of data disaggregated by gender, age and other relevant parameters, hindering potential adjustments that may be required for the needs of these population groups; Monitoring and evaluation trend data on the 16 EYE strategic indicators not being systematically presented to the EYE leadership group; and generally limited country disaggregation to gauge outlier countries.

Adaptations of EYE governance structures and the EYE partnership

Changes and developments in regard to EYE governance structures have been noted, the EYE partnership has evolved but not significantly changed in composition since the launch in 2017. The EYE governance structures were reviewed and revised in 2019 to enhance EYE management and attainment of the goals by: reinforcing regional collaboration and coordination; elevating the EYE leadership group to ensure they had decision-making power; streamlining the EYE programme management group to focus on programme management decisions; enhancing the EYE working groups' structure and objectives, and ensuring they were well differentiated from the task teams; and creating the vaccine delivery working group (VDWG) to “ensure better linkages to strengthening the delivery of yellow fever vaccine as part of the nine months/two year of life platform”.⁴¹ The evaluation finds that these changes were sound, based on evidence and introduced with an effort to optimize implementation of the strategy and reach the set targets. Partners further note that the collaboration of EYE partners has improved over time. Some members of the EYE partnership see a need for additional partners in the future to bring more funding, diverse experience and human resources to EYE efforts and to fast-track implementation.

Flexibility and adaptability of the EYE strategy, core documents and priorities

The EYE strategy document of 2017 included language related to ensuring flexibility/adaptability and incorporated new features that facilitated course correction and adaptation: “Risk and priorities for implementation of the strategy will be reviewed annually by the EYE leadership group... as risk changes, immunization activity priorities will need to be adjusted accordingly.”⁴² There are built-in flexibilities in the EYE structure (and budgeting) given its lack of fixed budget line items and detailed activity costings and given the focus on risk assessment and mitigation and continuous work of EYE technical experts including modelers.⁴³

In practice, these mechanisms have been useful for initiating operational changes. Implementation adjustments and tools have included EYE workplans, country impact assessments, standard operating procedures, country toolkits, and other implementation efforts that have been developed and enhanced to adapt and adjust over the last six years. Risk modelling and risk assessments became a core activity to gauge and adapt EYE priority activities; with the EYE risk analysis working group RAWG acting as technical advisors. Tools were developed for decisions to address risk and vaccine allocations, preparedness planning with countries, yellow fever vaccination campaign prioritizing, and others. The EYE RAWG conducts regular risk assessments of the 27 high-risk countries in Africa, using a “validated national risk assessment tool to help inform vaccine allocations for the coming year”.^{44, 45} It measured changes in risk in the African countries from 2020 to 2021, assessing that the risk score changes were fairly minor in that period.⁴⁶ According to national risk scoring, a few countries had a decreased score between 2020 and 2021, whereas a much larger number of countries had an increased risk score during that period, particularly in West African countries, but also noteworthy in Ethiopia.

There has reportedly been some enhanced integration across disease areas (to economize and optimize the use of limited resources)⁴⁷ and aligning efforts with the Immunization Agenda 2030

⁴¹ EYE Governance Structure [PowerPoint]. EYE Partnership; 2019.

⁴² [A global strategy to Eliminate Yellow fever Epidemics \(EYE\) 2017 – 2026](#). Geneva: EYE Partnership; 2018

⁴³ [A global strategy to Eliminate Yellow fever Epidemics \(EYE\) 2017 – 2026](#). Geneva: EYE Partnership; 2018.

⁴⁴ RAWG YF Country Risk Assessment Scores [unpublished report]. World Health Organization; 2020.

⁴⁵ The RAWG measures key variables indicating yellow fever risk, including YF levels/activity, epidemic potential, and YF vaccination/population coverage level, and classifies countries as high-, moderate, and low-risk.

⁴⁶ RAWG YF Country Risk Assessment Scores [unpublished report]. World Health Organization; 2020.

⁴⁷ [Episode 10: The Road to 2026](#) [audio file]. EYE Partnership; 2021.

(IA2030),⁴⁸ the Global Arbovirus Initiative (GLAI), Gavi 5.0,⁴⁹ and other global initiatives (see further detailed under Section 5.2.2). The EYE team was actively involved in developing and providing data for several IA2030 indicators, specifically on large, disruptive outbreaks and timely outbreak detection and response⁵⁰ as well as a Gavi 5.0 indicator on timely outbreak detection and response. But actual adjustments to the EYE design or EYE implementation to build this integration/alignment is less visible beyond analysis and reporting efforts of an ad hoc IA2030 task team (explored more under Section 5.2.2).

However, changes at the strategic level have not evolved in the same manner. Regional implementation plans/roadmaps were developed by PAHO and the African Region in 2017 to enable the roll-out of the EYE strategy in each region, as well as a more recent workplan for the African Region, yet the detailed roadmap to implement EYE in the Region of the Americas is still only available in a draft version. Countries targeted by the EYE strategy did not change during the first six years of implementation, where the 40 countries have remained the same. Some key informants mentioned that little attention is provided to “medium-risk” countries, yet many of them are bordering high-risk countries. It is not clear to the evaluation team if risk assessments are also carried out regularly for countries defined as “medium-risk”, and for countries in the Americas, as the available documents do not specify this. With climate change and the Aedes mosquito vector spreading, increased population movements and outbreaks occurring, and with Gavi eligibility criteria affecting countries and their ability to fund yellow fever vaccines (see Section 5.4), there may be a need to re-examine the prioritization of yellow fever high-risk countries in future design and funding decisions and a need to conduct regular risk assessments of “medium-risk” countries.

Targets in the M&E framework have not changed – not even since the COVID-19 pandemic affected all countries targeted by the EYE strategy and despite the M&E framework being amended in 2020/2021. Furthermore, progress on M&E strategic indicators are mainly presented to the leadership group in snapshot aggregate form whereas trend data have not been systematically presented to the leadership group, and generally without country disaggregation to gauge outlier countries (except for yellow fever case detection). This is deemed critical for adequate adaptation and course correction.

The lack of attention to gender, social inclusion, and human rights in the design and core documents (including the M&E framework) and very limited data monitoring of related indicators, make it difficult to ensure that EYE is adequately adjusting to meet the needs of specific populations. In addition, resource tracking was not employed to ensure course corrections were feasible and funded.

Consideration of new research findings

New important research findings have not yet been reflected in EYE core documents. Although the EYE strategy was designed to focus on attaining 80% population immunity through vaccination conferring lifelong immunity,⁵¹ and without explicit mention or attention to HIV-positive and other immunocompromised populations, there is some new research that may warrant additional technical considerations for the strategy, and potential SAGE and WHO guidance. These include discussions around potential contraindication of the yellow fever vaccine for moderately to severely

⁴⁸ Eliminate Yellow fever Epidemics: Monthly Update-June 2021 [unpublished report]. World Health Organization; 2021.

⁴⁹ Investment Document Grant [Word Document]. World Health Organization; n.d.

1st Toolkit, Evaluation of Global yellow fever Risk [unpublished document]. EYE Partnership; n.d.

⁵⁰ IA2030 IG 1.3 and SP 5.1 indicators.

⁵¹ [A global strategy to Eliminate Yellow fever Epidemics \(EYE\) 2017 – 2026](#). Geneva: EYE Partnership; 2018; EYE M&E Update August [PowerPoint]. Bader J; 2021.

immunocompromised people living with HIV⁵² or a need for precautionary booster vaccines.⁵³ Furthermore, new studies indicate that immunity may wane after vaccination in children,⁵⁴ and other research highlights the need to aim for more than 80% population immunity (90%+) to combat yellow fever outbreaks in highest-risk regions based on a yellow fever R_0 model.⁵⁵ The RAWG has developed a subnational risk assessment tool to “assist countries in determining the relative risk of yellow fever in various areas of their country in order to guide their planning for a phased subnational preventive campaign”,⁵⁶ so there is attention paid by EYE structures to the need to focus on different risk levels within countries. Furthermore, key informants have mentioned that the evidence of possible waning immunity is on the SAGE radar and is expected to be an agenda item in any of the upcoming SAGE meetings.

EQ2: To what extent was the EYE strategy implemented efficiently and coherently to maximize public health gains? (Efficiency and coherence)

This evaluation question is addressed through two sub-questions. The first sub-question explores aspects of efficient management of the EYE strategy and the second sub-question investigates the level of complementarity of interventions and alignment.

5.2.1 To what extent has implementation of the EYE strategy been managed efficiently by the EYE governance structures (optimal use of resources for maximum impact)? (EQ 2.1)

Summary box of key findings - EQ 2.1

- The EYE strategy is being managed through a multi-partner governance structure with clear articulation of global coordination/implementing bodies and their specific roles. The EYE leadership group, the programme management group, secretariat and working groups have enabled good coordination of partner efforts, and EYE entities are well-functioning overall, however, with differences in performance against workplans, and seemingly ambitious workplans vis-à-vis the human resource availability to implement the workplans. There is further scope to promote the leadership group as an actual decision-making forum.
- While there is a strong governance structure at the global level, challenges at the regional level were observed. There was limited engagement from the country level and acknowledged opportunity for expanded ownership and coordination of the EYE strategy implementation at regional and country levels.
- EYE partners have provided substantial coordination, technical assistance and direct support to the implementation of the EYE strategy, which have been well received by

⁵² “Because YF vaccines are live-attenuated, they are contraindicated in immunocompromised persons including persons with immune compromising conditions, those on immune modulating medications, and HIV-infected persons with moderate- to severe immune compromise.” (Chen L & Wilson M. Yellow fever control: current epidemiology and vaccination strategies. Trop Dis Travel Med Vaccines [Internet]. 2020; 6:1. doi: <https://doi.org/10.1186/s40794-020-0101-0>).

⁵³ “At the present time, the WHO has deemed 10-year booster doses of the 17D vaccine unnecessary, and removed the requirement for these boosters in 2013. Nonetheless, due to their compromised immune response, the United States Advisory Committee on Immunization Practices (ACIP) recommends that HIV+ individuals be given booster doses of the 17D vaccine every 10 years or as necessary” (Hansen C & Barrett A. The Present and Future of Yellow Fever Vaccines. Pharmaceuticals [Internet]. 2021; 14(9):891. doi: <https://doi.org/10.3390%2Fph14090891>).

⁵⁴ “...adhering to the conventional assumption that immunity to yellow fever is acquired after infection or vaccination and remains for a lifetime. However, there have been recent studies suggesting that this may not be the case in children. Domingo et al., 2019 found that immunity against yellow fever waned in children following vaccination. If these results are representative of infant and child vaccination across the regions and time, our estimates of population immunity may need to be readdressed.” (Gaythorpe K, Hamlet A., Jean K., Ramos D, Cibrelus L., Grske T. et.al. The Global Burden of yellow fever. Elife. 2021; 10:64670. doi: <https://doi.org/10.7554/elife.64670>).

⁵⁵ Ndeffo-Mbah M & Pandey A. Global Risk and Elimination of Yellow Fever Epidemics. J Infect Dis. 2020; 221(12): 2026-2034. doi: <https://doi.org/10.1093/infdis/jiz375>.

⁵⁶ Preliminary Subnational Risk Assessment [unpublished report]. EYE Partnership, 2021.

national governments in EYE countries. Advocacy efforts, EYE partners' meetings and numerous communication products, particularly an impressive podcast series, have given more visibility to yellow fever, yet there is room for broader dissemination of communication products and increased activity on social media and there is a perceived need to rejuvenate the commitments to the EYE strategy.

- Human resource capacity at all levels (global, regional and country levels) is a major challenge for timely and adequate implementation of the strategy, causing delays and inefficiencies in implementation. Moreover, most support has been given by the EYE secretariat to implement activities in Africa versus the Americas in response to regions' needs and asks. Resource mobilization efforts have resulted in 19% of the total costs of EYE implementation for the period 2017-2026 being realized.
- Progress of EYE is being monitored closely with frequent updates to the leadership group and programme management group. Whereas updates to the programme management group have been detailed and presented trend data and country disaggregated data, information of progress presented to the leadership group are mostly in aggregate snapshot form or presenting activity status, limiting the leadership group's mandate to perform due oversight and provide strategic direction to the programme management group.
- Investments have been allocated to develop an EYE dashboard with impressive data visualization, yet access to the dashboard and prototype country profiles is not publicly available, which limits usability by country government stakeholders.
- Documenting and disseminating best practices and lessons learned have not been prioritized sufficiently during the first six years of EYE implementation. The EYE secretariat is working on a learning strategy, which is anticipated to address this concern.
- Although the strategy clearly spelled out the costs of its implementation, tracking expenditures has not been prioritized. As a result, the evaluation team was not able to undertake analyses of either duplication of efforts or efficiency gains realized due to collaborative efforts among the EYE partners, other actors involved in immunization, and country governments.

Governance and strategic level guidance

The EYE strategy is being managed through a multi-partner governance structure with clear articulation of global implementing bodies and their specific roles. The role of WHO, Gavi and UNICEF is well defined and the main activities of the eight subgroups (the leadership group; the programme management group, the EYE secretariat, the risk analysis working group, the vaccine delivery working groups, the demand and supply working groups, the laboratory working groups, and the regional implementation teams) are also well defined.⁵⁷ The governance structure documents specify clear roles for the leadership group and composition of membership from WHO, Gavi and UNICEF. Functions and activities are listed, as is the articulation of governance structure where the EYE secretariat plays a coordination and M&E oversight role and the delivery of programmes at the country level is overseen by regional implementation teams. The bodies that provide technical guidance have also been clearly defined (**Error! Reference source not found.**).

The EYE governance structures were revised in 2019 in order to ensure better management of the overall strategy and accelerate work towards the achievement of its stated goals. The restructuring was discussed at the leadership group meetings and its suggestions to include the regional representation (the WHO Regional Office in Africa (AFRO) and PAHO) as part of the leadership group

⁵⁷ EYE Governance Structure [PowerPoint]. EYE Partnership; 2019.

was approved by Gavi, UNICEF and WHO members in 2021.⁵⁸ Figure 5 provides an overview of the updated EYE governance structure with the four working groups, three WHO regional offices (the WHO Regional Office for the Eastern Mediterranean (EMRO), the Americas (PAHO) and AFRO) as well as reflecting which entity is responsible for operational and technical guidance and delivery.⁵⁹

The EYE strategy partnership brings together strong international experts and partners with complementary skills and experiences. WHO leads on EYE secretariat functions, and regional implementation support; UNICEF leads the demand supply working group and is coordinating all procurement and supply of vaccines, ancillary and diagnostic materials to enable vaccination programme implementation; and Gavi, which is the main funder of the vaccines, is also closely involved in supply chain management on the diagnostics side, funding and supporting diagnostic commodities and activities including trainings/capacity building in countries. The US Centers for Disease Control and Prevention (CDC) brings technical expertise to the partnership on modelling, risk assessment etc. In addition to this, relevant academic institutions are involved in the oversight of implementation and vaccine producers and are active members of the EYE partnership.

Figure 5: EYE governance structure



Source: Horton J. Eliminate Yellow fever Epidemics (EYE) Strategy [PowerPoint Slides], 2022 May [cited 2022 May 24]

The leadership group is the oversight body of the EYE strategy and it sets the vision and goals and provides high-level political and strategic direction to the programme management group. The leadership group is responsible for ensuring that the EYE governance structure is well functioning, and that the members and organizations are held accountable to the EYE strategic objectives and principles.⁶⁰ The leadership group meets on a quarterly basis and on an ad hoc basis when deemed necessary. However, some informants shared a concern that, as much as the leadership group is meeting regularly and has the right composition at Director levels of the three partners WHO, UNICEF and Gavi, it is perceived more as an information sharing platform than an actual decision-making forum. There is limited evidence on actions taken in each meeting and existence of proper follow-up of actions that have been implemented. Due to competing priorities, several key informants mentioned that leadership group members from time-to-time delegate participation in meetings to lower-level staff, which may hinder the decision-making potential of the leadership group.

⁵⁸ Fifth Eliminate Yellow fever Epidemics (EYE) Strategy Annual Partners' Meeting [unpublished report]. Geneva: World Health Organization; 2021.

⁵⁹ EYE Governance Structure [PowerPoint]. EYE Partnership; 2019.

⁶⁰ EYE Governance Framework - Leadership Group [PowerPoint]. EYE Partnership; 2022.

The programme management group is established with clear terms of references (ToRs) to provide management and coordinating functions in order to ensure the successful implementation of the EYE strategy.⁶¹ The programme management group brought good coordination of partners' efforts, but there is weaker coordination at the regional level (particularly in AFRO) and at the country level. Programme management group meeting notes clearly document that this group is meeting regularly but shifting more to a combination of one meeting every two months and quarterly meetings in 2020 and 2021, as shown in

⁶¹ PMG responsibilities include: (i) review the programme targets and achievements based on the established M&E framework indicators; (ii) set annual strategic priorities for the WGs, ultimately resulting in prioritization of its activities; (iii) validate proposed goal and work plans (WP) from each WG; (iv) ensure accountability of the WGs by monitoring WP implementation; (v) translate prioritized research agenda (based on WHO input) into a WP with prioritized activities and timelines; (vi) serve as organizational advocate to mobilize resources to support implementation of WP activities while empowering regions and countries (e.g., financial and / or technical resources); (vii) provide input into Gavi's targeted country activities and partners' engagement framework; (viii) manage risks and develop mitigation plans based on input from the WGs; (ix) validate country prioritization in case of supply shortages based on input from the WGs; (x) provide regular updates on EYE progresses to yellow fever vaccine manufacturers; and (xi) take active role to ensure the partnership progresses actively and builds sustainability to maintain gains of EYE.

Table 4.

Table 4: Number of programme management group meetings for EYE, 2018-2021

Year	Number of meetings	Comments on the frequency of the meetings
2018	3 (November-December)	Monthly
2019	10	No meeting notes for August and December
2020	8	Six monthly meetings and three meetings occurring once every two months
2021	9	One quarterly meeting (August to October and one meeting every two months between November and December

PAHO has technical advisory group endorsement for the Region of the Americas in addition to participating in the various working groups and presenting performance in annual review events. For the Americas, however, the roadmap for implementation of the EYE strategy in Latin America and the Caribbean is still in a draft form.⁶² This roadmap discusses the importance of individual countries working to optimize regional cooperation; it also notes the role of PAHO once the roadmap is finalized. It will be critical to finalize and endorse this roadmap ensuring alignment with the EYE strategy.

In the African Region, the Regional Committee brought all partners together in 2017 to discuss and agree on strengthening governance and government engagement. A regional framework for EYE implementation is in place for Africa, which to a large extent is aligned with the EYE strategy, except for some indicators of success.⁶³ The EYE secretariat, and particularly the regional implementation team in WHO AFRO, have provided support to implementation across selected yellow fever high-risk countries in the African Region. Yet implementation oversight reportedly remains weak in the African Region and with lower performance on workplans than for other entities of the EYE governance structure (Figure 7).

EYE secretariat, working groups, and operational coordination

The EYE secretariat's primary role is to ensure appropriate coordination, communication, advocacy, planning, risk management, and monitoring and evaluation to enhance global implementation of the EYE strategy. The secretariat is hosted by the Health Emergency Interventions department of WHO's Health Emergency Programme (WHE). This department addresses high-impact epidemics and humanitarian affairs together with Ebola, cholera and meningitis.⁶⁴ The secretariat is also providing technical assistance and is leading on programmatic priorities such as: vaccine roll-out decision-making; international samples transporting (EYE.Ops); clinical management; research and innovation; urban readiness; IHR and private sector engagement (priorities for 2022 are presented in Figure 6).

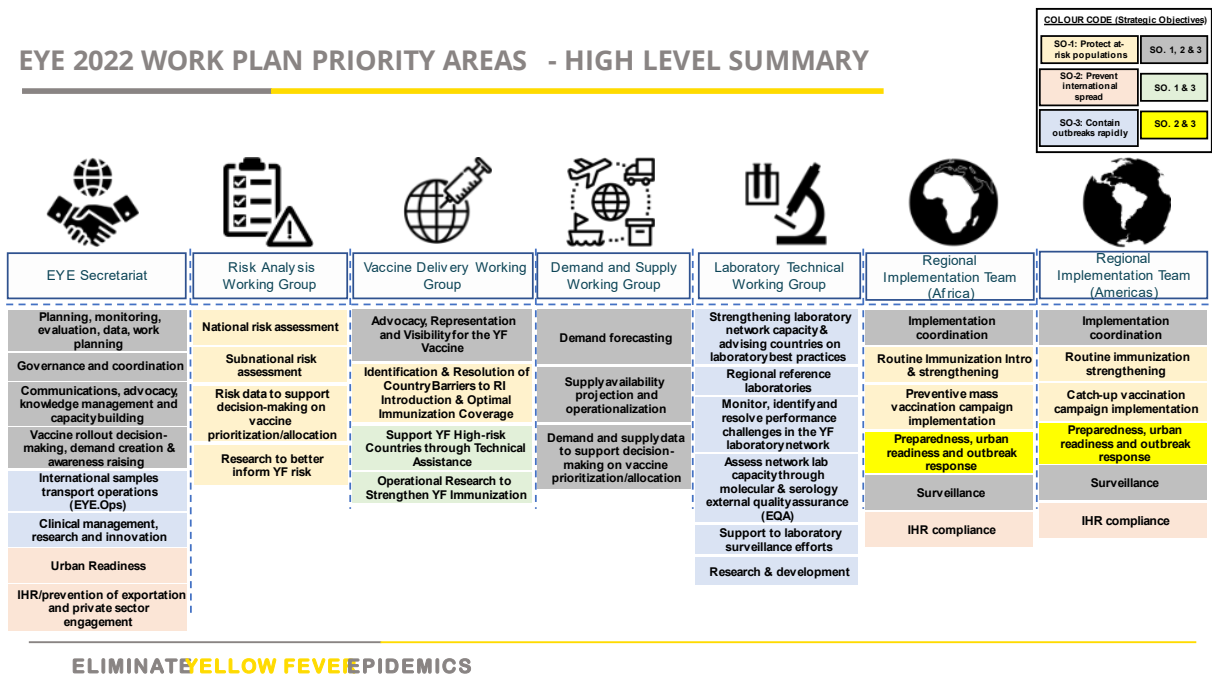
A review of EYE secretariat and EYE working group functions as part of the EYE consolidated work plans shows that entities are overall working well, yet with differences in performances. The EYE secretariat and working groups have a clear role division and monitor performance of workplans (see figures 6 and 7). There is evidence that working groups are active, meet regularly, and coordinate their respective activities through the programme management group.

⁶² Roadmap for EYE implementation in Latin America and the Caribbean [unpublished report]. World Health Organization; n.d.

⁶³ [Framework for implementing the global strategy to eliminate yellow fever epidemics \(EYE\) 2017-2026 in the African Region](#). Brazzaville: WHO Regional Office for Africa; 2017.

⁶⁴ EYE Partnership. EYE Governance Framework – Leadership Group [PowerPoint Slides], 2022 Mar [cited 2022 Jun 7].

Figure 6: Workplan priority areas for EYE in 2022- by EYE entity



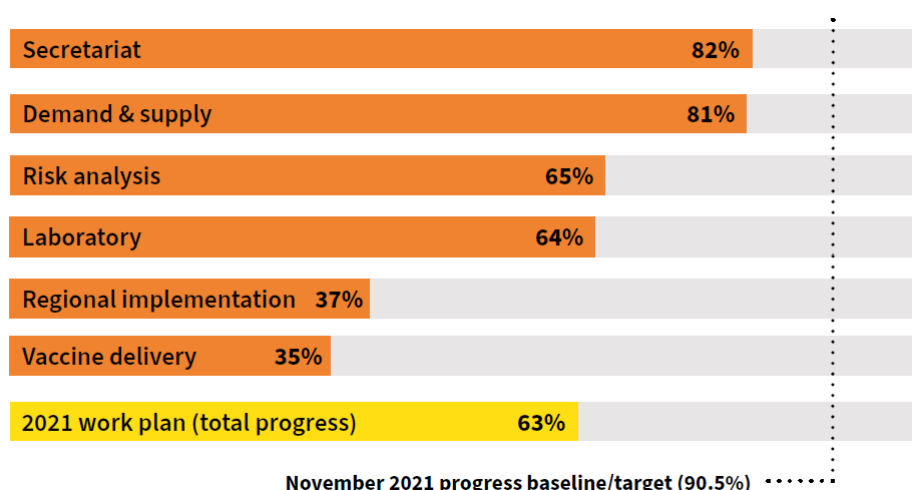
Source: EYE Partnership. EYE Governance Framework – Leadership Group [PowerPoint Slides], 2022 Mar [cited 2022 Jun 7]

The different working groups, the secretariat and the regional implementation team in AFRO have developed comprehensive annual workplans with relevant activities, but as mentioned by a key informant the workplans are also aspirational and likely overambitious considering the level of human resources available to support their implementation. In 2022, the EYE consolidated workplan included 185 outputs across 35 priority areas,⁶⁵ of which the EYE secretariat alone had 88 outputs.

The performance against the workplans is well monitored and reported monthly to the leadership group. Performance has varied across the secretariat, working groups and regional implementation teams as shown in the example below for the latest update on the 2021 workplans of various groups. Overall, the EYE secretariat has managed to complete almost all workplan milestones, whereas the vaccine delivery working group and the regional implementation team (AFRO) have shown weaker performance against their respective workplans (Figure 7). Key informants noted that timelines and resources for some workplan activities have generally been insufficient, and furthermore some working groups had more outputs, and some activities are research-related work, which would take longer to complete. Human resource scarcity contributing to delays in implementation is described later in this section.

⁶⁵ EYE Strategy 2022 Work Plan [PowerPoint]. EYE partnership; 2022.

Figure 7: Workplan completion progress on EYE working groups, EYE secretariat and African regional implementation team, Nov 2021



Source: EYE strategy Nov-Dec monthly leadership report, 2021

Notes to figure: regional implementation team includes only the African regional implementation teams and not the Region of the Americas. In the Americas, there is generally less information available to the evaluation team on the progress of workplans for EYE implementation, despite there being a regional implementation team for the Americas.

Evidence from key informant interviews confirms that there is a strong governance structure at the global level and the EYE strategy partners are coordinating more closely at the global level. Most respondents expressed through interviews the view that the governance structure works well, with good collaboration among the leadership group, the programme management group and the working groups, and some informants even suggested that other disease programmes could learn from this applied governance structure. Governance at the regional level was reportedly weaker and some key informants and country-level online survey respondents mentioned that there was scope to improve coordination of partner efforts at the country level. Yet some EYE high-risk countries have shown effective coordination and complementarity (see country case study extract from Brazil below).

Box 1: Coordination and management - the response to yellow fever outbreaks in Brazil

Coordination and management - the response to yellow fever outbreaks in Brazil

Political will, management, coordination were at the centre of the yellow fever response to the spread of the virus from 2016 to 2019. The coordinated and integrated response was evident from the community level to the municipalities, the regions and the state level, where the view was expressed that the response had the “full mobilization and cooperation of the State” in reference to São Paulo with the same sentiment in Minas Gerais. Governors were involved in decision-making and announced, as in the case of Minas Gerais, a public health emergency thereby raising awareness around the urgency to respond to the outbreak including the critical importance of immunization. Other key players in the coordination in Minas Gerais included *Secretaria de Estado de Saúde* ((SES) State Secretary of Health) along with state secretariats for the environment, agriculture, civil defence, military police, etc. Representatives from all these secretariats partook in regional-level seminars around the response focusing on the state of yellow fever.

In São Paulo, without the buy-in and support from the State Government, SES, the police, military, etc., the critical move to close one of the biggest parks in São Paulo City, which had never been done in the history of the State, would not have been possible. This critical measure brought much-needed attention to the public of the serious nature of the outbreak and resulted in an immediate flood of citizens to vaccination centres and vaccination campaign sites.

Source: Brazil MTE EYE country case study, Final evaluation report Volume III

Adequacy of participation by government partners

Following the EYE strategy formulation, a regional launch in Abuja was organized in 2018 with representation of national government institutions from 11 countries. This resulted in commitments by national governments to key EYE activities.

The EYE governance structure is, however, reported to be centred at the global level with limited engagement of countries. Countries have not been systematically involved in the meetings of the programme management or leadership groups, as this was not envisioned from the onset of the strategy. Moreover, only a few selected countries have been able to share their experience in EYE forums. During annual EYE partners' meetings conducted in 2020 and 2021, the Democratic Republic of the Congo, Ethiopia, Ghana, Nigeria, the Republic of the Congo (Congo) and Sudan have presented examples of challenges or best practices.⁶⁶ Due to funding constraints, there has been only one annual country performance meeting organized by AFRO in 2021, five years after the development of the strategy, where selected countries presented their performance. Such participation and engagement need to be scaled up.

These shortages have been recognized by several key informants, noting that there are no clear progress monitoring mechanisms with clear accountability (responsibility at country and global levels to report and take actions) – mechanisms that could help countries and the leadership group to work together and improve performance. Example of quotes are provided below:

“Countries have not been involved in the quarterly meetings of the decision-making programme management groups and leadership groups, but global decisions should be grounded in realities.”

“Countries' involvement during implementation: EYE could have done better [in terms of] governance and sustaining the engagement of countries/regions. Countries need to be more involved at the global level to drive the strategy...Countries haven't reported enough on their progress on EYE implementation but were also not prompted to do this.”

There is an acknowledged opportunity for expanded ownership, integration and coordination of the EYE strategy implementation at regional and country levels and the engagement of these levels with the EYE secretariat and key EYE management structures. Mechanisms are needed to support countries to contribute effectively and comprehensively and to be more actively engaged in EYE ownership, for example, in terms of data collection, coordination, decision-making and documentation. It is likely that country-level lessons learned and good practices exist but were not optimally disseminated. Yet there is a need for learning from successes and other lessons from high-risk countries, in order to help inform and improve EYE implementation on an iterative and ongoing basis and provide best practices that will contribute towards overall long-term sustainability. The EYE secretariat is working on a learning strategy that hopefully will capture these aspects.

Support to implementation and prioritization

EYE partners have provided substantial coordination and technical assistance to support implementation of the strategy. To support implementation of EYE, important strategic documents have been developed, which include: the EYE communications strategy, a resource mobilization strategy (the “engagement strategy”) and an EYE learning strategy (under finalization).⁶⁷ In addition, principles and standard operating procedures to inform global vaccine allocation for PMVCs have been developed and implemented. Further, a sequenced preventive mass campaign plan (2018-2026) was

⁶⁶ Fourth Eliminate Yellow fever Epidemics (EYE) Strategy Annual Partners' Meeting [unpublished report]. Geneva: World Health Organization; 2020; Fifth Eliminate Yellow fever Epidemics (EYE) Strategy Annual Partners' Meeting [unpublished report]. Geneva: World Health Organization; 2021.

⁶⁷ [EYE strategy: Annual 2021 highlights](#). Geneva: World Health Organization; 2021.

developed for countries in Africa⁶⁸ and is continuously being monitored and updated. Vaccine supply availability projections have been developed and shipment plans made by UNICEF supply division in dialogue with countries, based on vaccine allocations. The EYE operations team (EYE.Ops) has provided substantial direct operational support to handling shipments of samples etc. and the yellow fever testing algorithm has been reviewed and updated.

The EYE secretariat and working groups have also provided extensive support to countries on various subjects, including to develop country-specific EYE implementation plans and the organization of yellow fever campaigns, country calls, country missions and they have also recently started providing support to improve the quality of Gavi/ICG applications before their submissions. In addition, an abundant number of capacity-building trainings, particularly for laboratory staff, have been conducted across both regions. EYE partners have used online platforms such as webinars and have held in-person workshops.⁶⁹ There have also been deployments to support outbreak countries with rapid detection and response.⁷⁰ Laboratories have been supported for accreditation and improved quality assurance processes.⁷¹ National and subnational risk tools have been developed, and national risk assessment scores for yellow fever in Africa have been updated for 2021.

The working groups and the EYE secretariat further developed toolkits to guide the implementation of the different EYE activities at the country level. The topics appear relevant to the evaluation team. Key informants mentioned that toolkits were informed by country needs and a few country-level stakeholders mentioned that toolkits have been helpful, but there was unfortunately no systematic information gathered on the usability of the toolkits at the country level. EYE structures have also been effective in terms of generating relevant research and developing new tools and diagnostics that could become “game changers” for yellow fever (see also Section 5.3.1).

The EYE secretariat and the regional implementation team in AFRO have provided direct support to countries in the African Region. High-impact and high-risk countries were prioritized among the 27 African countries for this support due to human resource scarcity. Three countries were categorized as “no regret” countries: the Democratic Republic of the Congo, Ethiopia and Nigeria,⁷² because they represent the three most populous yellow fever high-risk countries in Africa. They are also very high-risk, fragile, conflict- and violence-affected, and home to numerous internal and external migrations and thus prone to spread locally, regionally and globally, with stretched resources and numerous competing priorities. These elements combined make them extremely important in determining the success of EYE implementation in Africa. Support to other high-risk countries in Africa has been provided on a needs-basis or for specific activities related to outbreak support, diagnostics, lab, capacity-building etc.

Yellow fever high-risk countries in the Region of the Americas are supported by PAHO headquarters and PAHO country offices in the implementation of the EYE strategy/overall yellow fever responses. This support includes both remote and in-person strategic and programme planning and technical assistance covering critical interventions outlined in the strategy (for example, surveillance, outbreak response including planning of campaigns, laboratories). At headquarters, PAHO is staffed with vaccine-preventable disease professionals, emergency response, laboratory, surveillance and other specialists. Certain PAHO country offices (for example, Brazil) guarantee attention to yellow fever

⁶⁸ [Framework for implementing the global strategy to eliminate yellow fever epidemics \(EYE\) 2017-2026 in the African Region](#). Brazzaville: WHO Regional Office for Africa; 2017.

⁶⁹ Fifth Eliminate Yellow fever Epidemics (EYE) Strategy Annual Partners’ Meeting [unpublished report]. Geneva: World Health Organization; 2021.

⁷⁰ Fifth Eliminate Yellow fever Epidemics (EYE) Strategy Annual Partners’ Meeting [unpublished report]. Geneva: World Health Organization; 2021.

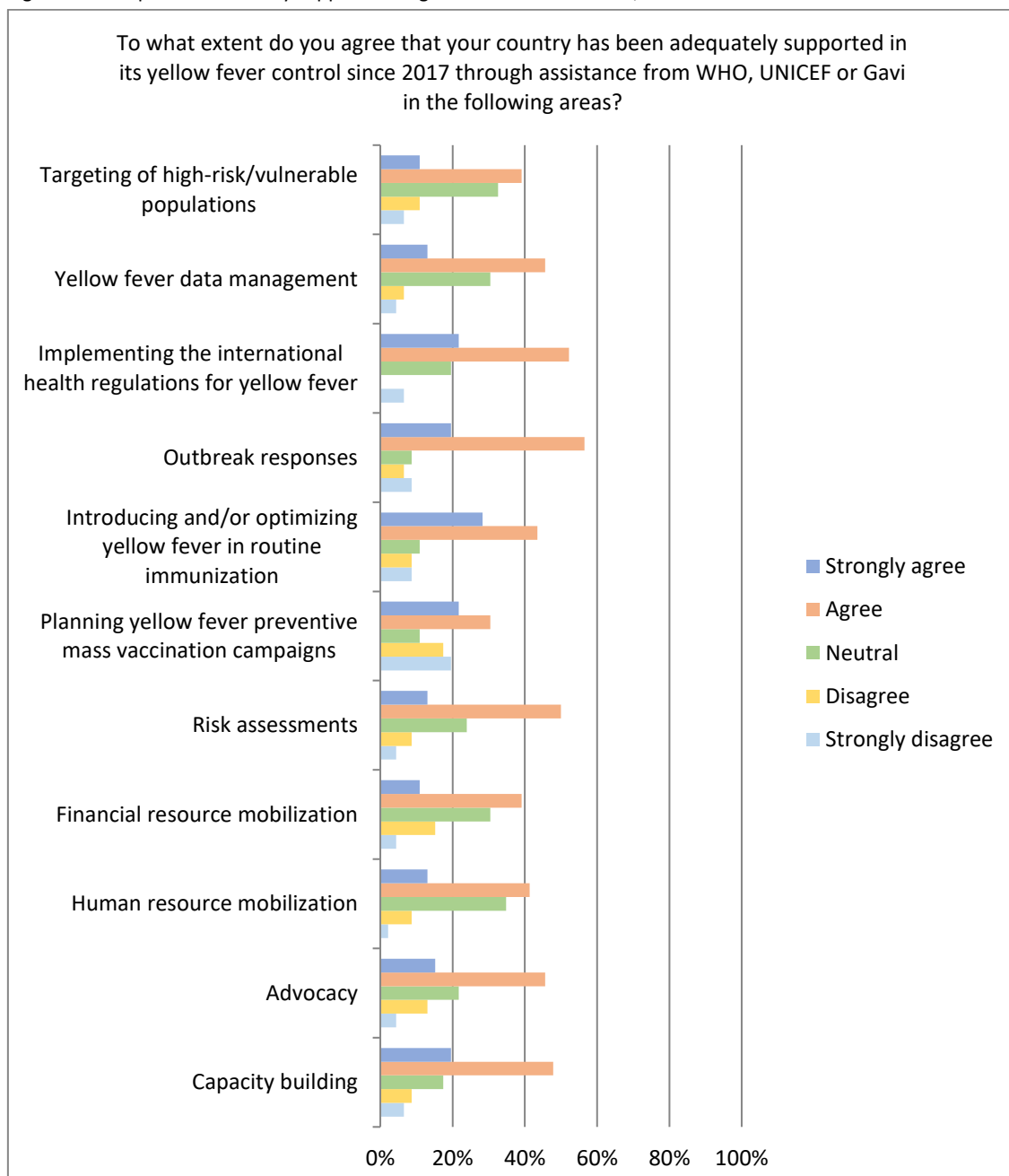
⁷¹ [EYE strategy: Annual 2018 highlights](#). Geneva: World Health Organization; 2019.; [EYE strategy: Annual 2019 highlights](#). Geneva: World Health Organization; 2019.; [EYE strategy: Annual 2020 highlights](#). Geneva: World Health Organization; 2020.; [EYE strategy: Annual 2021 highlights](#). Geneva: World Health Organization; 2021.

⁷² Investment Document Grant [Word Document]. World Health Organization; n.d.

implementation through specific yellow fever and arbovirus specialists. PAHO, at both headquarter and country levels, works closely with government and other key stakeholders to ensure that yellow fever remains high on the agenda of public health responses. Its work in Brazil is considered by stakeholders as critical to the successful response to recent yellow fever outbreaks (2017 and 2018) as well as having strengthened overall surveillance, laboratory, clinical management and other aspects of the yellow fever response. Unique to Brazil, particularly when compared to the Africa Region, is the fact that government resources fund over 80% of PAHO support to the country, which indicates the level of confidence and respect that the government has for its work.

National health authority respondents to the online survey across the 40 high-risk countries reported a general high level of adequate assistance from WHO, UNICEF and Gavi to implement yellow fever interventions in their country. The top three types of support most often cited as adequate were: outbreak response; implementing the IHR for yellow fever; and introducing and/or optimizing yellow fever in routine immunization (Figure 8).

Figure 8: Perceptions on country support through assistance from WHO, UNICEF or Gavi



Source: MTE online survey Q26

In terms of supporting activities under the three strategic objectives, there has been less attention to support implementation of activities under strategic objective 2 (prevent international spread) with activities, including prevention of urban outbreaks and protection of high-risk workers, being delayed and still in the preparation phase.⁷³ This was reportedly due to limited human resources and continuing yellow fever outbreaks that needed urgent attention. Furthermore, the EYE secretariat and EYE working groups have been mainly supporting and monitoring activities across African high-risk countries in line with regional and country asks, with PAHO supporting countries in the Region of the Americas.

Advocacy and communication

A number of high-level advocacy meetings/events at regional levels and global annual EYE partners' meetings have been conducted since 2017.^{74, 75} The launch of the EYE strategy in Abuja in April 2018 resulted in a commitment to targeting 11 countries to implement PMVCs and another five countries to introduce yellow fever in their routine immunization programmes. The annual partners' meetings have further been very instrumental in terms of stock-taking and facilitating cross-partnership and cross-regional collaboration. Additional advocacy efforts at the country level seem to have had less attention. A declining momentum has been noted in recent years and particularly after the COVID-19 pandemic. Several key stakeholders mentioned that it would be timely to rejuvenate the commitments to the EYE strategy at regional levels by organizing high-level events with participation of key country government officials.

The EYE secretariat additionally developed a series of webinars (international sample transportation – EYE.Ops, upcoming EYE Open WHO courses, the “Go.Data” yellow fever template, urban readiness guidance dissemination etc. are among the recent topics). These webinars are translated into French, Spanish, Portuguese and, where feasible, Arabic to maximize accessibility across the EYE high-risk country network; each webinar typically has 150-200 participants. There is also a monthly newsletter distributed to stakeholders in the global yellow fever control community, and annual highlights of achievements and challenges over the past year. The EYE strategy has further engaged in several social media platforms (Facebook, Twitter, LinkedIn and YouTube), but with fewer posts than expected according to the communication strategy, especially in LinkedIn and Facebook.⁷⁶ With more EYE human resource capacities, such platforms could be increasingly active.

The EYE partnership created the podcast series called "EYE on yellow fever" as part of their advocacy and communication strategy.⁷⁷ The podcast series focuses on the global risk of yellow fever and explains the role of the EYE strategy in eliminating yellow fever epidemics in high-risk countries. Originally the podcast series was supposed to be 10 episodes long, however, additional episodes were created, with a total of 16 now being available on various platforms.⁷⁸ The podcasts cover a broad

⁷³ Fourth Eliminate Yellow fever Epidemics (EYE) Strategy Annual Partners' Meeting [unpublished report]. Geneva: World Health Organization; 2020.

Fifth Eliminate Yellow fever Epidemics (EYE) Strategy Annual Partners' Meeting [unpublished report]. Geneva: World Health Organization; 2021.

⁷⁴ [EYE strategy: Annual 2018 highlights](#). Geneva: World Health Organization; 2019.; [EYE strategy: Annual 2019 highlights](#). Geneva: World Health Organization; 2019.; [EYE strategy: Annual 2020 highlights](#). Geneva: World Health Organization; 2020.; [EYE strategy: Annual 2021 highlights](#). Geneva: World Health Organization; 2021.

⁷⁵ [Eliminate Yellow fever Epidemics \(EYE\) Strategy Annual Partners' Meeting 2017](#). Geneva: World Health Organization; 2018; [Eliminate Yellow fever Epidemics \(EYE\) Strategy Annual Partners' Meeting 2018](#). Geneva: World Health Organization; 2019; Fourth Eliminate yellow fever Epidemics (EYE) Strategy Annual Partners' Meeting [unpublished report]. Geneva: World Health Organization; 2020; Fifth Eliminate yellow fever Epidemics (EYE) Strategy Annual Partners' Meeting [unpublished report]. Geneva: World Health Organization; 2021.

⁷⁶ According to the EYE communication strategy: [Eliminate Yellow fever Epidemics: Communication Strategy 2021 update](#). Geneva: World Health Organization; 2021. “Schedule a minimum of 3 posts per week on Twitter, Facebook and LinkedIn to increase following and sharing of EYE content”.

⁷⁷ [Eliminate Yellow fever Epidemics: Communication Strategy 2021 update](#). Geneva: World Health Organization; 2021.

⁷⁸ [Podcast: EYE on yellow fever](#). EYE Partnership; 2021.

range of yellow fever-related subjects such as diagnosis, surveillance, vaccination, vector control, and the effects of global warming and population movements. In the communication strategy update of the EYE partnership, various target groups were identified, and their interest areas summarized.⁷⁹ Table 5 shows subjects covered in the existing "EYE on yellow fever" episodes of relevance to the different groups identified.

Table 5: Target groups and "EYE on yellow fever" podcast topics

Target group	General public	Regional / country level	Potential partners	financial
Relevant content covered by the podcast	Yellow fever facts/information; Public health safety; Travel information; Data visualization.	Monitoring, evaluation and impact; Impact of programmes; Programme risks; Cross-disease linkages; Clinical management.	Impact of programme deliverables; Campaigns; Country case studies.	

The evaluation teams find that the podcast series is a great undertaking with relevant material of high quality, which provides listeners with easily accessible information on yellow fever, the successes and challenges, opportunities and risks. Yet key informants to this evaluation were not all aware of the podcast series and it would be important to monitor listeners and fully capitalize on this investment by disseminating the podcast series more broadly.

Results monitoring

Progress of EYE is being monitored closely with frequent (in some years even monthly) updates to the EYE leadership and programme management groups. Whereas updates to the programme management group have been detailed and presented trend data and country disaggregated data, information of results presented to the leadership group (presentations for leadership group meetings and leadership group reports) are mostly in aggregate and snapshot form or present activity status. Key informants in governance structures, especially in the leadership group, have mentioned that they primarily hear the positive results with less focus on challenges and outlier countries. A review of EYE annual partners' meeting reports also shows that presenting trends over time since inception of the EYE strategy on all strategic EYE indicators and country disaggregation has been limited. This is unfortunate, since such meetings would have presented a good opportunity to explore these trends. Furthermore, information available on progress of the 16 selected strategic indicators is not consistent across regions, with less information available from the Region of the Americas than from the African Region and as mentioned before, data are generally not monitored with respect to analysis of gender and age disaggregation.

Investments have been allocated to develop an EYE dashboard with impressive data visualization used for providing updates and monitoring of progress. Country snapshots are also available in the dashboard but do not cover all strategic indicators and data availability gaps/delays were noted as explained previously under Section 5.1.1. Some data delays are caused by data only being available to update annually. Another reported setback was delays in submission of data from regional levels to headquarters. More comprehensive country profiles are also available as an internal reference, but these are currently not published online and the dashboard is not publicly available.⁸⁰ These offline resources and closed platforms seem to be missed opportunities, limiting usability by country government stakeholders.

⁷⁹ [Eliminate Yellow fever Epidemics: Communication Strategy 2021 update](#). Geneva: World Health Organization; 2021.

⁸⁰ Access is currently limited to those who has access to the EYE SharePoint.

Human resource capacity

Human resource capacity at all levels of the system (global, regional, and country levels) is reported as a major challenge for adequate implementation of the EYE strategy. There is generally a perceived continuous lack of human resources at all levels - especially critical in AFRO, with one or two people to support 27 yellow fever high-risk countries. The strategy has to a large extent relied on all partners to provide in-kind support for its implementation, with only a few WHO staff being funded through external resources. This is further undermined by some reported challenges related to departmentalization (compartmentalization) in WHO and the “two main communities” working on EYE – “the emergencies people and the immunization people”, with their different approaches and perceptions on, for instance, the need for verticalized and time-sensitive approaches or more mainstreamed approaches to reaching the goal of eliminating yellow fever epidemics. The most optimal approach given the current situation would probably be a mix of both, which is discussed further later in the report.

The EYE secretariat staff (of whom there are three full time) and two regional staff in AFRO, as well as a few laboratory coordination staff, are the only personnel who focus on yellow fever 100% of their time. Most of the people in EYE working groups are not financed through yellow fever resources and some do the work on top of their full-time job. There is further a frequent turnover of staff and a reliance on consultants for some of the critical tasks (including in the EYE secretariat), which makes continuity of functions challenging. There is, however, widespread appreciation for the intense work, dedication and commitment of the limited EYE secretariat. Several key informants mentioned that without this devotion and the high work ethics of key staff the strategy would not have progressed as much as it has.

At the country level, yellow fever relevant activities are most often spread across multiple departments and personnel (for example, vaccination programmes, surveillance, emergency response, laboratory etc). Country-level yellow fever focal points from WHO are thus balancing many other responsibilities in their workplan and have reportedly limited bandwidth to dedicate to yellow fever. In addition, designated yellow fever focal points working in UNICEF and Gavi are also working on many other priorities. A vast majority of key informants expressed the view that there is insufficient staff in regional and country offices to adequately liaise with ministry of health and other country officials and to keep and build attention and ongoing efforts on yellow fever. They also noted the “limited human resources in the Essential Programme on Immunization (EPI) at all levels.”

Mechanisms to link national-, regional-, and country-level EYE efforts are lacking. Such efforts again rely on limited staffing capacity at regional levels. It is therefore challenging for EYE to ensure realities on the ground in countries. The plan was to have an EYE secretariat with a team lead plus five staff, but a key informant mentioned that they have “never gotten even close to this”. Additionally, there have been advocacy and resource mobilization efforts through the EYE secretariat to bolster support in select high-needs/ “no-regret” countries, but these have yet to be fully realized (some select countries have benefited from time-bound dedicated consultant supports). Although funding was secured for the planned human resources to oversee implementation of the EYE strategy at global and regional levels, this did not materialize into actual filled positions and staff as planned. Key informants stated that hiring EYE human resources in AFRO is reported to have taken about 17 months and that several positions and planned consultancies were never approved. Some key informants mentioned that global-level staff have put a lot of effort into filling the regional gaps. Furthermore, the turnover of human resources and reportedly long procedures of hiring new staff, coupled with the time required to onboard newly recruited staff, have caused challenges to continuity and give rise to inefficiencies. Accordingly, while the EYE strategy targets 40 countries, direct support has only been made available through the EYE secretariat to about one quarter of the African countries.

A degree of verticalization of the yellow fever programme (discussed more in Section 5.4) is further reported to have caused inefficiencies when the same people meet on yellow fever one day and attend the next meeting to discuss another disease. There is a certain reported fatigue from members of the different working groups because of membership overlaps in several working groups and the programme management group discussing similar subjects again and again.

Cost monitoring and control

Although the strategy clearly spelled out the costs of its implementation (see Table 3 in Section 5.1.1), tracking expenditures has not been prioritized. This is true not only for priorities but also for total levels and sourcing of funding. Although major players like Gavi, BMGF, WHO, UNICEF, CDC etc. are supporting the implementation of the strategy at global, regional, and country levels, this has not been consolidated and reported on an annual basis as part of annual reviews. While sustainability also requires country-level resource mobilization and investment, the strategy implementation and monitoring mechanisms have not been able to track the investments made by countries on the various types of EYE interventions. As a result, the evaluation team was not able to determine the level of investment (budget and expenditure by strategic objectives) from the different international partners and countries on an annual basis. The lack of such data limits undertaking an analysis of either duplication of efforts or efficiency gains on collaboration and working together.

Resource mobilization

The EYE secretariat developed an EYE engagement strategy in 2021 to mobilize additional funding from different sources. The EYE engagement (funding and advocacy) strategy (2022-2026) was developed and validated in Feb/March 2021 as a resource mobilization strategy with emphasis on the second half of implementation and includes a donor mapping and profiling.⁸¹ It is envisioned that the summary document will be circulated for information to the EYE partnership. This is a real achievement, but the engagement strategy does not spell out a mechanism for sustaining gains through domestic financing and exiting from external finance over the long term (see further discussion under Section 5.4).

A dedicated resource mobilization consultant for EYE at WHO headquarters, funded through the BMGF grant had recently been secured. However, it was difficult to understand countries' realities on the ground and the consultant's role was not as effective as expected. It was mentioned in hindsight that placing such a position at the regional level might have been a better option.

By mid-term, 39% of the projected costs to implement EYE activities from 2017 to 2022 had been mobilized by EYE partners corresponding to 19% of the total estimated costs of EYE implementation through 2026⁸² (see overview in Section 5.2.2 below). With information gaps and without expenditure tracking, it is not possible for the evaluation team to assess if financial resources, despite their realization, have been adequate given the contributions from the PAHO revolving fund and national governments, which were not included in the resource mobilization results. Delays of some activities (for example, PMVCs) might also have lowered the funding needs for the first half of EYE implementation. Key informants at the country level have mentioned financial resources as a challenge to implementation, whereas global-level key informants generally perceive domestic resource mobilization as the bigger challenge. (Sustainable financing is discussed more in Section 5.4).

⁸¹ EYE Partnership Non-Technical Stakeholders Engagement Strategy (2022-2026) [unpublished report]. EYE Partnership; 2022.

⁸² Comparing EYE costing and the EYE engagement documents, note that this does not include in-kind human resources, and contributions from the PAHO revolving fund and national governments which were not available to the evaluation team.

External resource mobilization efforts have largely been driven by WHO and are not typically discussed in programme management group meetings. A more inclusive approach to resource mobilization efforts for EYE is needed with dedication from all EYE partners towards this.

5.2.2 Has the EYE strategy taken advantage of complementarity of interventions and aligned with different global actors and strategies/initiatives to manage implementation efficiently? (EQ 2.2)

Summary box of key findings – EQ 2.2

- The design of the EYE strategy indicates the centrality of partnership to achieve its three strategic objectives.
- The EYE strategy partnership brings together strong international experts and partners with complementary skills, capacities and experiences.
- The EYE engagement strategy documented the contribution of funding for EYE implementation by different international EYE partners but did not specify levels of in-kind support.
- Alignment, cooperation and efficiencies in joint working between IA2030 and implementation of the EYE strategy 2023-2026 are currently being addressed, however, there appears to be missed opportunities of fully synergizing with IVB in WHO and other vaccine-preventable disease programmes and initiatives.
- The March 2022 launch of the GLAI notes complementarity with the EYE strategy, and EYE has been contributor to the GLAI core team since early inception phase.
- There is limited attention in any iteration of the EYE strategy M&E framework to partnership, alignment and complementarity, and the implementation of the strategy has not explicitly addressed actions towards alignment or complementarity with work focused on achieving the Sustainable Development Goals (SDGs) or with UHC2030.
- The EYE partnership has minimally engaged with CSOs and not yet engaged with extractive industries and other relevant private sectors which was initially planned for.
- More substantial complementarity and coordination would be required with organizations, departments and teams working on vaccine-preventable diseases, urban health, health system strengthening, vector surveillance, IHR, CSO and private sector partners.

Complementing resources

The EYE engagement strategy (the main funding and resource mobilization strategy for EYE) documented the contribution of funding by different international EYE partners.⁸³ An analysis of the information generated from this engagement strategy found that:

- a) about US\$ 899 million actual funding was mobilized by the mid-term; corresponding to 19% of the total estimated cost for implementing the EYE strategy from 2017 to 2026 and 39% of the total estimated cost of implementing the strategy from 2017 to 2022;
- b) the major source of direct financing for the EYE strategy is Gavi with a 99% share, mainly for vaccines and immunization; and
- c) the engagement strategy does not consider contributions from the PAHO revolving fund and national government contributions; and in-kind support from all partner organizations were not estimated (but also not costed for in the EYE costing summary).

⁸³ EYE Partnership Non-Technical Stakeholders Engagement Strategy (2022-2026) [unpublished report]. EYE Partnership; 2022.

The detailed financial contribution of each of the international partners is summarized in Table 6 below.

Table 6: EYE strategy financial investments by global partners 2016-2023

Source of funding	Supported activity/department	Timeframe	Financial allocation in US\$	Share in %
BMGF	EYE secretariat	2019-2021	1 318 710	
	AFRO	2019-2021	3 278 048	
	EYE secretariat	2022-2023	2 402 263	
	Subtotal BMGF		6 999 021	0.7%
Gavi	YF vaccines	2016-2020	278 000 000	
	YF vaccines (additional allocation)	2017-2020	150 000 000	
	YF immunization	2021-2025	448 000 000	
	Improving laboratory diagnostic capacity in Africa	Not specified	13 500 000	
	Subtotal Gavi		889 500 000	99%
WHO	Face masks for PMVCs	2020	2 400 000	0.3%
Total			898 899 021	

Source: WHO, the EYE engagement strategy 2022-2026

Note: This overview does not include financial contributions from national governments, PAHO revolving fund, nor in-kind human resources from WHO at all levels/PAHO, or from Gavi, UNICEF, CDC, and the Robert Kock institute.

In addition to globally mobilized financial support shown above from BMGF, Gavi, and WHO, the EYE engagement document also highlighted that partners were additionally providing in-kind human resource support. WHO is funding two EYE secretariat staff positions. PAHO, UNICEF, Gavi and other EYE partners such as BMGF, CDC and the Robert Koch Institute have provided significant in-kind human resource support to EYE coordination and working groups, and for procurement and supply of yellow fever vaccines and diagnostics - yet the extent of this support is not further detailed in the EYE engagement strategy⁸⁴ and was not available to the evaluation team although requested. The engagement strategy finally mentions that the US CDC Foundation funded the printing of more than 6 million vaccination cards and the provision of almost 90,000 bottles of hand sanitizers.

The potential of compiling and complementing resource demands across the partnership is an added value of the strategy although this potential is not fully leveraged with limited efforts at joint resource mobilization efforts and the extent of full-time equivalent human resource dedications being unknown.

Alignment with global policies, strategies and M&E frameworks

There is limited attention in any iteration of the EYE strategy M&E framework to partnership, alignment and complementarity, other than to the IHR and relying on WHO/UNICEF estimates of national immunization coverage (WUENIC) indicators. These are the only examples in the EYE strategy M&E framework with explicit reference to partnership, synergies, added value of joint action or economies of scale. Thus, there are no other relevant EYE strategy M&E framework indicators explicitly referring to alignment and complementarity (apart perhaps from tangentially through 1.3.1d and

⁸⁴ EYE Partnership Non-Technical Stakeholders Engagement Strategy (2022-2026) [unpublished report]. EYE Partnership; 2022.

1.4.1b, regarding Gavi applications by eligible countries). It could, however, be argued that the achievement of a number of strategic objectives 1-3 indicators does implicitly depend on such actions (for example, 1.3 - risk assessment and strategic objective 3, 3.3 - emergency vaccine stockpile).⁸⁵

This absence of attention is in contrast to, for example, the IA2030 M&E framework, whose impact goal indicator 3.2 is “Universal Health Coverage Index of Service Coverage”, with the intention of contributing to achievement of universal health coverage. A number of the IA2030 impact and strategic objective indicators explicitly address national-level actions from legislative, community and health perspectives. Stakeholders for achieving indicator progress include national entities such as immunization programmes. The IA2030 M&E framework explicitly addresses ownership at all levels.⁸⁶

The implementation of the EYE strategy has not explicitly addressed actions towards alignment or complementarity with work focused on achievement of the SDGs or with UHC2030. The most directly pertinent components of the SDGs are indicators 3B.1 (proportion of the target population covered by all vaccines included in their national programme) and 3D.1 (on the IHR) and aspects of SDG 5, while 13 of the 17 SDGs are said to have relevance to immunization. UHC2030 transformed from the International Health Partnership+ in 2016; its focus on health systems strengthening commits to mobilizing better aligned resources for achieving universal health coverage. Such focus is largely absent from EYE governance structure reports and updates, for example, the leadership and programme management groups’ documents.

There has further been limited linkage to existing vector surveillance and vector control programmes in the implementation of the EYE strategy. This was a theme that emerged during several key informant interviews as critical to the future elimination of yellow fever epidemics. The new WHO Global Arbovirus Initiative (GLAI) launched in March 2022,⁸⁷ however, has vector surveillance and control as a prime focus area – the GLAI Pillar 2 is: “Reduce epidemic risk. Priority actions [include] ... increase population protection through yellow fever vaccination in high-risk areas through the implementation of the EYE strategy.”⁸⁸ According to key informants, the EYE team is closely working with GLAI and this will facilitate synergies and alignment. It will be critical to continue the close collaboration of EYE with GLAI as its implementation starts to maximize on synergies. Furthermore, the GLAI can learn from the multi-partnership approach of EYE.

Alignment, cooperation, and efficiencies in joint working between IA2030 and implementation of the EYE strategy 2023-2026 are actively being addressed. The IA2030 framework refers to necessary alignment with the EYE strategy specific to governance and optimal synergies. This opens the door for leverage focused on enhanced complementarity and efficiencies of scale and resource use.⁸⁹ In 2021, an IA2030/EYE task team was established to identify areas of greatest strategic return, and the report proposes relevant strategies and focus areas that now need to be prioritized for greater synergies with

⁸⁵ The current iteration of the EYE M&E framework (May 2022) shows that the baseline for all 1.3 indicators either stands at zero (number and %) or remains to be determined. The target for 1.3.1c is 6 countries 2020-2026; for 1.3.1d 100%. The data source is to be EYE RAWG updates and for 1.3.1d also Gavi applications. These are potentially somewhat unrealistic targets when untethered by any baseline or regional/country-specific contextualization. WHO: EYE Strategy M&E Framework (Excel spreadsheet); accessed July 2022.

Of note also is that there is minimal reference in any EYE M&E or other documentation to how the digital data system the DHIS2 (District Health Information System - version 2) might be expanded and/or more effectively analysed so as to represent a resource for more granular yellow fever data collection and use. For very brief discussion, see EYE M&E Update April [PowerPoint]. Bader J; 2021.

⁸⁶ [Immunization Agenda 2030: A Global Strategy To Leave No One Behind](#). Geneva: World Health Organization; 2020.

⁸⁷ [Launch of the WHO Global Arbovirus Initiative](#). Geneva: World Health Organization; 2022.

⁸⁸ [Inaugural meeting of the Technical Advisory Group on Arboviruses 2021](#). Global Arbovirus Initiative & World Health Organization; 2022.

⁸⁹ [Implementing the Immunization Agenda 2030](#). Geneva: World Health Organization; 2021.

IA2030.⁹⁰ Aspects of EYE integration with IA2030 are further discussed under sustainability in Section 5.4.2.

Synergy and complementarity with different global and country level actors

The design of the EYE strategy indicates the centrality of partnership to achieve its three strategic objectives. It sets out potential “synergies with other programmes and sectors”. The EYE strategy strategic objective 2 refers in detail to application of the IHR, in terms of strengthening alignment. However, there is no stated direct complementarity of the strategy with current international strategies and initiatives at the time of the strategy formulation, for example, the Gavi Strategy 4.0, and the Global Vaccine Action Plan 2011-2020.

EYE partners listed in the EYE strategy document represent an extensive group of key actors with complimentary roles. The EYE partnership is unique in this sense and provides opportunities of synergizing efforts of relevant major global actors, including WHO, UNICEF, Gavi and the private sector (yellow fever vaccine manufacturers). It is, however, important to note that weighting is towards multilateral, bilateral and technical representation. Partner organisations are members of relevant EYE governing bodies and EYE working groups and key informants have mentioned that the EYE strategy has provided the added value of shared visions and goals, and a clear role division on yellow fever for the three main partners.

However, the EYE strategy has not optimally addressed the potential for effective partnership with civil society. This finding is based largely on the limited operational focus in the EYE strategy and key related documents such as the 2021 communication strategy (which refers to 'community' only in terms of, for example, the IHR and academic communities) and EYE secretariat and EYE updates. As mentioned previously, there is further a limited number of CSO partners in the EYE partnership at global level. Selected EYE country toolkits do mention the importance of working with CSOs, yet none of the key EYE documents to-date (and podcasts) consider in any detail the potential role of CSOs in for example, working with hard-to-reach and/or vulnerable groups such as young men, in addressing vaccine hesitancy, etc.

Yet there is a wealth of evidence for the positive involvement of CSOs in all areas of public health, including immunization. Just one very recent example of how such partnership is acknowledged as crucial is the new WHO Fund for Pandemic Prevention, Preparedness and Response (PPR), which was officially established on 9 September 2022, with WHO providing technical leadership. CSOs will be integral to the fund. However, at the country level under EYE there are good examples of working with CSOs and community structures, this is further elaborated in section 5.4.2.

Furthermore, there appears to be missed opportunities of fully synergizing with IVB in WHO (leading on vaccination efforts for other diseases), where coordination could be strengthened including through enforced ownership of EYE in IVB, and coordination between IA2030 and EYE working groups. Examples of missed opportunities include: the lack of routine presence in EPI managers' meetings, which take place regularly; and limited information flow, which was reported to be compromising this collaboration. The inadequate attention to GE+HR in the EYE strategy and its implementation (see Section 5.5) was another example mentioned where such attention is widely infused in the IVB, and its work and expertise is available in the form of a gender focal point.

In addition, experts on health system strengthening, urban health, IHR and vector control are not sufficiently represented in EYE governance structures/working groups and linkages seems to be inadequate to promote complementarity.

⁹⁰ [Optimizing Immunization Agenda 2030 \(IA2030\) implementation to support achievement of Global Strategy to Eliminate Yellow fever Epidemics \(EYE\) objectives](#). Geneva: World Health Organization; 2021.

More substantial complementarity would thus be required with departments and teams working on vaccine-preventable diseases, urban health, health system strengthening, IHR and CSO partners to maximize efficient implementation of EYE. Additional attention to alignment and potential efficiencies with, for example, action on humanitarian emergencies specific to yellow fever is also desirable. The EYE on yellow fever podcast 8 (Public Health in a Humanitarian Crisis) especially refers to such matters, as do a few key informants: “The EYE strategy needs to feed into and feed off the global health emergencies/global preparedness group/global efforts.” There is also consideration from key informants of how work with vulnerable groups might best inform humanitarian actions to ensure yellow fever and other immunization work continues.

At present, the EYE governance structure could benefit from a more diversified partner base. Key informants suggest there is a need and opportunity to expand the participation in governance to include more expertise and perspectives and to share the workload. They note the potential for significant added value from inclusion of expert, community-focused health/immunization CSOs in EYE strategy implementation. Furthermore, while private sector engagement with vaccine suppliers and producers is impressive and unique, engagement with extractive industries (such as the oil and mining industries) and other sectors (such as construction and forestry) have not yet started despite this being a priority mentioned in the EYE strategy. Engaging such private sector partners appears relevant to the evaluation team in order to advance access to high-risk workers and tap into corporate social responsibility efforts.

EQ3: What results have been achieved by the EYE partnership in the implementation of the strategy? (Effectiveness)

The third evaluation question explores the results of EYE implementation achieved to the mid-term (sub-question 3.1) and contextual factors/changes that affected yellow fever spread and influenced programme implementation (sub-question 3.2).

5.3.1 To what extent is the EYE strategy on course to achieving its objectives and results by the end of 2026? (EQ 3.1)

Summary box of key findings – EQ 3.1

Epidemiological update:

- The threat of yellow fever outbreaks continues to affect countries in Africa and the Americas, despite advances in vaccine activities.
- Twenty-two yellow fever large disruptive outbreaks⁹¹ have been reported in the period 2017-2021 across 11 countries (9 in Africa and 2 in the Americas) some of which were in close proximity to urban centres with the inherent risk of international spread.
- A total of 4039 confirmed cases of yellow fever has been reported across Africa and the Americas in the period January 2016 to August 2022, with an increasing trend in the number of cases in African countries since 2017 but a decreasing annual number of yellow fever confirmed cases in the Americas since 2019.
- Yellow fever outbreaks are generally found in populations that had not been reached by routine immunization services or large-scale campaigns, people living in areas with compromised security, or hard-to-reach and mobile populations. Almost all recent yellow fever cases from the Americas were found among male agricultural workers or those active in resource/extractive industries, whereas cases in African countries were more equally

⁹¹ Definition of a large disruptive outbreak of yellow fever: more than five cases confirmed in symptomatic persons from a localized cluster in space and time in a known endemic area necessitating a large-scale reactive vaccination response OR > 1 cases confirmed from probable local transmission in a non-endemic area.

distributed across males/females and more cases were observed among infants in Africa than in the Americas.

Key findings related to the progress by mid-term on the 16 strategic M&E indicators⁹² of EYE:

- There has been marked progress on the number of people vaccinated through PMVCs in Africa and the milestone for 2022 is within reach if planned campaigns for 2022 materialize. Delays have been observed and were mainly attributed to competing priorities for national governments, including COVID-19, but also indications of funding and vaccine supply constraints at the country level.
- Yellow fever vaccine availability has greatly increased. Through the EYE implementation period the supply of vaccines for Gavi-eligible countries increased by approximately 75%.⁹³ Less stock outs are also being reported at country levels. However, a risk of vaccine supply challenges exists due to the limited number of suppliers, complex and lengthy vaccine production, and global inflation.
- Post vaccination campaign coverage surveys indicate inadequate and declining coverage levels. Vaccination campaign coverage levels, post campaign surveys and their quality need urgent attention by the EYE partnership given the trend observed and the recent outbreaks in West African countries with a history of large-scale campaigns.
- Few countries have a ministry of health-endorsed national plan for implementation of the EYE strategy, and most plans are now outdated.
- Two yellow fever high-risk countries have not yet included yellow fever vaccine into routine immunization (Ethiopia and South Sudan) and a few countries (Argentina, Kenya, and Panama) have only introduced yellow fever vaccine in routine immunization schedules in selected subnational areas. Based on risk classification, Argentina and Panama do not need to include yellow fever vaccinations into routine immunization nationwide, whereas a reassessment of risks is essential across Kenya given the recent yellow fever outbreaks. Multi-partner and substantive efforts need to be invested for Ethiopia and South Sudan to integrate yellow fever vaccines into routine immunization.
- Persistent suboptimal routine immunization coverages for yellow fever vaccine, amongst other vaccine-preventable diseases, is observed for a majority of yellow fever high-risk countries, and in some countries yellow fever routine immunization coverage rates worsened during the COVID-19 pandemic. Large country variations are, however, observed, and coverage rates have also been affected by population growth. In the Americas, fewer countries reached yellow fever vaccine coverage rates above 80% in 2021 compared to 2016, whereas an increase of countries reaching coverage rates above 80% in 2021 was noted in Africa compared to 2017 (yet a decrease since 2014). The gap between yellow fever vaccine and measles-containing vaccine coverage through routine immunization seems to be narrowing. However, data quality concerns persist for routine immunization, which may have affected interpretation.
- There has been little progress so far on planned EYE activities related to strategic objective 2, including engaging major industries/targeting at-risk workers and developing urban readiness plans. This needs urgent attention and acceleration.
- Three of the 40 countries (Argentina, Brazil and Peru) do not require a yellow fever vaccination certificate from incoming travellers from endemic countries (2021). At EYE inception in 2017, four countries (Argentina, Ecuador, Peru and South Sudan) did not require a yellow fever vaccination certificate.
- Major progress is noted in the African Region on the time from onset of disease/suspected case to confirmatory results due to strengthened laboratory capacity, and a well-functioning

⁹² The EYE PMG and LG have decided to monitor EYE progress mainly through 16 strategic M&E indicators, where data is more comprehensively available than for the remaining 30 indicators.

⁹³ Overview, Progress, Challenges, and Next Steps [PowerPoint]. EYE Partnership; 2021.

international sample shipment transportation system (EYE.Ops), with the weakest link being transportation of samples from local levels to national reference labs. Complex diagnostic processes still cause delays in rapid detection and response in Africa, but new diagnostic tools in the pipeline look promising.

- While the proportion of outbreak response vaccination campaigns starting within 86 days has seen an increase since 2018 (but a decrease since 2017), the average number of days between index case and campaign start had increased (a few countries have significant delays and contribute to this latter increase). Response delays noted during recent outbreaks are mostly attributed to the time period from a notified yellow fever case until a request is submitted to ICG. The most frequently cited obstacles to yellow fever surveillance included: funding challenges, insufficient supply of commodities, limited human resource capacity, inaccessible or hard-to-reach communities, and limited community engagement.
- Large country variations are observed on almost all EYE strategic indicators, thus warranting monitoring of country disaggregated performance data. In terms of programmatic milestones (different from strategic indicators of the M&E framework) the EYE programme has overall met most of its milestones, however, with delays.

This section starts with an epidemiological update on the situation at mid-term after which it will describe the progress, achievements and challenges related to 16 strategic indicators of the EYE M&E framework.

Epidemiological update

The threat of yellow fever outbreaks continues to affect countries in Africa and the Americas. Twenty-two large yellow fever disruptive outbreaks have been reported in the period 2017-2021 across 11 countries.⁹⁴ The number of large disruptive outbreaks has increased almost every year since 2017, reaching six in 2021 (

⁹⁴ Definition: IA2030 indicator of disruptive large outbreak of YF: more than 5 cases confirmed in symptomatic persons from a localized* cluster in space and time in a known endemic area necessitating a large-scale** reactive vaccination response OR > 1 cases confirmed from probable local transmission in a non-endemic area).

*not in same household

** greater than 100,000 doses administered

Table 7) and with most large outbreaks reported in Nigeria (8) and Brazil (4) Source: EYE dataset, August 2022

Figure 9).

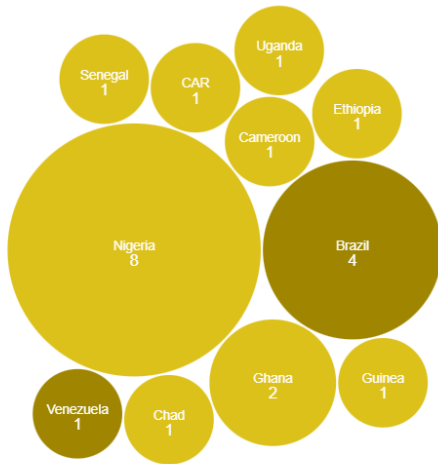
A concerning finding is the apparent resurgence of yellow fever outbreaks in countries with a history of large-scale PMVCs (for example, Cameroon, Chad and Ghana). The likely reasons for these outbreaks include persistent suboptimal coverage of routine immunization over at least a decade or two, as well as coverage gaps of yellow fever large-scale campaigns - particularly among vulnerable and hard-to-reach populations. These aspects are further analysed and described later in this section.

Table 7: Number of large disruptive yellow fever outbreaks 2017-2021- global

2017	2018	2019	2020	2021
3	4	4	5	6

Source: EYE dataset, August 2022

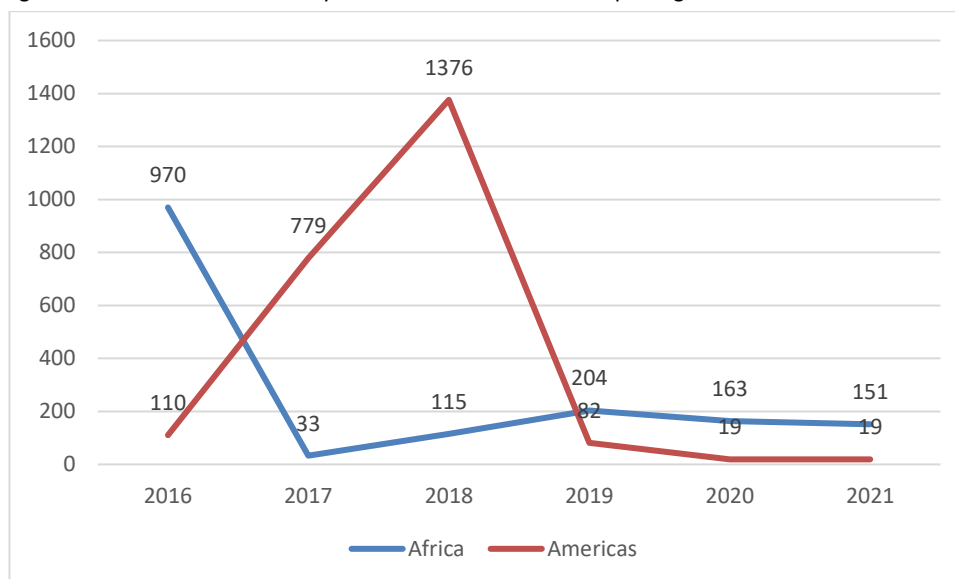
Figure 9: Number of large disruptive yellow fever outbreaks 2017-2021



Source: EYE dashboard, August 2022

A total of 4039 confirmed cases of yellow fever has been reported across Africa and the Americas in the period January 2016-August 2022, with an increasing trend in the number of cases in African countries since 2017 and a decreasing annual number of yellow fever confirmed cases in the Americas since 2019. Figure 10 **Error! Not a valid bookmark self-reference.** presents the trend in number of confirmed cases in Africa and the Americas from 2016 to 2021.⁹⁵

Figure 10: Number of confirmed yellow fever cases 2016-2021 per region



Source: WHO, weekly epidemiological record: No 32, 2017, 92; No 32, 2018, 93; No 33, 2019, 94, No 34, 2020, 95; No 33, 2021, 96; No 32, 2022, 97.

In the following section, epidemiological trends in Africa and the Americas will be explored in more detail.

⁹⁵ 2022 data from African countries not published at the time of review, and 2022 data from the Americas still preliminary.

African Region

Yellow fever was among the top five most frequently reported events in the African Region in 2019,⁹⁶ only surpassed by COVID-19, measles, polio (cVDPV) and cholera, and was assigned a WHO Grade 2 Health Emergency at regional level.^{97,98}

From 1 January 2021 to 26 August 2022, a total of 12 countries in the African Region have reported 184 confirmed cases and 274 probable cases, including 21 deaths, reflecting ongoing complex viral transmission (Figure 11). The majority of cases were reported in Ghana (33%) and mainly in the last quarter of 2021. Across African countries, the male-to-female ratio was 1.2, the majority were below 30 years of age (73%) and some cases among infants were also reported.⁹⁹ Several countries in West and Central Africa reported confirmed yellow fever cases during 2020 and 2021 after a decade or more without any reported cases, including in countries that had completed large-scale preventative mass vaccination campaigns (for example, Cameroon, Chad and Ghana).

In 2021, nine African countries – Cameroon, the Central African Republic (CAR), Chad, Congo, Côte d’Ivoire, the Democratic Republic of the Congo, Gabon, Ghana, and Nigeria reported a total of 151 confirmed cases of yellow fever. Of these nine countries, eight continue to report confirmed cases of yellow fever thus expressing ongoing transmission in 2022 (Cameroon, the Central African Republic, Chad, Congo, Côte d’Ivoire, the Democratic Republic of the Congo, Ghana and Nigeria). Additionally, yellow fever cases were reported from Kenya, Niger and Uganda in 2022.¹⁰⁰

⁹⁶ [Progress report on the implementation of the regional strategy for health and security and emergencies 2016-2020](#). World Health Organization; 2021.

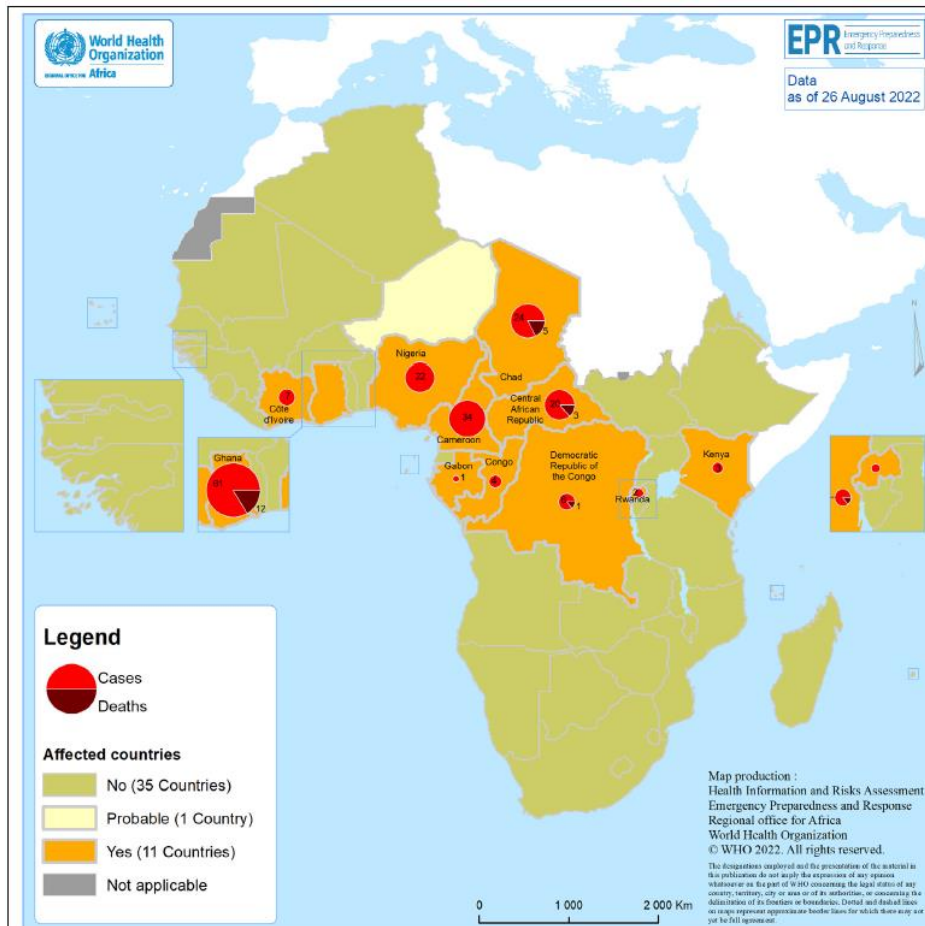
⁹⁷ Definition of Grade 2: “A single country or multiple country emergency, requiring a moderate response by WHO. The level of response required by WHO always exceeds the capacity of the WCO. Organizational and/or external support required by the WCO is moderate. The provision of support to the WCO is coordinated by an Emergency Coordinator in the Regional Office. An Emergency Officer is also appointed at headquarters to assist with the coordination of Organization-wide support.” Source: <https://www.who.int/emergencies/grading>

⁹⁸ [Outbreaks and Emergencies Bulletin, Week 36: 29 August - 4 September 2022](#). World Health organization; 2022.

⁹⁹ [Yellow fever - East, West, and Central Africa](#). World Health Organization; 2022.

¹⁰⁰ Until October 2022.

Figure 11: Yellow fever cases reported in Africa 1 Jan 2021-26 Aug 2022



Source: Weekly bulletin of outbreaks 29 Aug-4 Sep 2022, WHO

Notes: The map has a mistake: Rwanda incorrectly figured, this should be Uganda.

The location of some of the outbreaks is a major concern due to the potential for rapid urban spread and amplification (Abidjan, Brazzaville, Kampala in particular),¹⁰¹ unprotected migrant/nomadic populations (Ghana, Nigeria), low yellow fever routine immunization coverage and delayed preventive yellow fever vaccination campaigns.

The outbreaks are generally found in populations with existing immunity gaps¹⁰² including in populations that have not been reached by routine immunization services or large-scale vaccination campaigns, mobile populations and people living in hard-to-reach areas, and areas with compromised security.¹⁰³ The intensification of yellow fever transmission is also attributed to the natural cycle of virus transmission in jungle settings and greater population movement. This trend is likely to persist for several years given suboptimal vaccine coverages that worsened with COVID-19.

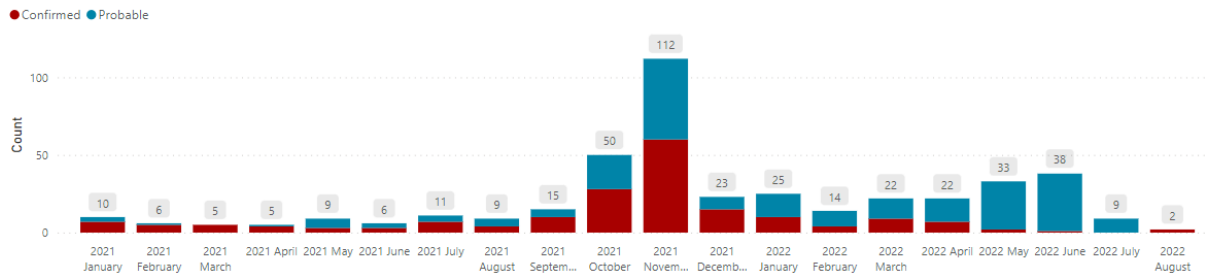
Figure 12 below presents the number of confirmed and probable cases in Africa between January 2021 and August 2022, a spike was observed in November 2021, mainly due to outbreaks in Ghana.

¹⁰¹ [Outbreaks and Emergencies Bulletin, Week 36: 29 August - 4 September 2022](#). World Health Organization; 2022.

¹⁰² [Outbreaks and Emergencies Bulletin, Week 36: 29 August - 4 September 2022](#). World Health Organization; 2022.

¹⁰³ [Outbreaks and Emergencies Bulletin, Week 36: 29 August - 4 September 2022](#). World Health Organization; 2022.

Figure 12: Number of yellow fever cases in Africa 1 Jan 2021-12 Aug 2022, confirmed and probable cases



Source: EYE dashboard, August 2022

The Region of the Americas

In the Americas, outbreaks in the period 2017-2022 have been reported in Bolivia, Brazil, Colombia, Peru and Venezuela, with a total of 2 324 confirmed cases, of which 96% were reported in Brazil (Figure 13), and the vast majority being recorded in the period 2016-2018.¹⁰⁴ The downward trend observed in the number of confirmed cases in 2019-2020,¹⁰⁵ continued in 2021 and 2022, with signs of widespread virus circulation but only occasional spill-over to humans.

In 2021, 19 confirmed cases were reported from the Americas (8 cases in Brazil and 11 cases in Venezuela).¹⁰⁶ In 2022, five cases were confirmed in Brazil, five in Bolivia and two in Peru.¹⁰⁷ Recent yellow fever cases were confirmed in settings with low population immunity in Bolivia, Brazil, Peru and Venezuela, and the vast majority of cases (about 75%) were reported in males exposed to wild and/or forested areas in agricultural or extractive industry work.

Figure 13: Number of confirmed yellow fever cases 2017-2022, Americas map



Source: WHO, Weekly epidemiological record: No 32, 2017, 92; No 32, 2018, 93; No 33, 2019, 94, No 34, 2020, 95; No 33, 2021, 96; No 32, 2022, 97

¹⁰⁴ [Outbreaks and Emergencies Bulletin, Week 36: 29 August - 4 September 2022](#). World Health Organization; 2022.

¹⁰⁵ [Outbreaks and Emergencies Bulletin, Week 36: 29 August - 4 September 2022](#). World Health Organization; 2022.

¹⁰⁶ [Outbreaks and Emergencies Bulletin, Week 36: 29 August - 4 September 2022](#). World Health Organization; 2022.

¹⁰⁷ [Outbreaks and Emergencies Bulletin, Week 36: 29 August - 4 September 2022](#). World Health Organization; 2022.






Progress, achievements, and challenges

This section provides an overview of the progress across the three overall strategic objectives of the EYE strategy.¹⁰⁸












1. Protect at-risk populations: Yellow fever transmission is minimized through maintenance of high levels of population immunity in at-risk areas.
2. Prevent international spread: No international exportation of yellow fever from high-risk countries to other areas, by 2026.
3. Contain outbreaks rapidly: No sustained yellow fever transmission by 2026.

The EYE M&E framework has been revised several times since the inception of EYE and in 2021 it was decided to mainly focus on 16 strategic indicators where more data were available. This mid-term evaluation is thus reporting against progress on these selected 16 strategic indicators out of a total of 46 indicators in the M&E framework. Table 8 provides an overview of progress at mid-term for these indicators, followed by a short summary of the table. Red, amber, green on track colour coding refers to a collected evaluation of progress to date on each indicator *vis-à-vis* the baseline for 2017 and targets for 2026. A detailed description of progress and challenges related to each of the 16 indicators is provided in the pages following Table 8.

Table 8: Strategic Indicators for EYE, mid-term progress against 2026 targets

Strategic indicators	Baseline	Status at mid-term	Target for 2026	Source	On track status at mid-term
Strategic objective 1- Protect at-risk populations					
1.1 Proportion of people vaccinated through PMVCs and RVCs in YF high-risk countries (only AFR)	N/A	39%/185 million (2022)	100%/478 million	EYE dataset Aug 22	
1.2 Proportion of YF high-risk countries achieving at least 80% routine vaccination coverage of the annual child cohort with YF vaccine*	Africa: 19% Americas: 50% (2017)	Africa: 22% Americas: 25% (2021)	100%	WUENIC 2021	
1.3 Proportion of YF high-risk areas (Admin1) achieving at least 80% coverage via campaign completion	80% (2018)	43% (2021)	100%	Post campaign coverage surveys for PMVCs	
1.4 Proportion of YF high-risk countries with multi-year national plan that includes YF activities	N/A	57%** (8 of 14) 86%	100%	EYE internal tracking files	
1.5 Proportion of YF high-risk countries with a difference in immunization coverage between YFV and MCV1 lower than 5%*	47% (16 of 34) (2017)	63% (22 of 35) (2021)	100%	WUENIC 2021	
Strategic objective 2- Prevent international spread					

¹⁰⁸ EYE Strategic M&E Framework [PowerPoint]. EYE Partnership; 2020.

2.1 Proportion of relevant major industry employers engaged and implementation of YF industry guidance	N/A	N/A	100%	EYE internal tracking file	
2.2. Proportion of high-risk countries carrying out entry screening for YF vaccination proof on main airports and seaports, on travellers coming from endemic countries	36/40 (all but Argentina, Ecuador, Peru, South Sudan) (2017)	37/ 40 (all but Argentina, Brazil, Peru) (2021)	100%	ITH country list 2022	
2.3 Proportion of high-risk countries that have engaged IHR focal points to strengthen YF IHR capacity	N/A	N/A	40 (100%)	EYE internal tracking file	
2.4 Proportion of YF high-risk countries with yellow fever measures included in their preparedness, readiness and response plans	N/A	N/A	40 (100%)	EYE internal tracking file	
Strategic objective 3- contain outbreaks rapidly					
3.1 Proportion of YF cases investigated within 2 weeks of index case notification	85% (2017) AFR only	89% (2021) AFR only	100%	AFR YFLN datasets	
3.2 Proportion of samples transported within 14 days from local level to national reference laboratory	97% (2017) AFR only	81% (2021) AFR only	100%	AFR YFLN datasets	
3.3 Proportion of IgM test results reported by national reference laboratories in YF high-risk countries within 7 days after receipt of blood specimen	41% (2017) AFR only	79% (2021) AFR only	100%	AFR YFLN datasets	
3.4 Proportion of samples transported within 5 days from national reference laboratory to regional reference laboratory	N/A	81% (2022)	100%	EYE Ops	
3.5 Proportion of positive YF cases referred for confirmation at regional reference laboratory (RRL) with results made available within 28 days from receipt of specimen (by RRL)	N/A	91% (2021)	100%	AFR YFLN	
3.6 Proportion of months during which YF emergency stockpile is full	100% (2017)	100% (2021)	100%	ICG secretariat	
3.7 Proportion of YF outbreaks with RVCs starting within 86 days from onset of symptoms of first case	67% (2017)	50% (2021)	100%	EYE internal tracking files	

Abbreviations: YF: yellow fever; N/A: Not available; PMVC: Preventive mass vaccination campaign; RVC: reactive vaccination campaigns; AFR YFLN: African yellow fever Laboratory Network; M: million, MCV1: measles containing vaccine 1st dose; RRL: regional reference laboratory; IgM: Immunoglobulin M; IHR: International Health Regulations (2005)

*Considering only countries that have introduced YF in routine immunization programmes, and French Guyana did not report in 2021

**Source: EYE internal tracking files

Notes:

Red, amber, green colour coding refers to a collected evaluation of progress to date on each indicator vis-a-vis baseline for 2017 and targets for 2026.

Baseline data was missing for almost all indicators in the EYE M&E framework, data has been added for 2017 according to analysis undertaken by the MTE.

Summary of Table 8

Overall, while some important achievements on the EYE M&E framework indicators are observed during the first five years of EYE implementation (especially on the number of people vaccinated, availability of vaccines and decreased turnaround time for confirmatory results), some critical challenges and setbacks are observed (declining coverage levels through routine immunization and yellow fever vaccination campaigns, immunity gaps among vulnerable, hard-to reach and high-risk populations) and some critical activities are yet to start (protecting high-risk workers, urban readiness plans, strengthening IHR for yellow fever). In addition, significant data gaps and data quality concerns of the strategic indicators of the EYE M&E framework persist and a limited number of mid-term targets was available in the EYE M&E framework. Targets for 2026 strategic indicators seem ambitious given progress at mid-term and require revision for greater realism.

Strategic objective 1- Protect at-risk populations

EYE strategic indicator 1.1: Proportion of people vaccinated through PMVCs and reactive vaccination campaigns in yellow fever high-risk countries (AFR)

Since the EYE strategy's launch in 2017, the implementation of PMVCs has accelerated and **185 million people** in Africa have been protected against yellow fever by August 2022 through completed preventive, catch-up, and reactive vaccination campaigns. The target for EYE is to reach 478 million by 2026 across the African Region. This achievement thus translates into 39% of the target population reached by mid-term.

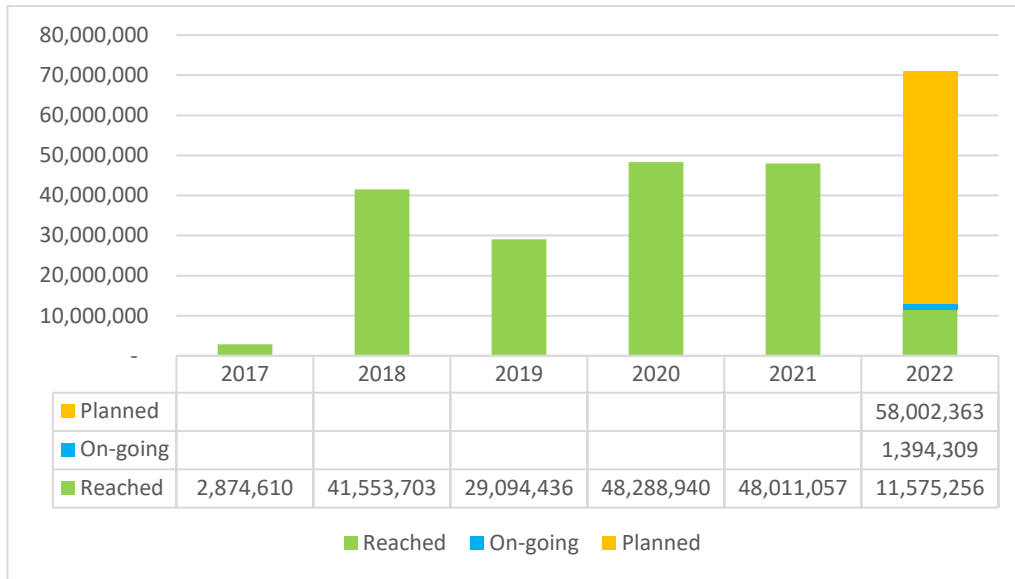
Reactive vaccination campaigns, PMVCs, and catch-up campaigns have been implemented across 12 countries in Africa (Cameroon, Chad, Congo, the Democratic Republic of the Congo, Ethiopia, Ghana, Guinea, Kenya, Nigeria, Senegal, South Sudan and Uganda) since 2017 (Figure 14). PMVCs contributed to 85% of the reached populations. Of the 185 million reached, almost 118 million had been reached in Nigeria alone. Three countries – Angola, Ghana and Sudan – have completed nationwide large-scale campaigns, while two large countries – Nigeria and the Democratic Republic of the Congo – have continued or launched multiyear campaigns.¹⁰⁹ The Democratic Republic of the Congo has reportedly achieved a lower yellow fever risk score in 2021 due to successful yellow fever PMVCs.¹¹⁰

An additional 59 million people are expected to be reached through ongoing and planned vaccination campaigns in 2022 with PMVCs in Congo, the Democratic Republic of the Congo, Nigeria, Uganda, and reactive vaccination campaigns in the Central African Republic, Chad, Ghana, (Figure 14, Figure 15 and Figure 16). The programme is on track to meet this important milestone for 2022 if reaching the planned population in 2022.

¹⁰⁹ Fifth Eliminate Yellow fever Epidemics (EYE) Strategy Annual Partners' Meeting [unpublished report]. Geneva: World Health Organization; 2021.

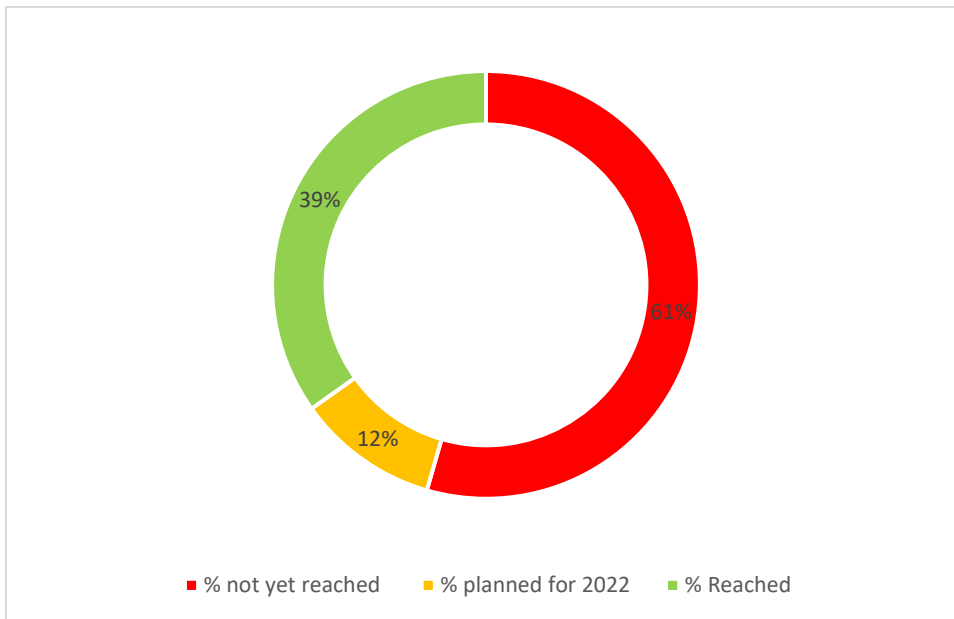
¹¹⁰ Fifth Eliminate Yellow fever Epidemics (EYE) Strategy Annual Partners' Meeting [unpublished report]. Geneva: World Health Organization; 2021.

Figure 14: Number of people reached/planned to be reached through yellow fever vaccination campaigns (PMVC, reactive vaccination campaign, catch-up campaigns), Africa, 2017-2022



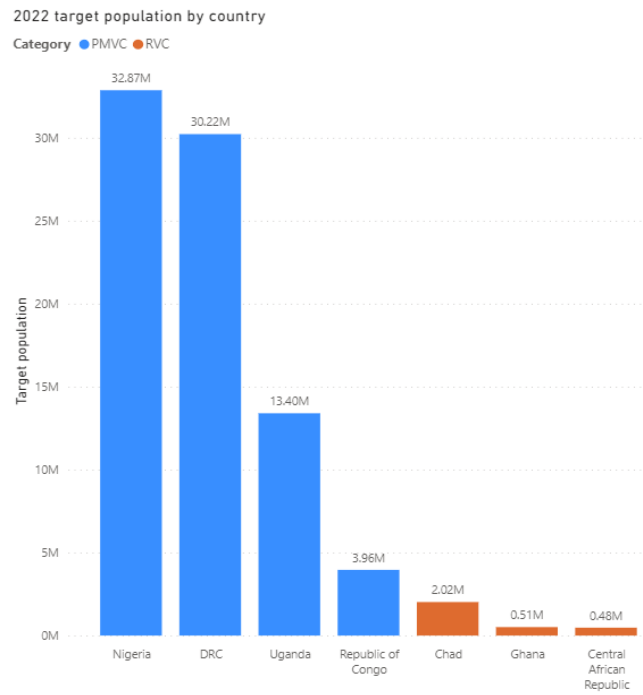
Source: EYE dataset August 2022

Figure 15: Progress since 2017 towards target of reaching 478 million people with yellow fever vaccine in Africa



Source: EYE dataset August 2022

Figure 16: 2022 yellow fever vaccination campaign target population per country and type of campaign



Source: EYE dashboard, Aug 2022

Notes: since this data was depicted, a DRC campaign planned to reach an estimated 15 million has now been postponed to 2023.

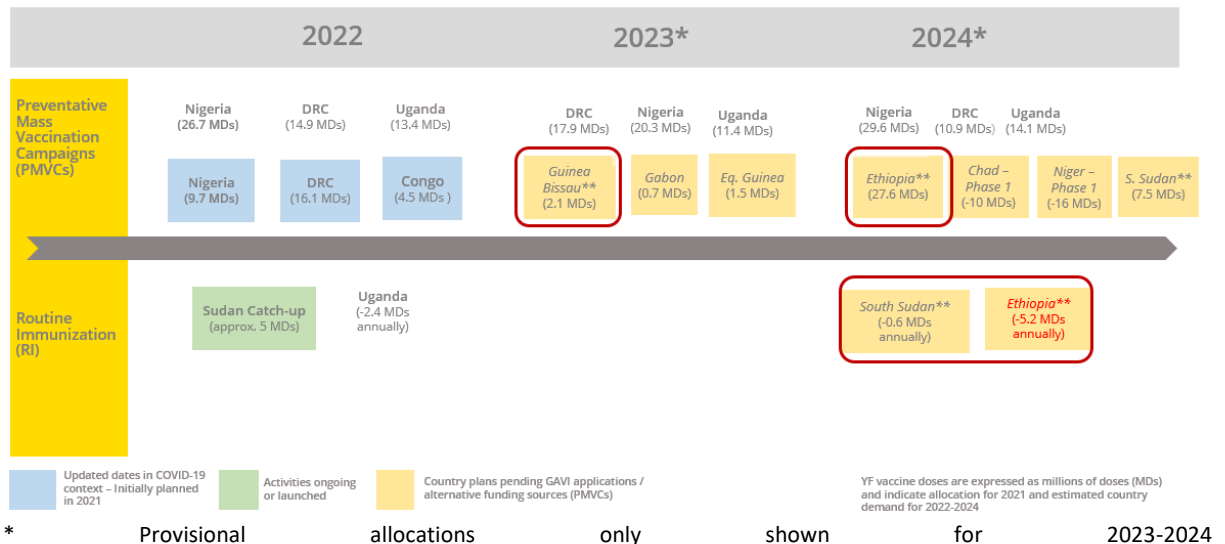
PMVC

Eight countries in Africa have yet to initiate PMVCs (Chad, Ethiopia, Equatorial Guinea, Gabon, Guinea Bissau, Niger, South Sudan, Uganda) – the plan for their initiation is presented in Figure 17. The resurgence of yellow fever outbreaks in Africa as mentioned earlier under the epidemiological update is not fully addressed by current campaigns, plans for routine immunization introduction, financial, policy or supply allocation. Recent yellow fever large disruptive outbreaks have happened in several countries that are not planned to have large-scale vaccination campaigns (Brazil, Cameroon, the Central African Republic, Guinea, Kenya, Senegal, Venezuela) or only estimated to initiate in 2024 (Chad, Ethiopia). This is partly explained because countries in East and Central Africa that already benefited from PMVCs were not prioritized to “re do” the activities through EYE. Targeted catch-up campaigns to reach under-immunized communities and strengthening of routine immunization performance will be critical in these countries. These are activities that will need to be properly financed and accounted for during allocation of vaccines.

PMVCs have reportedly been deprioritized due to other competing public health priorities, including COVID-19, and delays in the implementation have been noted due to a lack of financial resources/funding and challenges with political commitment at the country level. This is delaying reactive vaccination campaigns and PMVC implementation and impacting submission of quality Gavi applications.¹¹¹ Submissions to Gavi are pending for several high-risk countries with difficult contexts to advance, including for Ethiopia despite heavy investments into sorting out challenges.

¹¹¹ EYE Strategy 2020 Work Plan [PowerPoint]. EYE Partnership; 2020.

Figure 17: Planned PMVCs & routine immunization activities in Africa, 2020-2024 based on 2021 allocation



According to the draft roadmap for Latin America and the Caribbean, PMVCs will be applied in the Region of the Americas according to countries' needs (in high-risk areas with yellow fever vaccination coverage below 80%).¹¹² In the Americas, according to data shared by the EYE secretariat, Brazil reported reaching more than 3.5 million people through reactive vaccination campaigns in 2017 in outbreak affected states.¹¹³ There was also an intensification of vaccination activities in 2020–2022 in Venezuela,¹¹⁴ where a PMVC was introduced in November 2020, initially prioritizing 10 states considered to be at high risk. As of November 2021, 83% of the targeted population in Venezuela had been vaccinated (3.8 million out of 4.6 million targeted). The PMVC in Venezuela is planned to be completed in 2022.¹¹⁵ Two yellow fever high-risk countries of the Americas - Bolivia and Colombia – reported postponement of planned campaigns due to COVID-19 in 2020.¹¹⁶ Both countries are however planning to integrate yellow fever vaccine into catch-up measles, mumps and rubella campaigns in high-risk localities.

Significant delays in implementing large-scale vaccination campaigns were noted across both regions. Country level respondents to the online survey reported on barriers to starting PMVCs, and the analysis found that competing priorities and lack of funding were the most often cited reasons (Figure 18). Lack of vaccines appears as the third most frequently cited reason in both regions (Americas and Africa) for not having initiated PMVCs. It should be noted that results were not always consistent among respondents from each country and present individual perceptions. In addition, the small sample size should be taken into account, and only four people across four different countries of the Americas (Paraguay, Peru, Trinidad and Tobago, and Venezuela) reported a lack of vaccines as a barrier to introduce PMVC. A total of 15 individuals across 12 yellow fever high-risk African countries reported lack of vaccines as a barrier to initiate PMVCs.

Lack of funding was more often reported as a barrier to PMVCs among respondents from Africa (41%) than for the Americas (21%). Lack of funding could refer to both donor funding and domestic resource allocation. In relation to this, some key informants at the country level mentioned that domestic

¹¹² Draft roadmap for EYE implementation in Latin America and the Caribbean, PAHO 2021.

¹¹³ EYE dataset, August 2022.

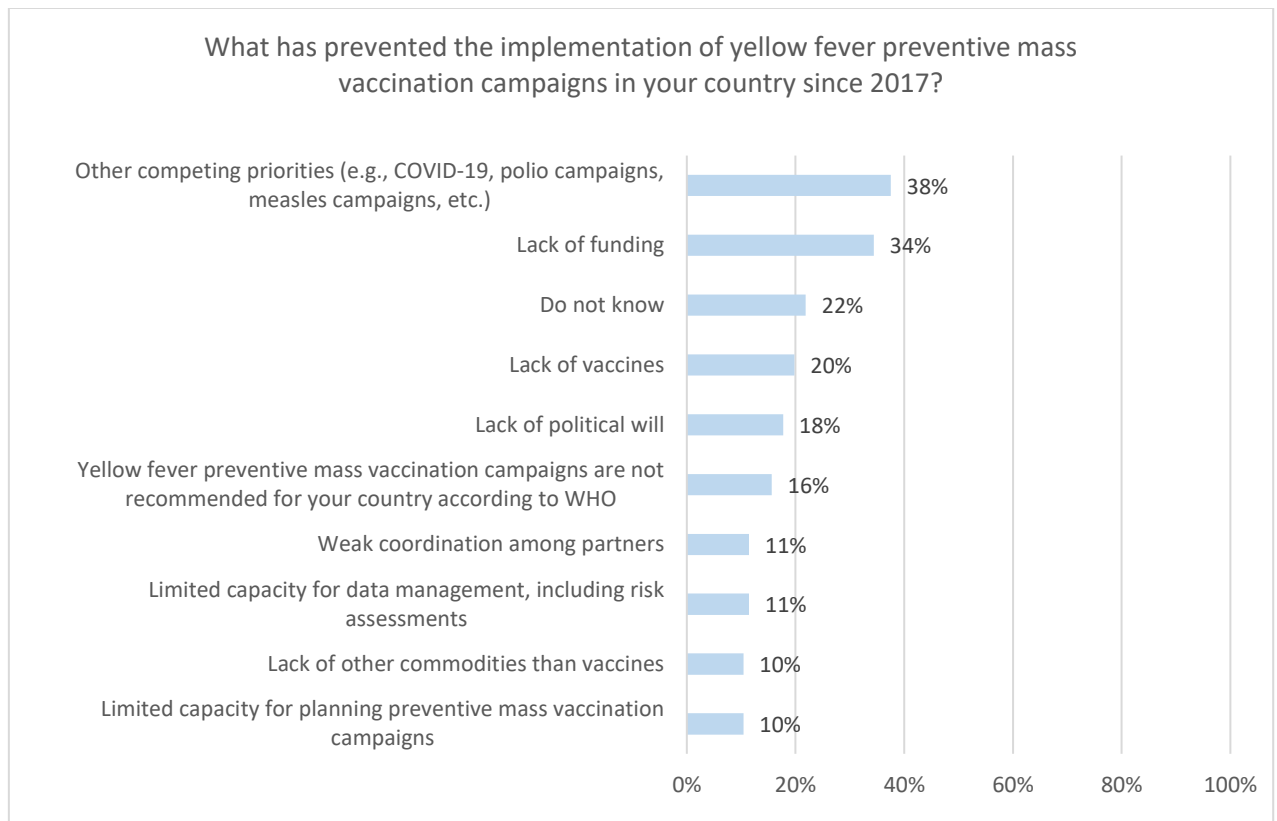
¹¹⁴ Fifth Eliminate Yellow fever Epidemics (EYE) Strategy Annual Partners' Meeting [unpublished report]. Geneva: World Health Organization; 2021.

¹¹⁵ WHO, Weekly epidemiological record: No 32, 2022, 97.

¹¹⁶ WHO, Weekly epidemiological record No 33, 2021, 96.

funding/contributions for PMVCs often came late and delayed the campaigns or in some cases had hindered the start of a campaign.

Figure 18: Perceived barriers to PMVCs



Source: MTE online survey Q24

Similarly country level stakeholders reported related ongoing challenges with the implementation of PMVCs in countries where PMVCs had already been implemented (Table 9), with funding and reaching high-risk areas or an inaccessible population being ranked as the most significant challenges, followed by human resource capacity, data quality concerns, supply of vaccines and COVID-19.

On a more positive note, the vast majority of survey respondents further replied that PMVCs have been informed by an up-to-date risk assessment to guide implementation (78%).¹¹⁷

¹¹⁷ MTE online survey Q21.

Table 9: To what extent do you agree that the following are continuing challenges to yellow fever PMVCs in your country?

	STRONGLY DISAGREE	DISAGREE	NEUTRAL	AGREE	STRONGLY AGREE	TOTAL	WEIGHTED AVERAGE
Human resource capacity	8.11% 3	13.51% 5	13.51% 5	40.54% 15	24.32% 9	37	3.59
Funding	2.70% 1	10.81% 4	8.11% 3	35.14% 13	43.24% 16	37	4.05
Supply of vaccines	8.11% 3	21.62% 8	13.51% 5	29.73% 11	27.03% 10	37	3.46
Supply of commodities other than vaccines	8.11% 3	16.22% 6	27.03% 10	32.43% 12	16.22% 6	37	3.32
Inadequate guidelines/SOPs	10.81% 4	29.73% 11	27.03% 10	27.03% 10	5.41% 2	37	2.86
Community engagement/mobilization	8.11% 3	16.22% 6	21.62% 8	45.95% 17	8.11% 3	37	3.30
Coordination among partners	8.11% 3	24.32% 9	24.32% 9	37.84% 14	5.41% 2	37	3.08
Data quality	5.41% 2	13.51% 5	27.03% 10	32.43% 12	21.62% 8	37	3.51
Inaccessible high-risk areas or hard-to-reach populations	8.11% 3	0.00% 0	10.81% 4	56.76% 21	24.32% 9	37	3.89
COVID-19	8.11% 3	18.92% 7	13.51% 5	37.84% 14	21.62% 8	37	3.46
Detailed planning for the campaign	10.81% 4	24.32% 9	13.51% 5	40.54% 15	10.81% 4	37	3.16
Vaccine hesitancy or vaccine resistance	8.11% 3	24.32% 9	18.92% 7	40.54% 15	8.11% 3	37	3.16
Other competing priorities (e.g., polio campaigns, measles campaigns, etc)	8.11% 3	16.22% 6	18.92% 7	40.54% 15	16.22% 6	37	3.41

Source: MTE online survey Q23

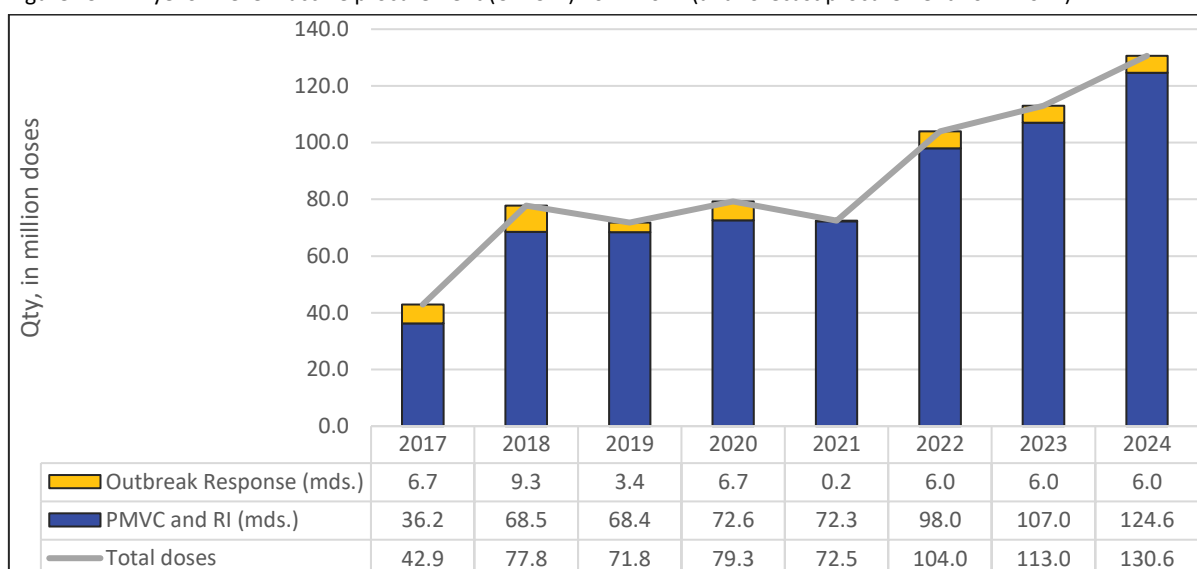
Vaccine supply

Through EYE implementation the supply of vaccines available for procurement by UNICEF has increased by approximately 75% since 2017.¹¹⁸ The procured vaccine supply increased from 43 million doses in 2017 to 79 million doses in 2020, and then decreased to 72.5 million doses in 2021, according to the EYE secretariat.¹¹⁹ This was made possible by yellow fever vaccine manufacturers, which are integral to the partnership, and by the UNICEF and Gavi steering the shipping, forecasting and procurement efforts via the EYE demand and supply working group (DSWG). The forecasting from May 2022, estimates that demand from countries receiving yellow fever vaccines from UNICEF will increase to over 130 million doses in 2024 (Figure 19).

¹¹⁸ Overview, Progress, Challenges, and Next Steps [PowerPoint]. EYE Partnership; 2021.

¹¹⁹ EYE Secretariat [PowerPoint]. EYE Partnership; 2022.

Figure 19: EYE yellow fever vaccine procurement (UNICEF) 2017-2021 (and forecast procurement 2022-2024)



Source: EYE strategy overview, progress, challenges and next steps, 24 May 2022 PPT

The EYE partners' meeting report of 2021 states that "global yellow fever vaccine demand is now averaging 90 million doses per year" (up from 20 million in 2001).¹²⁰ Beyond the UNICEF-procured vaccines, which are mainly for Gavi-eligible countries, additional markets for yellow fever vaccine include the countries of Latin America and the Caribbean – largely covered by the manufacturer in Brazil with a few exemptions, and the travellers and domestic markets.

There is also general agreement among country level survey respondents that the yellow fever vaccine supply has improved. Of the survey respondents for this evaluation, 85% agree or strongly agree that yellow fever vaccine supply in their country has improved since 2017.¹²¹ However, there are indications from the mid-term evaluation online survey that vaccine supply still presents challenges at the country level: 60% of survey respondents noted that yellow fever vaccine supply is still a challenge for their routine immunization programmes;¹²² and supply of yellow fever vaccines was the second most frequently noted reason for the continuing gap in coverage between yellow fever and MCV1 (the first being data quality concerns).¹²³ A majority of respondents (67%) also agreed or strongly agreed that vaccine supply shortages presented a challenge to their outbreak response,¹²⁴ and 56% said supply of vaccines was an ongoing challenge for their yellow fever PMVCs.¹²⁵ Differences between regions were noted as presented in Table 10 below, with African countries reporting vaccine supply challenges more frequently, in particular for PMVCs and outbreak responses.

Table 10: Vaccine supply challenges as perceived by country level stakeholders

Vaccine supply challenges	Overall N (%)	Respondents from Africa N (%)	Respondents from the Americas N (%)
Strongly agree or agree that vaccine supply is a continuing challenge to RI	55 of 90 (61%)	37 of 58 (64%)	17 of 30 (57%)
Strongly agree or agree that vaccine supply is a continuing challenge to PMVCs	21 of 37 (57%)	16 of 25(64%)	5 of 11 (45%)

¹²⁰ Fifth Eliminate Yellow fever Epidemics (EYE) Strategy Annual Partners' Meeting [unpublished report]. Geneva: World Health Organization; 2021.

¹²¹ MTE online survey (Q12).

¹²² MTE online survey (Q14).

¹²³ MTE online survey (Q15).

¹²⁴ MTE online survey (Q19).

¹²⁵ MTE online survey (Q23).

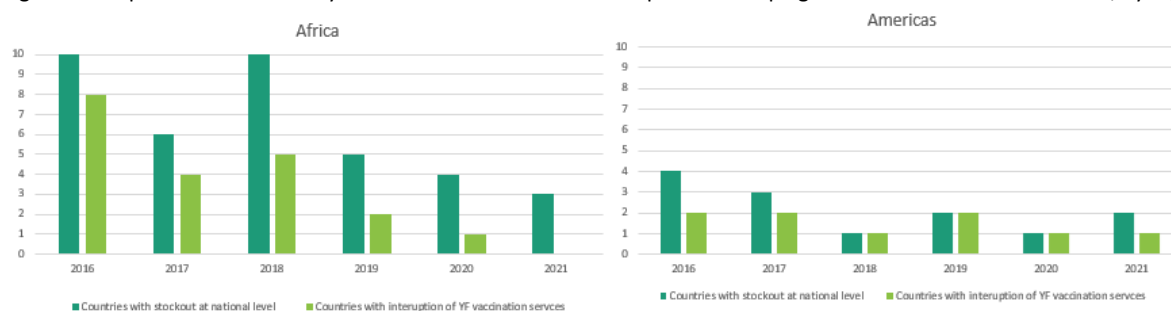
Strongly agree or agree that vaccine supply is a continuing challenge to outbreak responses	42 of 62 (68%)	33 of 45 (73%)	9 of 15 (60%)
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Source MTE online survey Q14, Q19, Q23

It should, however, be noted that by “vaccine supply”, respondents could be referring to local supply chain issues in-country that hamper availability of sufficient vaccine. This does not necessarily imply global or regional supply issues, nor reflect on EYE supply/delivery performance but rather could be reflective of “vaccine management” challenges in their country, which was further cited by 60% (54 of 90 respondents) of respondents. Respondents could also have interpreted the question as “a fear of insufficient vaccine supply” instead of actual deficient supply.

Through annual surveys conducted by the EYE partnership, countries have reported if they have experienced stock outs of vaccine at national levels and whether such had interrupted vaccination services. A clear declining trend is noted between 2016 and 2021, especially in Africa (Figure 20). In 2021, three countries in Africa and two countries in the Americas reported having experienced a stock out at the national level (Chad for 0.5 months, Congo for 2 months, Guinea for 1 month, Ecuador for 2 months and Trinidad and Tobago for an unreported period). Of the five countries reporting stock outs in 2021, only one country (Ecuador) reported that the stock out had interrupted vaccination services.

Figure 20: Reported stock outs of yellow fever vaccines and interruption of campaigns due to stock outs 2016-2021, by region



Source: EYE data set, August 2022

EYE strategic indicator 1.2: Proportion of yellow fever high-risk countries (with yellow fever as part of routine immunization) achieving at least 80% yellow fever vaccination coverage of the annual child cohort (WUENIC data)

Introduction of yellow fever vaccine in routine immunization programmes

As of August 2022, of the 40 (27 in Africa, 13 in the Americas) yellow fever high-risk countries, 35 countries (24 countries in Africa and 11 countries in the Americas) have introduced yellow fever vaccine into routine immunization nationwide. Two high-risk countries, Ethiopia and South Sudan, have not yet embarked on introducing yellow fever into routine immunization, whereas Argentina, Kenya and Panama have only introduced yellow fever into high-risk area subnational routine immunization schedules according to risk assessments.¹²⁶ Given the recent yellow fever outbreak in Kenya in 2022 a new risk assessment in Kenya might be warranted to gauge the need for more large-scale implementation of yellow fever vaccine into routine immunization schedules. Uganda recently introduced yellow fever into routine immunization (October 2022) and Brazil, Equatorial Guinea and Sudan also introduced yellow fever within routine immunization during the EYE strategy implementation period.¹²⁷ The remaining 31 high-risk countries had introduced yellow fever vaccine in routine immunization programmes before the launch of the EYE strategy.

¹²⁶ [Yellow Fever](#). World Health Organization; 2022.

¹²⁷ [Yellow Fever](#). World Health Organization; 2022.

Yellow fever vaccine coverage through routine immunization programmes

Most countries that have included yellow fever vaccine into routine immunization have, however, witnessed longstanding suboptimal routine immunization coverages for yellow fever (and measles, polio etc.), which have generally worsened since the onset of the COVID-19 pandemic. In 2021, there was a net increase in un-immunized infants, mainly due to an overall decrease in general immunization services throughout the pandemic. According to the latest 2021 WUENIC data (released in July 2022) only 8 out of 35 yellow fever high-risk countries achieved the target of 80% coverage of yellow fever vaccine through routine immunization. These suboptimal yellow fever coverages through routine immunization leads to growing immunity gaps and vulnerability to outbreaks.¹²⁸

In the Americas, a distinct decreasing trend on yellow fever routine immunization coverage since 2017 across high-risk countries is noted. In 2017, 7 of 12 reporting countries (58%) achieved at least 80% yellow fever vaccination coverage through routine immunization whereas in 2021, only 3 (Columbia, Guyana, Trinidad and Tobago) of 12 reporting countries (25%) achieved the target. It is noteworthy that this decreasing trend started even before the pandemic but worsened in 2020 and 2021. (Figure 21).

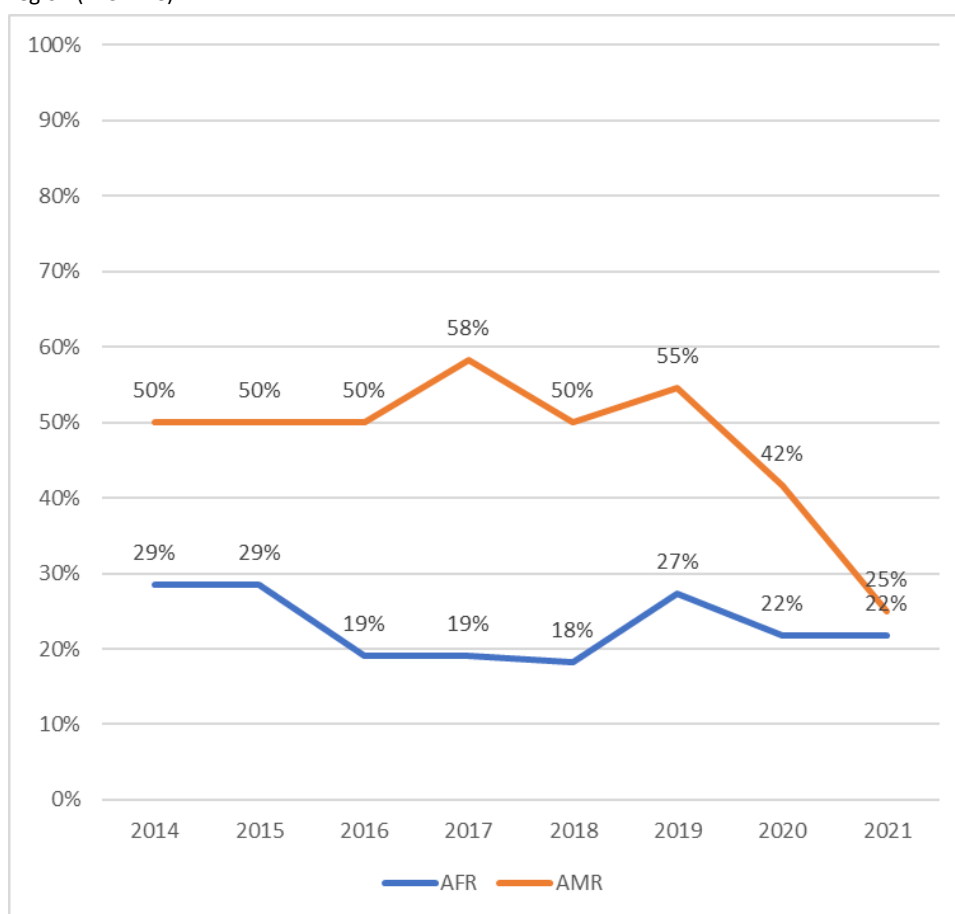
Across African yellow fever high-risk countries, the trend has been more stable, but chronically suboptimal coverage rates for most countries since 2017. In 2017, four of 21 (19%) reporting countries achieved at least 80% coverage. In 2021, five (Burkina Faso, Ghana, Niger, Senegal, Sierra Leone) of 23 reporting countries (22%) reached the 80% coverage target. Over the last eight years the highest proportion of yellow fever high-risk African countries reaching the target was reported in 2014 and 2015 (at 29%). (Figure 21). The average yellow fever vaccination coverage for all reporting African countries decreased by 3 percentage points¹²⁹ between 2020 and 2021.¹³⁰ It should be mentioned that population growth is also expected to have influenced these coverage rates, but the extent to which population growth has influenced routine immunization coverage rate has not been estimated.

¹²⁸ [Outbreaks and Emergencies Bulletin, Week 36: 29 August - 4 September 2022](#). World Health organization; 2022.

¹²⁹ Note: not a weighted average.

¹³⁰ Fifth Eliminate Yellow fever Epidemics (EYE) Strategy Annual Partners' Meeting [unpublished report]. Geneva: World Health Organization; 2021.

Figure 21: Proportion of yellow fever high-risk countries achieving at least 80% routine coverage of annual child cohort by region (WUENIC)



Source: WUENIC data 2014-2021

Abbreviations: AFR: African Region, AMR: Region of the Americas

Table 11 presents the list of countries that have achieved the target of 80% disaggregated per year and region from 2014 to 2021. It is noteworthy that more or less the same countries, with few variations, reached the target during this period. The following section describes the trend of yellow fever vaccination coverage through routine immunization across the two regions in more detail.

Table 11: Yellow fever high-risk countries (with yellow fever as part of routine immunization) achieving at least 80% yellow fever vaccination coverage of the annual child cohort (WUENIC data) 2014-2021

Region	Year	Countries	Number (%)
Africa	2014	Burkina Faso, Congo, Gambia, Ghana, Senegal, Sierra Leone	6 of 21 reporting countries (29%)
Americas	2014	Columbia, Ecuador, Guyana, Paraguay, Trinidad and Tobago, Venezuela	6 of 12 reporting countries (50%)
Africa	2015	Burkina Faso, Congo, Gambia, Ghana, Senegal, Niger	6 of 21 reporting countries (29%)
Americas	2015	Bolivia, Colombia, Guyana, Paraguay, Trinidad and Tobago, Venezuela	6 of 12 reporting countries (50%)
Africa	2016	Gambia, Ghana, Guinea-Bissau, Sierra Leone	4 of 21 reporting countries (19%)

Americas	2016	Bolivia, Ecuador, Guyana, Paraguay, Trinidad and Tobago, Venezuela	6 of 12 reporting countries (50%)
Africa	2017	Gambia, Ghana, Niger, Sierra Leone	4 of 21 reporting countries (19%)
Americas	2017	Bolivia, Columbia, Ecuador, Guyana, Paraguay, Trinidad and Tobago, Venezuela	7 of 12 reporting countries (58%)
Africa	2018	Burkina Faso, Gambia, Ghana, Guinea-Bissau	4 of 22 reporting countries (18%)
Americas	2018	Bolivia, Columbia, Ecuador, Guyana, Paraguay, Trinidad and Tobago	6 of 12 reporting countries (50%)
Africa	2019	Burkina Faso, Gambia, Ghana, Niger, Senegal, Sierra Leone	6 of 22 reporting countries (27%)
Americas	2019	Columbia, Ecuador, Guyana, Paraguay, Trinidad and Tobago, Venezuela	6 of 11 reporting countries (55%)
Africa	2020	Burkina Faso, Gambia, Ghana, Senegal, Sierra Leone	5 of 23 reporting countries (22%)
Americas	2020	Columbia, Guyana, Paraguay, Trinidad and Tobago, Venezuela	5 of 12 reporting countries (42%)
Africa	2021	Burkina Faso, Ghana, Niger, Senegal, Sierra Leone	5 of 23 reporting countries (22%)
Americas	2021	Columbia, Guyana, Trinidad and Tobago	3 of 12 reporting countries (25%)

Source: WUENIC data 2014-2021

Figure 22 presents the country disaggregated trend of yellow fever vaccine coverage in routine immunization across African yellow fever high-risk countries since 2016. The figure shows a highly diverse picture. Nine countries have reported improved coverage rates since EYE inception in 2017, four have remained at the same levels, and seven have reported a decreased rate since 2017.¹³¹ Chronic suboptimal coverage (less than 80%) in all years since 2016 is observed for 15 out of the 21 reporting countries in Africa¹³²: Angola, Benin, Cameroon, the Central African Republic, Chad, Congo, the Democratic Republic of the Congo, Equatorial Guinea, Gabon, Guinea, Liberia, Mali, Nigeria and Togo.

In 2021, Angola, Guinea, the Central African Republic, Chad and Liberia were in the lowest tier below 50%¹³³ and Burkina Faso, Ghana, Niger, Senegal and Sierra Leone were in the highest tier with coverage rates above the target of 80%. A decreasing trend since 2019, presumably caused by pandemic disruptions, is visible for about half of all reporting countries, whereas a few countries have showed improvements since 2019 (Chad, Gabon, Ghana, Nigeria and Senegal. (

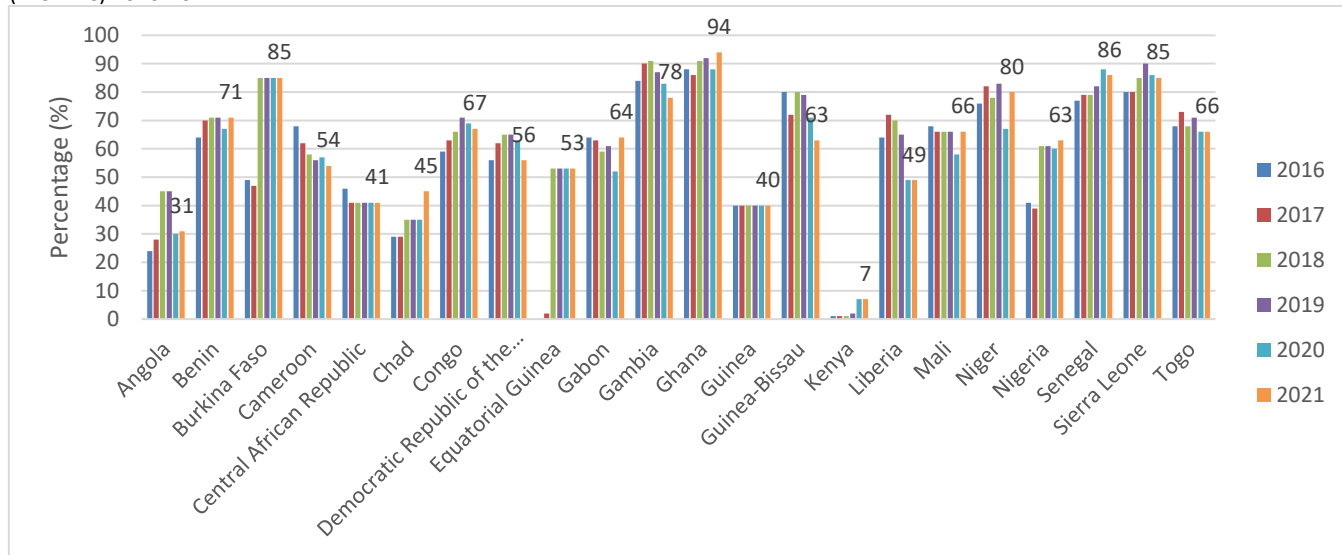
¹³¹ Discounting Kenya and Equatoria Guinea where YF vaccine in RI was initiated after 2017.

¹³² When discounting Kenya where yellow fever vaccine is only introduced in certain risk areas

¹³³ When not considering Kenya.

Figure 22).¹³⁴

Figure 22: Yellow fever vaccination coverage within routine immunization across yellow fever high-risk countries in Africa (WUENIC) 2016-2021

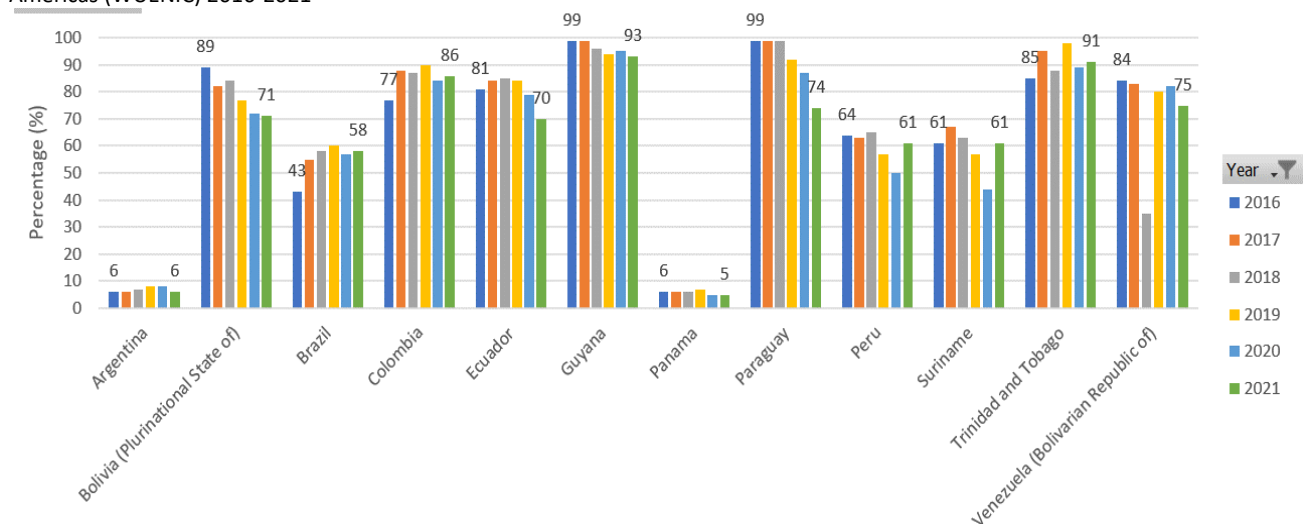


Source: WUENIC data 2016-2021

Note: Kenya has not introduced YF vaccine in RI nationwide

In yellow fever high-risk countries of the Americas, only 3 out of 12 reporting countries (Columbia, Guyana, Trinidad and Tobago) reached national coverage estimates more than 80% in 2021. Brazil, Peru and Suriname are in the lowest tier – all below 65% in all reporting years.¹³⁵ A decreasing trend since 2016 is observed for almost all countries except for Brazil, Colombia and Trinidad and Tobago. (Figure 23).

Figure 23: Yellow fever vaccination coverage within routine immunization across yellow fever high-risk countries in the Americas (WUENIC) 2016-2021



Source: WUENIC data 2016-2021

Note: Argentina and Panama have not introduced routine immunization nationwide

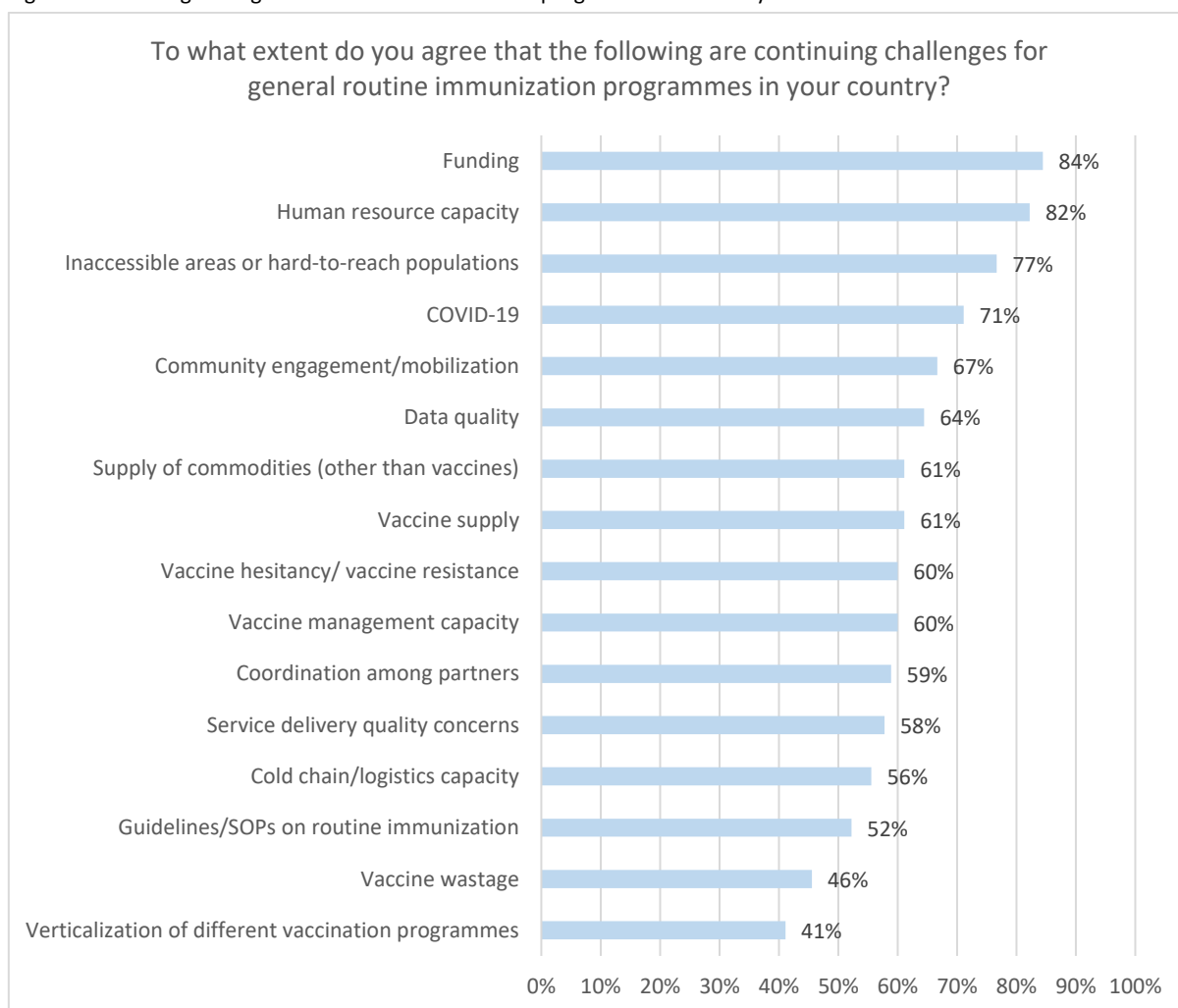
¹³⁴ [Yellow Fever](#). World Health Organization; 2022.

¹³⁵ Discounting Argentina and Peru where YF vaccine in RI is only implemented in high-risk subnational areas.

Challenges for routine immunization programmes

Country level respondents to the online survey reported most frequently that funding and human resource capacity were continuing challenges for general routine immunization. This was followed by inaccessible or hard-to-reach populations, COVID-19, challenges with community engagement/mobilization and data quality (Figure 24). Routine immunization data/coverage levels were further questioned by many key informants due to denominator challenges and major data quality concerns in general. WUENIC estimates are further reported to mask any disparities at subnational level (for example, Senegal: district coverages 47-72% versus 88% WUENIC).¹³⁶

Figure 24: Challenges for general routine immunization programmes at country level



Source: MTE online survey Q14

Notes: percentages reflect the proportion of respondents replying “agree” or “strongly agree” to the question

Vaccine hesitancy and supply chain concerns were also frequently reported (by more than 50% of respondents in both regions). Disaggregating data by region, vaccine supply and cold chain/logistics were perceived as a continuing challenge to routine immunization programmes by a larger proportion of African respondents, whereas supply of other commodities and vaccine wastage were more often cited as a challenge to routine immunization in the Americas (Table 12). Vaccine supply challenges have been discussed earlier in this section and are also discussed in the sustainability Section 5.4. In terms of supply of other commodities, the specific commodities of concern were not noted by respondents.

¹³⁶ [Yellow Fever](#). World Health Organization; 2022.

Table 12: Routine immunization challenges related to cold chain/logistics, supply of other commodities and vaccine wastage as perceived by country level stakeholders, regional disaggregation

RI SCM challenges	Overall N (%)	Respondents from Africa N (%)	Respondents from the Americas N (%)
Strongly agree or agree that cold chain/logistics capacity is a continuing challenge to RI programmes	50 of 90 (56%)	34 of 58 (59%)	15 of 30 (50%)
Strongly agree or agree that vaccine supply is a continuing challenge to RI programmes	55 of 90 (61%)	37 of 58 (64%)	17 of 30 (56%)
Strongly agree or agree that supply of other commodities (than vaccines) is a continuing challenge to RI programmes	55 of 90 (61%)	34 of 58 (59%)	20 of 30 (67%)
Strongly agree or agree that vaccine wastage is a continuing challenge to RI programmes	41 of 90 (46%)	23 of 58 (40%)	17 of 30 (57%)

Source: MTE online survey Q14

The mid-term evaluation online survey further indicated that vaccine wastage is a continuing concern for country routine immunization programmes, especially in countries of the Americas (Table 12). High wastage rates, as much as 90%, for lyophilized vaccines, of which yellow fever is an example, have been reported through a study conducted in the Gambia.¹³⁷ Statistics vary greatly, but wastage of lyophilized vaccines is often in the 20-60% range, according to studies conducted in Cameroon, India and elsewhere.^{138, 139, 140} Lyophilized vaccines are freeze-dried, do not contain preservatives and need to be thrown away soon after opening. It will be important to examine the extent of wastage and use methods to reduce wastage rates for yellow fever vaccines and thus stretch the available vaccine supply. UNICEF notes that “the VDWG has worked closely with the Measles and Rubella Partnership to advocate for the use of a 5-dose YFV vial in routine immunization instead of a 10-dose vial to reduce the wastage rate” and “recently the VDWG developed and shared evidence-based information notes, which could help countries to advocate for switching from 10-dose to 5-dose vials”. So, some wastage mitigation efforts are underway. To that extent Bio-Manguinhos in Brazil has committed to providing 4 million 5-dose vials to PAHO region in 2023/2024 (in addition to 9 million 10-dose vials to PAHO and 34.9 million 10 doses to UNICEF over the same period), this does not include production for the Brazilian market (6 million 5-dose vials in 2023).¹⁴¹

¹³⁷ Usuf E, Mackenzie G, Ceasay L, Sowe D, Kampmann B, Roca A. Vaccine wastage in The Gambia: a prospective observational study. *BMC Public Health*. 2018 Jul 11;18(1):864. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6042329/>.

¹³⁸ Article: Assessment of Vaccine Wastage in a Tertiary Care Centre of District Rohtak, Haryana (India). 2015. By Vikas Gupta (“wastage factor and wastage rate were higher in lyophilized vaccines (2.75) and (63.76%) compared to that of liquid vaccines i.e. 1.35) and (26.36%)” pg4) Gupta V, Mohapatra D, Kumar V. Assessment of Vaccine Wastage in a Tertiary Care Centre of District Rohtak, Haryana. *Ntl J of Community Med*. 2015; 6(3):292-296.

¹³⁹ Nkenyi R, Pak GD, Tonga C, *et al*. A retrospective review of vaccine wastage and associated risk factors in the Littoral region of Cameroon during 2016–2017. *BMC Public Health*. 2022; 22:1956. doi: <https://doi.org/10.1186/s12889-022-14328-w>.

¹⁴⁰ Review of Vaccine Wastage at rural Primary Health Care Facilities in three districts of Uttar Pradesh. USAID; n.d. (https://pdf.usaid.gov/pdf_docs/PA00JZF5.pdf).

¹⁴¹ Bio-Manguinhos: innovation and production at the service of the public health [PowerPoint]; 2022.

When key informants were asked about EYE’s role in strengthening routine immunization, there were only a few examples of how implementation of the EYE strategy may strengthen routine immunization, this included applying a life course vaccination perspective, integrated catch-up campaigns and opportunities of reaching zero-dose children during yellow fever vaccination campaigns. Some of the EYE partnership key informants believed that improving performance of routine immunization, beyond specific aspects for yellow fever, was outside the scope of EYE.

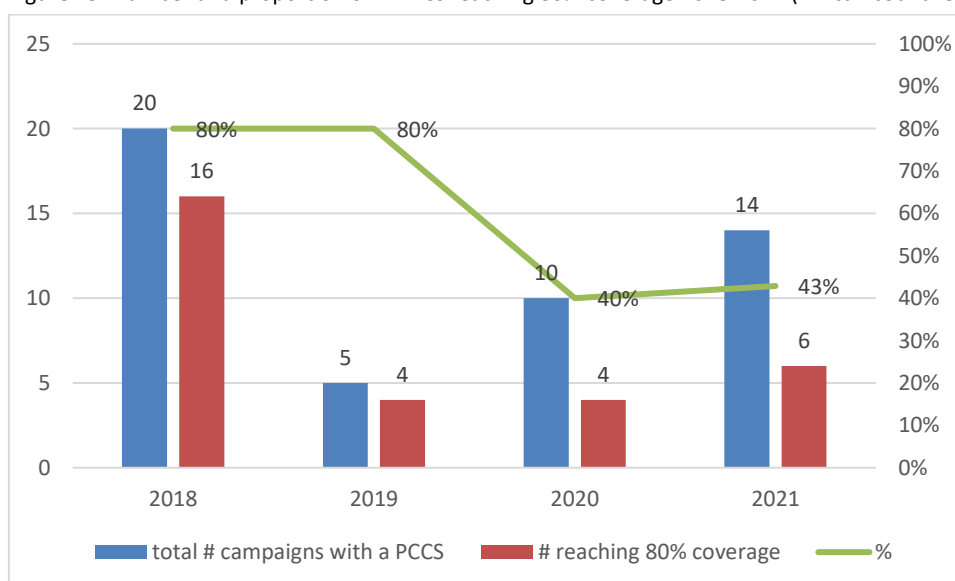
EYE strategic indicator 1.3: Proportion of yellow fever high-risk areas (Admin1) achieving at least 80% coverage via campaign completion

Coverage rates of PMVCs

After conducting a vaccination campaign, it is recommended that the coverage be analysed through a survey. Over the period 2018-2021, 49 of 68 (72%) PMVCs implemented across four African countries (Nigeria, the Democratic Republic of the Congo, Ghana, Sudan) analysed the coverage of the vaccination campaign through a post campaign coverage survey (PCCS). Ghana has reported mainly on administrative coverage data, yet there were reports of challenges with the denominator (estimating the population size targeted for the campaign) and several rates were above 100%.

Figure 25 below presents the number of PMVCs where such coverage surveys have been conducted, and the number and proportion reaching 80% coverage rates. A clear decreasing trend is observed since 2018 with 80% (16 of 20) of PMVCs reaching at least 80% coverage in 2018 and only 43% (6 of 14) of PMVCs reaching this target in 2021.

Figure 25: Number and proportion of PMVCs reaching 80% coverage 2018-2021 (African countries)



Source: EYE dataset, August 2022

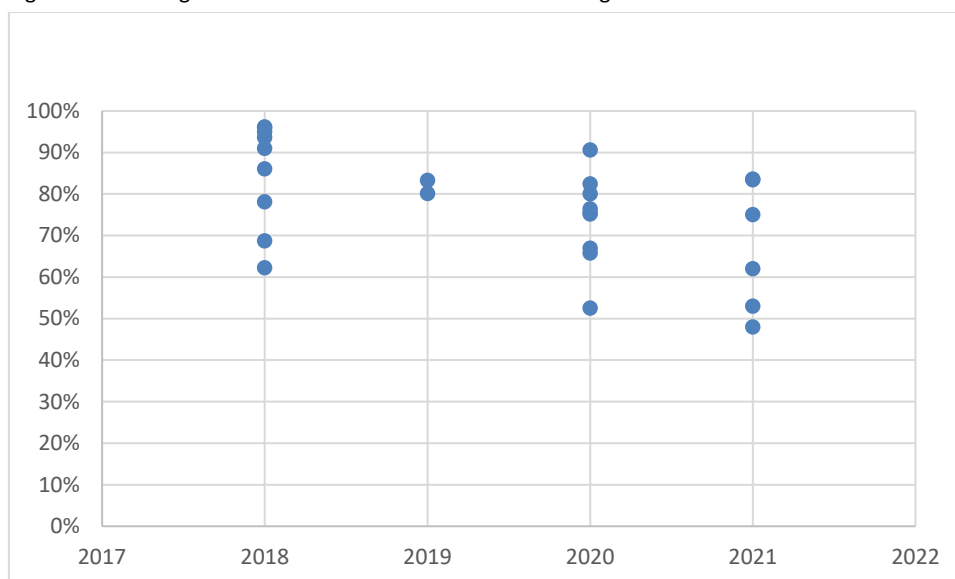
Countries included: DRC, Ghana, Nigeria, Sudan

Increased emphasis on dual or multi-antigen campaigns in the past few years may have contributed to this decline. An example is Nigeria, where almost all PMVCs in 2021 were integrated with another antigen. Coverage figures for Nigeria 2021 PMVCs were lower than in previous phases – yet a decreasing trend has been observed since 2020 in Nigeria before wide implementation of multi-antigen campaigns (Figure 26). There might thus be other factors affecting lower coverage rates since 2020, of which the COVID-19 pandemic and related restrictions are considered a major contributor. Several countries have further reported increasing vaccine hesitancy, including fear that yellow fever vaccination activities were a ruse to administer COVID-19 vaccine to the community.¹⁴² In addition data quality concerns pertain to the PCCS. Post vaccination coverage surveys, PMCVs and their quality

¹⁴² [Global yellow fever update 2021: Weekly Epidemiological Update](#). World Health Organization; 2022.

need detailed analysis and attention by the EYE partnership given the coverage trend observed and recent outbreaks in West Africa in countries with a history of large-scale PMVCs.

Figure 26: Coverage rates for PMVCs in various districts of Nigeria 2018-2021



Source: EYE dataset August 2022

EYE strategic indicator 1.4: Proportion of yellow fever high-risk countries with a multi-year national plan that includes yellow fever activities

Country plans for EYE implementation

According to the EYE dashboard in 2022, eight African countries have reported to have a multi-year national plan that includes yellow fever: Angola, Congo, Equatorial Guinea, Ethiopia, Gabon, Ghana, Nigeria, South Sudan. There is no information in the dashboard on the extent to which these plans are funded, implemented etc. The evaluation team accordingly received country work plans for EYE implementation for the same eight countries. However, they all ended in 2020 and it is not clear to what extent the plans were implemented and if new country plans are being developed. The evaluation team further notes that only some of the country plans were costed. The EYE secretariat recently held a webinar to assist countries in drafting new country plans for EYE implementation (see Section 5.4.2 for more information on country plans).

Another recent source (EYE annual partners' meeting 2021),¹⁴³ however, mentions that 11 countries had completed the development of their EYE implementation plans by 2021 (Angola, Congo, the Democratic Republic of the Congo, Equatorial Guinea, Ethiopia, Gabon, Ghana, Niger, Nigeria, South Sudan and Uganda) and of these, five country plans had been validated by their ministries of health (Angola, Congo, Equatorial Guinea, Ethiopia and Gabon). So, there is conflicting evidence on this indicator, and data from the Americas on this indicator were not available to the evaluation team.

EYE strategic indicator 1.5: Proportion of yellow fever high-risk countries with a difference in immunization coverage between yellow fever vaccine and MCV1 lower than 5%

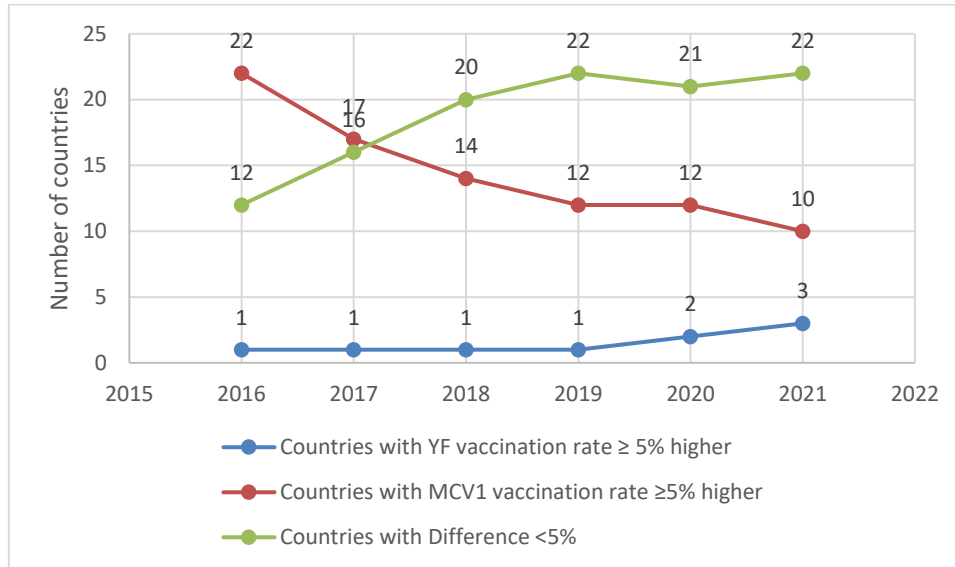
Difference between coverage rates of yellow fever vaccine and MCV1 through routine immunization programmes

There has been interest in the EYE partnership over several years in the potential reasons behind a marked difference in some countries between yellow fever and the measles-containing vaccine – 1st dose (MCV1) estimated coverage rates (WUENIC data). Before the launch of the EYE strategy in 2016, the yellow fever vaccine coverage rate gap, in countries that have implemented yellow fever into

¹⁴³ Fifth Eliminate Yellow fever Epidemics (EYE) Strategy Annual Partners' Meeting [unpublished report]. Geneva: World Health Organization; 2021.

routine immunization, was above five percentage points in 22 countries. This has now declined to 10 countries (seven when considering only countries that have implemented yellow fever in routine immunization nationwide)- although the trend is affected also by a decrease in measles coverage rather than only an increase in yellow fever routine immunization coverage. The declining trend of the gap between measles and yellow fever vaccine coverage over time is shown in Figure 27.

Figure 27: Differences in vaccination coverage rates, yellow fever vaccine and MCV1, 2016-2021 (WUENIC)



Source: WUENIC data 2016-2021

As of 2021, 13 yellow fever high-risk countries that had introduced yellow fever into routine immunization had a difference of 5% or more between yellow fever and MCV1. (Angola, Argentina, Brazil, Chad, Ecuador, Guinea, Kenya, Liberia, Niger, Panama, Paraguay, Peru, and Venezuela),¹⁴⁴ however, Argentina, Kenya and Panama have only introduced yellow fever into high-risk area subnational routine immunization, which obviously explains the difference.^{145, 146} MCV1 coverage is higher than yellow fever coverage in seven countries that have fully introduced yellow fever into routine immunization nationwide, however, in three countries the situation is the opposite (Venezuela, Paraguay and Ecuador has a 7, 6 and 5 percentage point higher estimated coverage for yellow fever than MCV1 respectively).

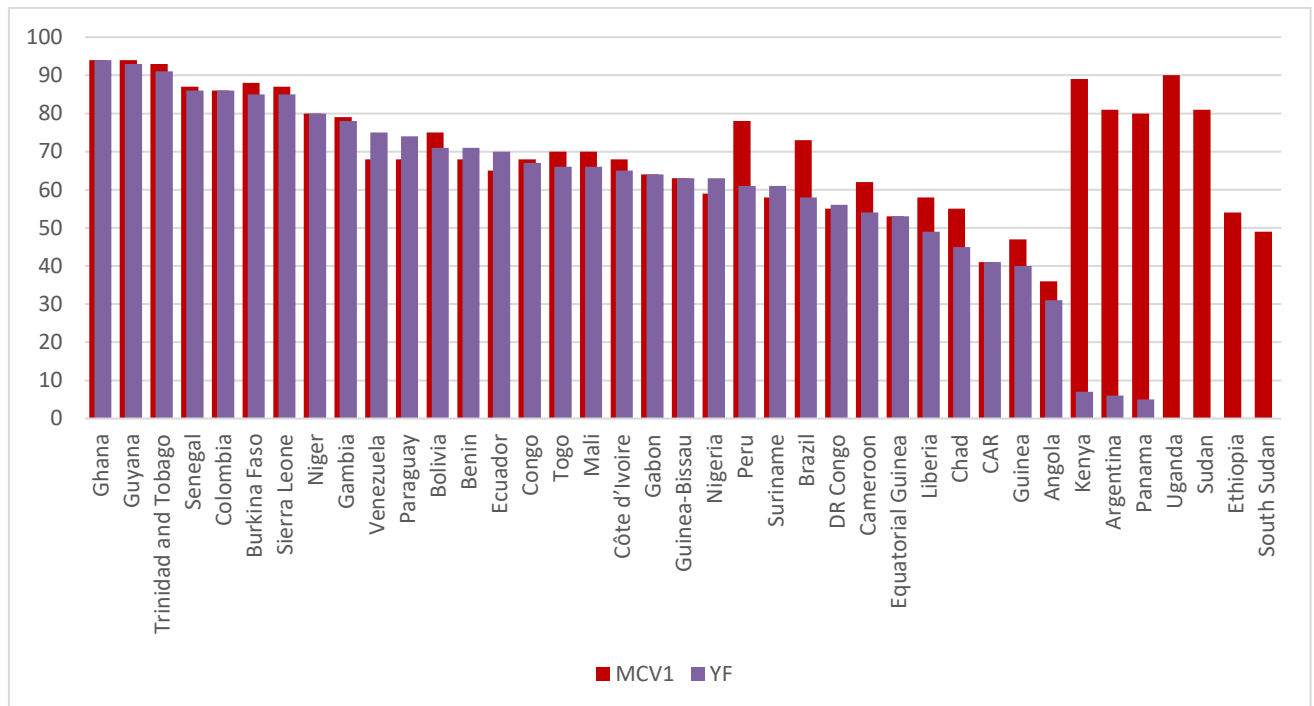
Figure 28 below presents the latest status of yellow fever and MCV1 coverage through routine immunization in 2021.

¹⁴⁴ EYE dashboard [unpublished data]. EYE Partnership; 2022.

¹⁴⁵ [Vaccination schedule for Yellow fever](#). World Health Organization; 2022.

¹⁴⁶ [Yellow Fever](#). World Health Organization; 2022.

Figure 28: Vaccination coverage rates (through routine immunization) for yellow fever and MCV1 in 2021 for yellow fever high-risk countries



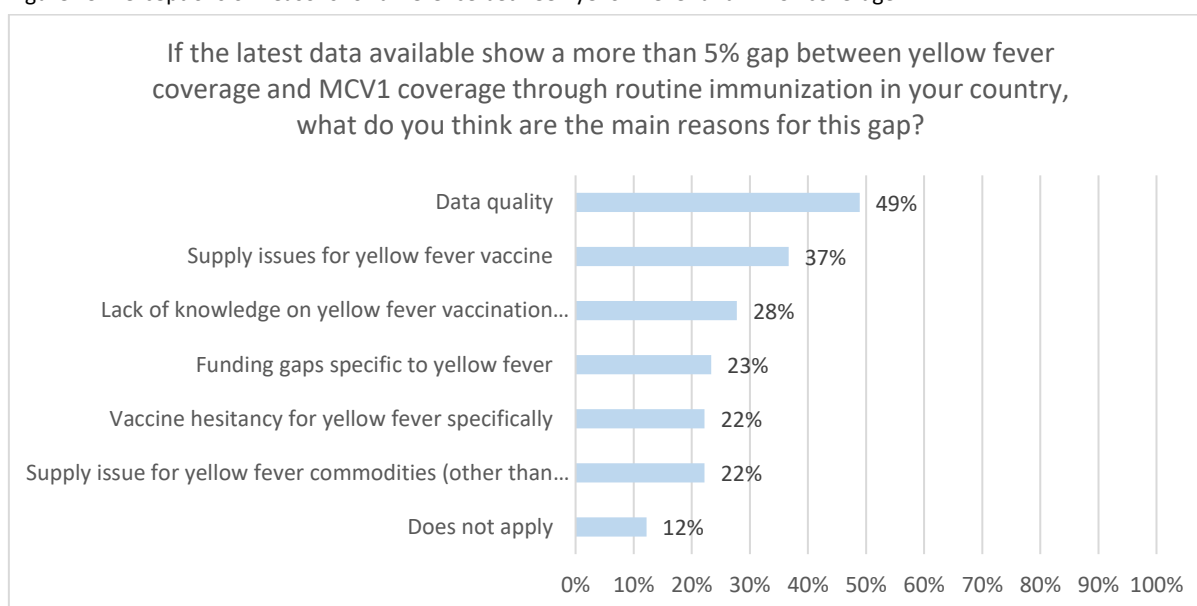
Source: WUENIC data 2021

Notes: the following countries had not introduced yellow fever into RI in 2021: Uganda, Sudan, Ethiopia, South Sudan. Kenya, Argentina and Panama only for high-risk areas. Data missing for French Guyana.

The largest differences are noted in Peru, Brazil and Chad where MCV1 coverages were 17, 15 and 10 percentage points higher than for yellow fever in 2021 respectively, followed by Liberia, Cameroon, Guinea, Angola (9, 8, 7 and 5 percentage points lower for yellow fever than MCV1 respectively). Brazil was one of the latest countries to introduce yellow fever vaccine within routine immunization (in 2017), which partly could explain the difference. The online survey respondents from Brazil and Peru indicated that a lack of knowledge on yellow fever vaccination guidelines might be one of the reasons. In Chad, survey respondents indicated that lack of yellow fever vaccines (or it could be interpreted as a fear of stock out) was a potential cause of the difference – however, noting the very small sample size of (six respondents from Brazil, three from Peru and two from Chad).

Interestingly, survey respondents from all seven countries that had a lower coverage for yellow fever than MCV1 reported data quality issues (49%) as the main reason for the difference, followed by supply issues for yellow fever vaccine (37%) and a lack of knowledge on yellow fever vaccination guidelines (28%) (Figure 29). Data quality issues at the country level was repeatedly mentioned by key informants as a weakness impeding proper planning. A large difference above 10% is notable across only three countries (Brazil, Chad and Peru), where data concerns might not explain the difference. This calls for further detailed root cause analysis to understand the reasons of this difference. The EYE VDWG has, as one of its deliverables, the analysis of countries with low yellow fever and a gap with MCV1 aiming to trigger specific recommendations/actions for a selection of countries.

Figure 29: Perceptions on reasons for difference between yellow fever and MVC1 coverage



Source: MTE online survey Q15

Strategic objective 2- Prevent international spread

In the period of EYE implementation (2017-2022), no confirmed yellow fever case has been exported from yellow fever high-risk countries to non-endemic areas causing local transmission.¹⁴⁷

Two of four strategic indicators for EYE strategic objective 2- Prevent international spread are not tracked (indicators 2.1 and 2.3¹⁴⁸) as activities related to engaging major industry employers and IHR focal points are still in preparatory phases and data on the indicators are thus not collected.¹⁴⁹ With regards to engaging industry, an initial mapping of private sector actors (including the extractive industry) has been done, but starting the actual engagement is reported by key informants as a major undertaking that requires more human resources.¹⁵⁰ Several programme management group update presentations have emphasized that planning and implementation of activities to protect at-risk industry workers (including through vaccination) must start.¹⁵¹

IHR focal points for yellow fever are also yet to be identified in all high-risk countries and IHR trainings need to be carried out.¹⁵² The proposed activities in EYE on nominating an IHR focal person for yellow fever and providing IHR training seems very relevant but needs urgent attention and acceleration to meet targets by 2026.

Progress and challenges on the remaining two indicators under strategic objective 2 are provided below.

EYE strategic indicator 2.2: The proportion of high-risk countries carrying out entry screening for yellow fever vaccination proof on main airports and seaports, on travellers coming from endemic countries

¹⁴⁷ One YF case was reportedly imported to Canada but with no local transmission. Source: Yellow fever. Public Health Ontario; 2022 (<https://www.publichealthontario.ca/en/diseases-and-conditions/infectious-diseases/vector-borne-zoonotic-diseases/yellow-fever>).

¹⁴⁸ i. the proportion of relevant major industry employers engaged and implementation of yellow fever industry guidance; ii. the proportion of high-risk countries that have engaged IHR focal points to strengthen yellow fever IHR capacity.

¹⁴⁹ EYE M&E Update May [PowerPoint]. Bader J; 2022.

¹⁵⁰ EYE M&E Update May [PowerPoint]. Bader J; 2022.

¹⁵¹ EYE M&E Update October [PowerPoint]. Bader J; 2021.; EYE M&E Update August [PowerPoint]. Bader J; 2021.

¹⁵² EYE M&E Update October [PowerPoint]. Bader J; 2021.

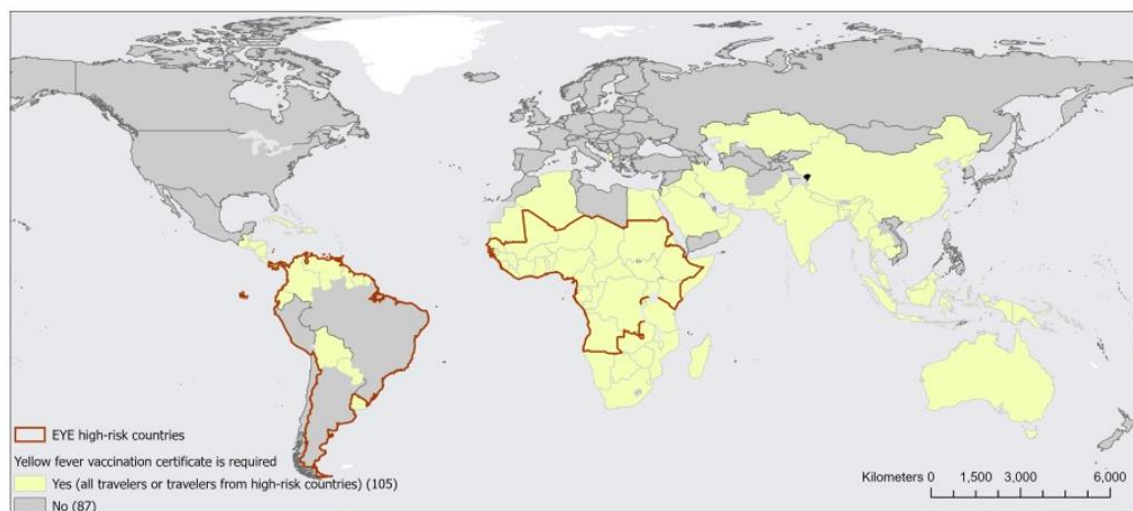
Implementation of IHR for yellow fever

Nearly all yellow fever high-risk countries and several countries beyond the yellow fever high-risk countries require vaccination proof from travellers coming from endemic countries (Figure 30). According to the latest WHO International Travel and Health (ITH) Country Lists, Electronic State Parties Self-Assessment Annual Reporting Tool (e-SPAR) from IHR, only 3 of the 40 high-risk EYE countries (Argentina, Brazil, and Peru) do not require a yellow fever vaccination certificate from travellers coming from endemic countries in 2021. In 2017, four countries did not have this requirement (Argentina, Ecuador, Peru, and South Sudan), so a slight improvement, yet a concerning finding is that Brazil, which is bordering several yellow fever high-risk countries, does not require proof of immunization.

On a positive note, 66% of the respondents to the mid-term evaluation online survey reported improvements since 2017 in applying the IHR for yellow fever in their country,¹⁵³ although this may not be directly related to the EYE strategy as activities have not yet started. In addition, 25% ranked consistent application of the IHR for travellers in/out of country as a top five priority to sustain elimination of yellow fever epidemics in their country.¹⁵⁴ Yet, key informants at country, regional, and global levels mentioned that enforcing effective implementation of IHR at points of entry will be important and that attention to this by EYE seems to have been insufficient so far. Porous border areas and land-crossings in high-risk countries are a challenge in many high-risk countries. Of the six outbreaks supported by the ICG in 2020, viral transmission was reported to impact border areas and mobile populations with risk of spread, including in western Senegal, the outbreaks in Guinea with close proximity to bordering Mali, and the Uganda outbreak, with detections also in South Sudan.¹⁵⁵ Many moderate-risk yellow fever countries further share borders with countries that are both high-risk and have had recent outbreaks (including Eritrea, Mauritania, Somalia, Tanzania, Zambia).

It is deemed critical for health security purposes that the last few countries adopt the yellow fever vaccination proof requirement and that more attention is provided to strengthen control of porous borders/ land crossings and seaports. Useful experience could be gained from the screenings done at informal, land border crossing during the West Africa Ebola outbreak in 2014-2016.

Figure 30: WHO International Travel and Health (ITH) Yellow fever Country List 2021



Source: Bader J. EYE M&E Update PMG meeting [PowerPoint Slides], 2021 Aug 11 [cited 2022 May 24]

EYE strategic indicator 2.4: Proportion of yellow fever high-risk countries with yellow fever measures included in their preparedness, readiness and response plans.

¹⁵³ MTE online survey Q12.

¹⁵⁴ MTE online survey Q31.

¹⁵⁵ Fifth Eliminate Yellow fever Epidemics (EYE) Strategy Annual Partners' Meeting [unpublished report]. Geneva: World Health Organization; 2021.

Urban readiness and response plans

Yellow fever remains a real threat in urban areas and responding to outbreaks in large urban settings is challenging and costly due to their rapid amplification and the high risk of quickly depleting vaccine supplies in the event of a large urban outbreak. Furthermore, the risk of international spread from urban outbreaks is large.¹⁵⁶ Until populations in urban settings can be protected fully, authorities need to be prepared to detect and respond to yellow fever outbreaks and need to be ready. This is acknowledged by EYE partners:

“The increased risk of yellow fever urban outbreaks with international spread is a major public health issue that we need to tackle as a multisectoral and multilevel community.”¹⁵⁷

“The most recent yellow fever outbreaks in Cameroon, Cote d’Ivoire and Uganda have raised concerns due to the proximity of outbreaks to urban settings.¹⁵⁸ Furthermore, the risk remains high for urban outbreaks in Kano and Lagos in Nigeria where PMVCs have not yet been implemented.”¹⁵⁹

According to the literature review and key informants, activities related to preparedness, readiness and response plans for yellow fever outbreaks in urban settings are still in the preparatory phase. The topic was discussed at the latest EYE annual partners’ meeting, noting that it was essential to, “accelerate implementation of the operational phase by providing technical and financial support to countries to develop urban resilience plans, strengthen capacities for surveillance in urban areas, strengthen vaccine supply and increase vaccination coverage in urban areas”.¹⁶⁰

In 2021, the EYE secretariat commenced the preparation of technical guidelines for preparedness, readiness and response planning for yellow fever outbreaks in urban settings. This is due to be completed in 2022. A two-day online table-top simulation exercise on urban yellow fever outbreaks, followed by an after-action review was completed in December 2021 for input into the technical guidance. This involved 40 participants, 4 partners and 7 countries.¹⁶¹ The next step is to assist high-risk countries develop strong urban readiness plans for yellow fever. In total 17 respondents (18%) to the mid-term evaluation online survey reported that an urban readiness plan existed and was being implemented. Respondents replying in this way were from the following countries: Benin, Brazil, Burkina Faso, Colombia, Congo, the Democratic Republic of the Congo, Ghana, Guinea-Bissau, Nigeria, Peru, Senegal, Sudan, Suriname, Togo and Uganda. However, there was generally disagreement on the status of urban readiness plans among the respondents from the same country to this question. See Table 13 below for overview of replies.

Table 13: Status of urban readiness plans for yellow fever at the country level

Urban readiness plan for YF in your country	Overall N (%)	Respondents from Africa	from Respondents from the Americas
Does not exist	35 (36%)	27 (42%)	8 (28%)
In development	11 (11%)	8 (12%)	2 (7%)
Developed, but not implemented	10 (10%)	5 (8%)	5 (17%)
Implemented	17 (18%)	13 (20%)	4 (14%)
Do not know	23 (24%)	12 (18%)	10 (34%)

Source MTE online survey Q25

¹⁵⁶ Fourth Eliminate Yellow fever Epidemics (EYE) Strategy Annual Partners’ Meeting [unpublished report]. Geneva: World Health Organization; 2020.

¹⁵⁷ Fourth Eliminate Yellow fever Epidemics (EYE) Strategy Annual Partners’ Meeting [unpublished report]. Geneva: World Health Organization; 2020.

¹⁵⁸ [Outbreaks and Emergencies Bulletin, Week 36: 29 August - 4 September 2022](#). World Health Organization; 2022.

¹⁵⁹ [Outbreaks and Emergencies Bulletin, Week 36: 29 August - 4 September 2022](#). World Health Organization; 2022.

¹⁶⁰ Fifth Eliminate Yellow fever Epidemics (EYE) Strategy Annual Partners’ Meeting [unpublished report]. Geneva: World Health Organization; 2021.

¹⁶¹ Fifth Eliminate Yellow fever Epidemics (EYE) Strategy Annual Partners’ Meeting [unpublished report]. Geneva: World Health Organization; 2021.

There is scope to learn from examples across EYE countries on working with municipalities (for example, Ouagadougou in Burkina Faso) for urban resilience planning and accountability. WHO has recently worked to improve involvements of municipalities in Ouagadougou to get interventions embedded in municipality plans and conducted annual meetings with municipality networks. These efforts have enhanced ownership and accountability of local actors.

Vector surveillance and control

Surveillance and control of the vectors of yellow fever virus have an important contribution to make to outbreak responses, particularly in urban areas. The EYE strategy itself concentrates only marginally on vector surveillance and control as discussed under Section 5.2.1, and several key informants mentioned this as a missing link in the strategy and its implementation. Recommendations for vector control were presented and discussed during the latest EYE annual partners' meeting and included:

- integrating Aedes surveillance and control in ongoing malaria control programmes;
- establishing a data-sharing system between countries to link vector surveillance with human-case surveillance; and
- organizing opportunities for stakeholder collaboration, engaging multisectoral partners from public and private sectors.

EYE has yet to capitalize on these opportunities for linkages and stronger vector surveillance and control programmes, including the new GLAI.

Strategic objective 3- Contain outbreaks rapidly

Yellow fever diagnostics and surveillance

The EYE strategy implementation and its monitoring have had a focused attention on existing delays and barriers for a rapid detection of yellow fever cases and confirmatory testing. EYE has made remarkable investments to improve yellow fever diagnostic and surveillance capacities in countries through: trainings; improved lab capacity; development and procurement of reagent bundles to facilitate supply availability in-country; accreditation of laboratories to conduct confirmatory testing; engaging with an international courier and the establishment of EYE.Ops to fast-track international shipment of samples; developing yellow fever testing algorithms; and the research and development of new diagnostic assays.

The efforts implemented so far through the EYE strategy have greatly improved and expedited yellow fever diagnostics and confirmation of results process. In 2018, the average time from when the yellow fever specimen was prepared until it was sent to regional referral labs was 79 days. In 2020 this had reduced to 18 days.

However, yellow fever diagnostics are complex and still contribute to delayed outbreak responses in some countries. Yellow fever patients who present early (usually up to 10 days after symptoms onset) in their illness will only have yellow fever viremia (virus in their blood), which is detectable with polymerase chain reaction (PCR) tests.¹⁶² Although PCR platforms and capacity for diagnostics now largely exists (for HIV, COVID-19), across both high-risk African countries and countries of the Americas, yellow fever-specific PCR test kits are needed.

Patients who present later in their illness will often have IgM antibodies to yellow fever (but not yellow fever viremia), which is not detectable with a PCR test. Therefore, testing capacity for both viremia

¹⁶² Viral RNA can be detected in serum samples during the first 10 days since the onset of symptoms (viremic phase) or even longer than 10 days in severe cases, by molecular methods such as conventional (end-point) or real-time reverse transcription polymerase chain reaction (RT-PCR). Source: [Laboratory Diagnosis of Yellow Fever Virus infection](#). Pan American Health Organization; 2018.

(PCR) and IgM antibodies is needed to accurately diagnose yellow fever at various stages of the disease. Enzyme-linked immunosorbent assay (ELISA) testing is the norm for detection of IgM antibodies but requires a plaque reduction neutralization test (PRNT) confirmatory testing due to the cross-reacting ability of Dengue, West Nile, Zika, and yellow fever IgM antibodies.

In Africa, most yellow fever patients present late or have a sample taken late, necessitating an IgM and a PRNT confirmatory test, whereas patients in the Americas are often caught earlier in their disease stage and are largely diagnosed through PCR. The earlier case detection in the Americas is further related to the early warning system of non-human primates (see further description in Section 5.3.2). In Africa, the need for complex PRNT confirmatory testing remains, until improved IgM antibody testing platforms become available, and PRNT confirmatory testing can only be conducted at one of the three regional accredited reference labs in Cameroon, Senegal and Uganda.

There are positive examples of efforts to enhance diagnostic efficiencies. These include innovations such as the development of multiplex diagnostics to detect (and differentiate between) different flaviviruses and other new testing assays. As an example, the reverse transcription polymerase chain reaction molecular platforms (RT-PCR) across high-risk countries in the Americas have been strengthened during the last 10 years, both into the arboviruses and influenza networks. These platforms have been rapidly adapted to respond to multiple pathogens (including chikungunya, Zika, and SARS-CoV-2) during the last three years. For yellow fever, at least 10 out of the 13 yellow fever high-risk countries have molecular detection capacity fully implemented, while efforts to increase the capacity in other countries is ongoing.

The relevance and importance of coordinated and multifaceted surveillance efforts for a rapid response and yellow fever outbreak containment was demonstrated across outbreaks in Brazil between 2017 and 2018. An example from São Paulo, constituted the mapping of corridors of transmission in order to identify priority areas/timing for vaccination by consolidating information from zoological, epidemiological and entomological surveillance efforts, and working together in a coordinated manner with various departments within the State Secretariat of Health (See Box 2 below).

Box 2: Multifaceted yellow fever surveillance in São Paulo, Brazil

Multifaceted yellow fever surveillance in São Paulo, Brazil

During the yellow fever outbreaks in 2017 and 2018 and in the years following the outbreaks, São Paulo has developed some of the most sophisticated surveillance systems in Brazil, which include:

Non-human primate (NHP) surveillance - Studies of NHPs are at the forefront of surveillance work in the State of São Paulo where best practices in combining epizootic and epidemiological surveillance in the fight against yellow fever during the 2016-2019 outbreak period were notable. Rapid genomic surveillance together with epidemiological and spatial data helped guide vaccination responses during the outbreak.

Entomological surveillance efforts - Entomological research from 2016 to 2019 in São Paulo alone was carried out in 207 municipalities including 889 localities with over 1,200 days of mosquito collection. Areas of monitoring activities were concentrated along the corridors of transmission in line with what zoological and epidemiological surveillance was demonstrating.

Ecological corridors of transmission strategy - Consolidating information from zoological, epidemiological and entomological surveillance efforts, and working together in a coordinated manner with various departments within the State Secretariat of Health, São Paulo was able to map out corridors of transmission in order to identify priority areas/timing for vaccination. This was essential given the speed the virus was travelling during the outbreaks from 2017 to 2019 (based on real time surveillance efforts determined to be 2.7 km/day) and the vast numbers of individuals who required vaccination.

Source: Brazil MTE country case study, Final evaluation report Volume III

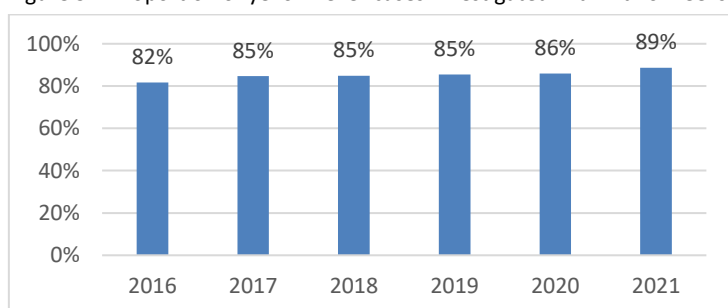
The following section presents reported progress against the six EYE strategic indicators related to timeliness of yellow fever diagnostics and timely response to an outbreak.

EYE strategic indicator 3.1: Proportion of yellow fever cases investigated within two weeks of index case notification

The first indicator under EYE strategic objective 3 relates to the time between index case notification and case investigation with a sample. It should be noted that a proxy is applied for this indicator as neither the index case notification date nor the results date from the regional laboratories have been made available in a coherent and consistent manner. Proxy data here actually shows the "Proportion of yellow fever cases with samples being taken within 2 weeks of symptom onset". Furthermore, data for this indicator were not reported for the Americas.

Among 21 countries in Africa with suspected yellow fever cases, the overall average proportion of suspected cases with a blood specimen taken within two weeks has been above the target of 80% for the entire EYE implementation period and with an increasing trend since 2020. In 2021, 6 359 out of 7 178 (89%) suspected cases had a blood sample taken with two weeks.¹⁶³ (Figure 31).

Figure 31: Proportion of yellow fever cases investigated within two weeks of symptoms onset - overall average (Africa)



Source: EYE dataset August 2022

Large country variations are, however, noted - Figure 32 presents trends for 10 countries in Africa for the period 2016-2021 on the same indicator. Some countries did not meet the target of 80% in 2021 (the Central African Republic, Chad, the Democratic Republic of the Congo, Nigeria) whereas others have remained stable and above 80% during all years (for example, Benin, Burkina Faso, Cameroon, Congo, Côte d'Ivoire, Gabon, Gambia, Ghana, Liberia, Mali, Senegal, Togo). Three countries have improved performance on this indicator during the EYE implementation period to reach 80% by 2021 (Guinea, Niger, Sierra Leone).

¹⁶³ EYE dashboard [unpublished data]. EYE Partnership; 2022.

Figure 32: Proportion of yellow fever cases with specimen taken within two weeks of symptom onset (10 countries in Africa)

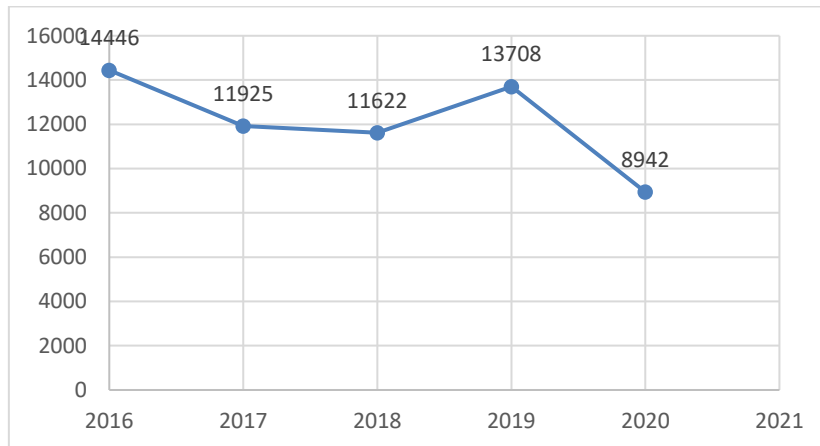


Source: EYE dataset, August 2022

A decrease over the EYE implementation period is noted on the number of suspected cases reported in Africa, particularly in 2020 (Figure 33). More detailed analysis found that the outbreak in Angola and

the Democratic Republic of the Congo in 2016 contributed vastly to the high number of suspected cases in 2016. Additionally, almost all countries had a lower number of cases reported in 2020, which, by several key informants, was thought to be caused by COVID-19 interruption of surveillance services. Several countries did not report data on this indicator for 2021 at the time of the evaluation and the extent of recovery since COVID-19 is thus not possible to analyse.

Figure 33: Annual number of suspected yellow fever cases reported 2016-2020 (21 countries in Africa)



Source: EYE dataset August 2022, NB: missing data for 2021 for several countries and thus not shown in this trend figure

Barriers to early testing for yellow fever have been mentioned by key informants and include differential diagnostics (for example, malaria, Dengue, hepatitis etc) and health care workers not consistently considerate of testing for yellow fever when a patient presents with yellow fever symptoms. About 50% of the mid-term evaluation online survey respondents¹⁶⁴ expressed the view that insufficient capacity of health care workers to identify yellow fever suspect cases remains a challenge to yellow fever surveillance.

The lack of point-of-care-based testing for yellow fever was further mentioned as a constraint. UNICEF has assisted in market-shaping efforts to encourage development of better yellow fever diagnostic test kits, by working with the Foundation for Innovative New Diagnostics (FIND),¹⁶⁵ Gavi, WHO and the EYE secretariat to issue target product profiles (TPPs)¹⁶⁶ in 2019 (including desired scope, pricing, performance, operational characteristics, and other features of the desired products). These target product profiles are for three yellow fever diagnostics: rapid diagnostic test, standardized molecular assay test kit and standardized immunoassay test kit. These are desired for use in the yellow fever lab network for better, decentralized yellow fever diagnostics,¹⁶⁷ to enable “rapid response to control of outbreaks earlier and close to the source.”¹⁶⁸

EYE strategic indicator 3.2: Proportion of samples transported within 14 days from local level to national reference laboratory

When the specimen has been collected from the yellow fever suspect case, the sample is sent to a national reference laboratory for testing. The number of days this procedure takes should not exceed 14 according to the EYE strategic indicator framework. The average number of days between collection

¹⁶⁴ MTE online survey Q16

¹⁶⁵ Eliminate Yellow Fever Epidemics: Monthly Update-February 2019 [unpublished report]. World Health Organization; 2019.

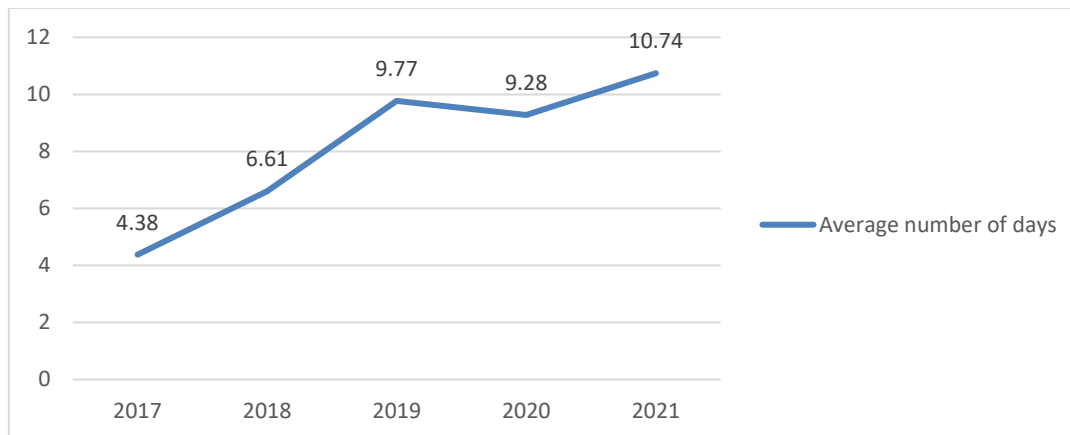
¹⁶⁶ Target product profiles for identification of yellow fever infection. Geneva: Gavi, FIND, World Health Organization; 2019 (<https://www.unicef.org/supply/media/2536/file/yellow-fever-virus-TPP-2019.pdf>).

¹⁶⁷ Target product profiles for identification of yellow fever infection. Geneva: Gavi, FIND, World Health Organization; 2019 (<https://www.unicef.org/supply/media/2536/file/yellow-fever-virus-TPP-2019.pdf>).

¹⁶⁸ EYE call to researchers and developers to accelerate towards improved yellow fever diagnostics. World Health Organization; 2019 (<https://www.who.int/news/item/01-10-2019-eye-call-to-research-and-developers-to-accelerate-towards-improved-yellow-fever-diagnostics>).

of specimen and receipt in the national laboratory has increased since 2017 and was 10.7 days in 2021 across African high-risk countries (Figure 34).

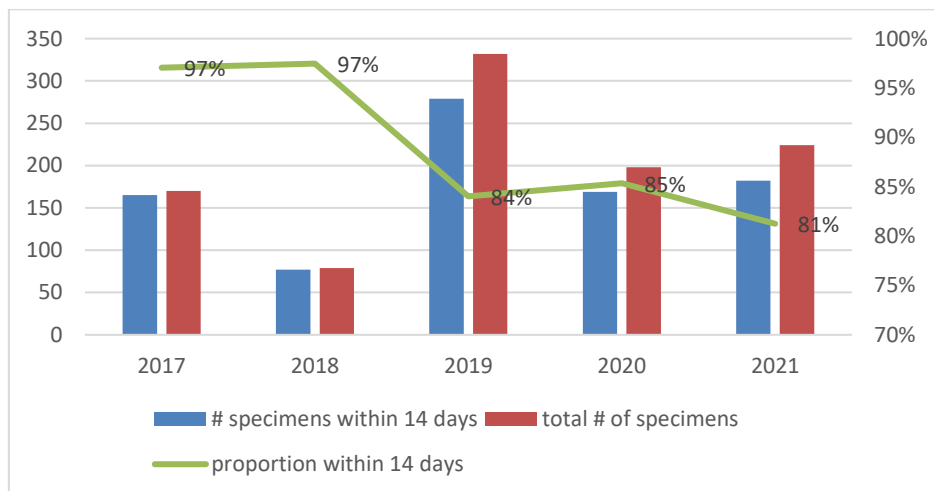
Figure 34: Average number of days from specimen collection to receipt in national laboratory 2017-2021 (Africa)



Source: EYE dataset, August 2022

The proportion of samples transported within 14 days from local level to national reference laboratory decreased from 97% (160 of 170) in 2017 to 81% (182 of 224) in 2021 (Figure 35). Note that only IgM positive samples are included and data for this indicator are only available for Africa.

Figure 35: Samples transported within 14 days from local level to national reference laboratory (Africa)



Source: EYE dataset August 2022

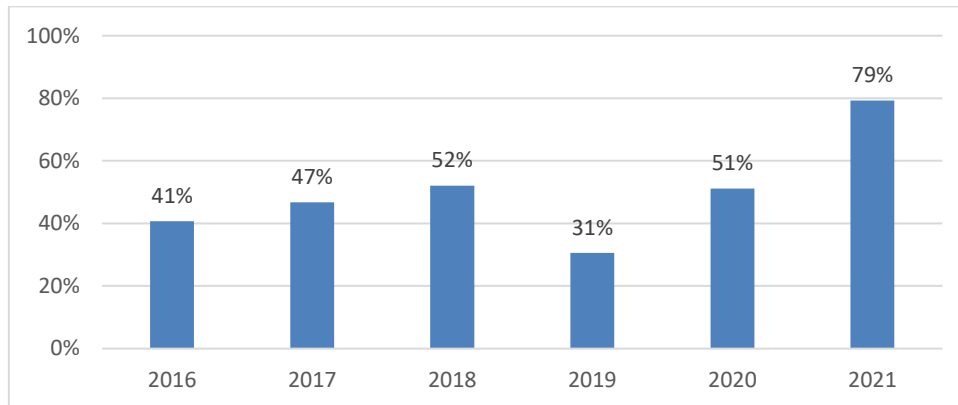
Note: only IgM positive samples are included.

When investigating data more closely, it appears that delays are often concentrated in certain countries or subregions thus indicating localized logistical sample transportation challenges. Country-level respondents to the online survey reported that sample transportation in general represented a continuing challenge to yellow fever surveillance – 47 of 67 (70%) of respondents from the African Region agreed or strongly agreed with this statement and 16 of 32 (50%) of respondents from the Region of the Americas agreed or strongly agreed. Some key informants mentioned that the lack of community-based surveillance for yellow fever was a missed opportunity, and others noted that the polio funding ramp down in several countries (for example, in Nigeria) had affected yellow fever surveillance efforts including infrastructure for sample transportation – see also Section 5.3.2 on external factors affecting EYE implementation.

EYE strategic indicator 3.3: Proportion of IgM test results reported by national reference laboratories in yellow fever high-risk countries within seven days after receipt of blood specimen

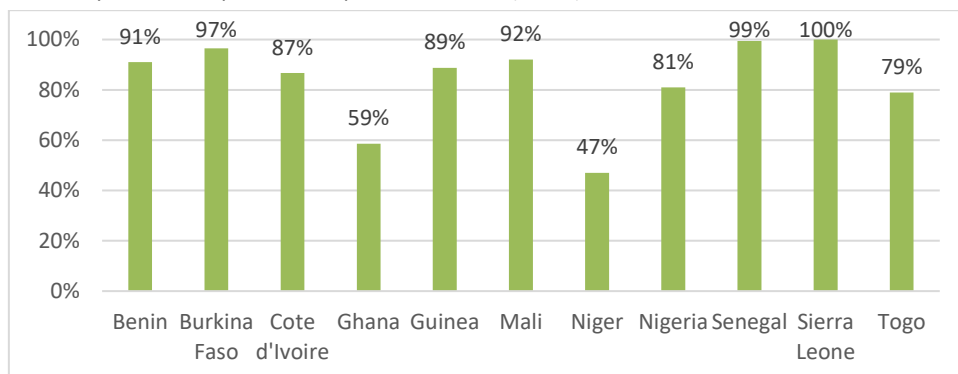
The turnaround time for testing blood specimen at the national reference laboratory is another strategic indicator for EYE. Significant progress is visible on this indicator over the last few years with 79% of IgM test results ready within seven days in 2021 as opposed to 47% during EYE inception in 2017 (Figure 36). Large country variations are observed with values ranging between 47-100% in 2021 (Figure 37). Special attention to improving the turnaround time at national reference labs in Niger and Ghana is warranted given their weaker performance. Note that only data from Africa were available to the evaluation team to analyse trends on this indicator.

Figure 36: Proportion of IgM test results reported by national reference laboratories in yellow fever high-risk countries within seven days after receipt of blood specimen, 2016-2021 (Africa)



Source: EYE dataset, August 2022

Figure 37: Proportion of IgM test results reported by national reference laboratories in yellow fever high-risk countries within seven days after receipt of blood specimen in 2021 (Africa)



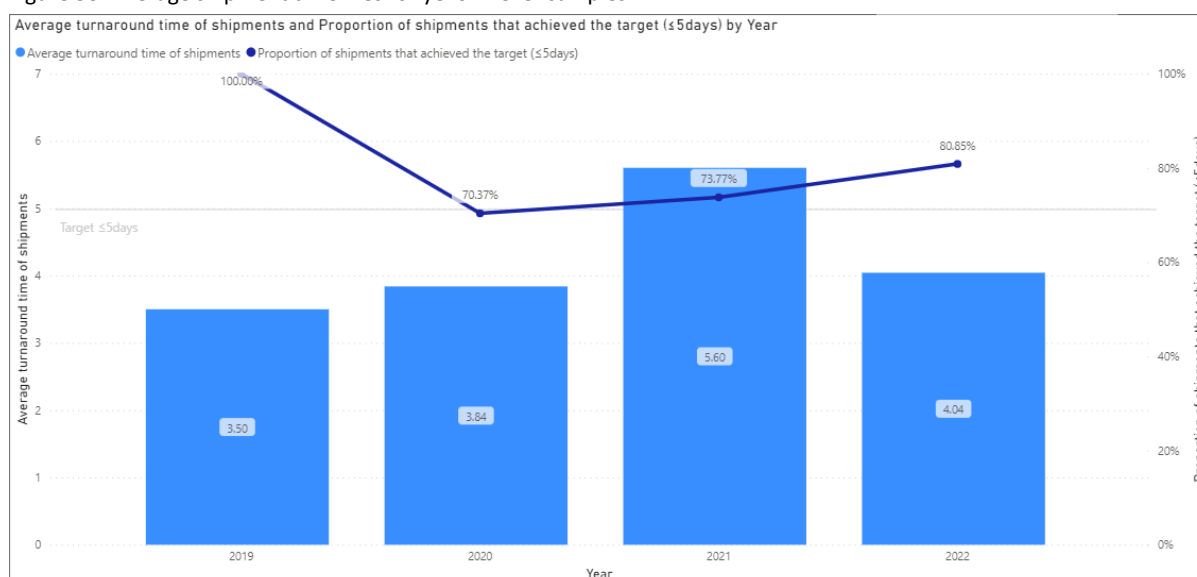
Source: EYE dataset August 2022

EYE strategic indicator 3.4: Proportion of samples transported within five days from national reference laboratory to regional reference laboratory

The EYE operations team (EYE.Ops) has, since 2018, engaged with an international courier to transport yellow fever samples from countries to one of the three reference labs in Africa for confirmatory yellow fever testing. The average turnaround time for shipments from national reference laboratories to regional reference laboratories was 4.04 days in 2022 (August) and 81% of shipments¹⁶⁹ (38 of 47) achieved the target of less than five days (Figure 38).

¹⁶⁹ NB only emergency shipments are counted.

Figure 38: Average shipment timelines for yellow fever samples



Source: EYE dashboard, Sep 2022

Note: Emergency shipments only.

EYE strategic indicator 3.5: Proportion of positive yellow fever cases referred for confirmation at regional reference laboratory (RRL) with results made available within 28 days from receipt of specimen (by RRL)

EYE has supported the establishment and certification of three regional reference labs in Africa, up from the original one. This has reduced yellow fever confirmatory testing times. The reference laboratories (Institute Pasteur Dakar in Senegal, Uganda Virus Research Institute (UVRI) in Entebbe, and Centre Pasteur du Cameroun (CPC) in Yaoundé) have undergone trainings and capacity-building and improved their operations (although the Cameroon lab has not been able to conduct any confirmatory tests since December 2021, due to a contamination issue).

In 2020, 91% (111 of 122) of positive yellow fever cases referred for confirmation at the regional reference laboratories had results available within 28 days from receipt of specimen,¹⁷⁰ thus close to meeting the target of 100% by 2026.

Progress on indicators 3.3, 3.4 and 3.5 have greatly improved turnover rates of yellow fever tests. Before the EYE strategy and in the early days of EYE implementation, the average time to confirm yellow fever was above 100 days between sample arrival to national lab and testing completion at regional reference lab.¹⁷¹ In 2020 this was reduced to 38 days on average (data for 2021 not yet available).

EYE partners are working on enabling new diagnostic tests, including one new RT-PCR molecular test kit that will help countries conduct their own confirmatory testing, and two more Immunoglobulin M (IgM) tests, which reportedly could be “game changers.” Introduction of new approved diagnostics could greatly improve yellow fever testing thereby facilitating rapid response to potential outbreaks and targeting of PMVCs.

Yet other challenges persist for optimal yellow fever surveillance, and the online survey identified the following as the top five challenges to yellow fever surveillance, presented in descending order: Funding challenges (86 of 101 (85%) agreed or strongly agreed that this was a challenge to yellow fever surveillance); insufficient supply of commodities (72%); limited human resource capacity (80%); inaccessible or hard-to-reach communities (73%); and limited community engagement (68%).

¹⁷⁰ EYE dashboard [unpublished data]. EYE Partnership; 2022.

¹⁷¹ Overview, Progress, Challenges, and Next Steps [PowerPoint]. EYE Partnership; 2021.

Additional persisting challenges related to yellow fever surveillance at the country level as reported by more than 50% of survey respondents in both regions included: COVID-19, data quality concerns, capacity of health care workers to identify yellow fever suspect cases, sample transportation, and in-country laboratory capacity. Confirmatory testing was further mentioned as a continued challenge by 54% of African respondents, but only by 30% of respondents from the Americas.

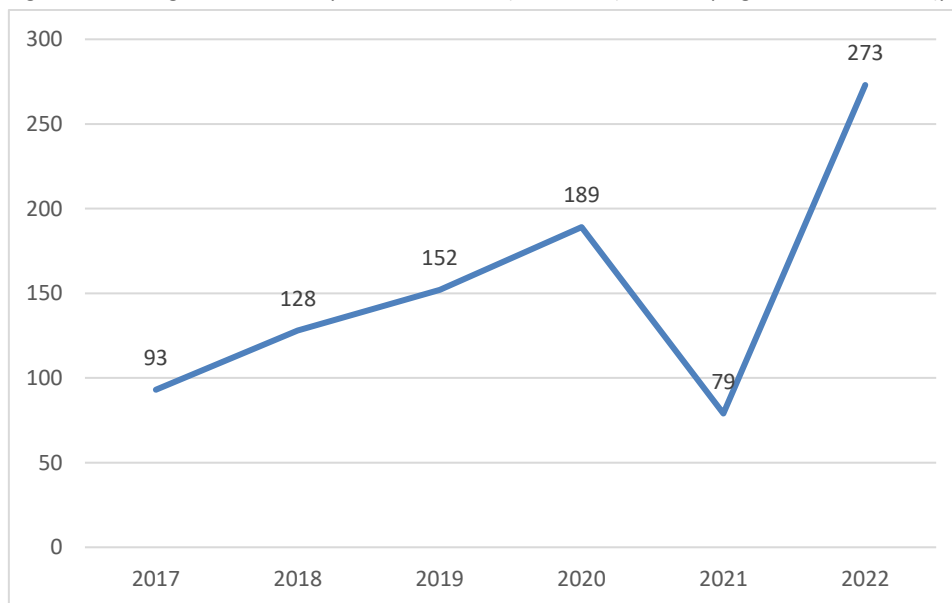
EYE strategic indicator 3.6: Proportion of months during which yellow fever emergency stockpile is full

Vaccine shortages was a major concern before EYE. The ICG secretariat and partners (IFRC, MSF) have managed the yellow fever emergency vaccine stockpile of 6 million doses since 2017, replenishing it when it depleted during outbreaks, and working to facilitate and streamline emergency orders by countries when outbreaks do occur, and country stocks are limited.

EYE strategic indicator 3.7: Proportion of yellow fever outbreaks with reactive vaccination campaigns starting within 86 days from onset of symptoms of first case

Since 2017, 32 outbreaks across Africa and Brazil (of which 18 defined as large disruptive outbreaks) have been monitored in terms of how quickly the reactive vaccination campaign (in most cases with an ICG request) started after yellow fever symptoms in an index case were registered. An increasing trend is observed with regard to the average number of days between onset of disease and campaign start - as depicted in Figure 39. However, this data should be interpreted with caution, since it is noted that in a few cases in 2020 (Ethiopia) and 2021 (Guinea) the country initiated its own response before the ICG requested campaign started, with no additional information provided. Furthermore, the increase in 2022 is greatly attributed to a significant delay to one outbreak in Cameroon (511 days). Discounting this outbreak, the average number of days would be 214 in 2022, yet still higher than previous years.

Figure 39: Average number of days between onset (index case) and campaign start 2017-2022 (year of implementation)



Source: EYE dataset August 2022

Notes:

2017: average number of days for the following outbreaks: 3 outbreaks in Nigeria and 1 outbreak in Brazil

2018: average number of days for: 4 outbreaks in Nigeria, 1 in Congo and 1 in Ethiopia

2019: average number of days for: 3 outbreaks in Nigeria, 1 in South Sudan

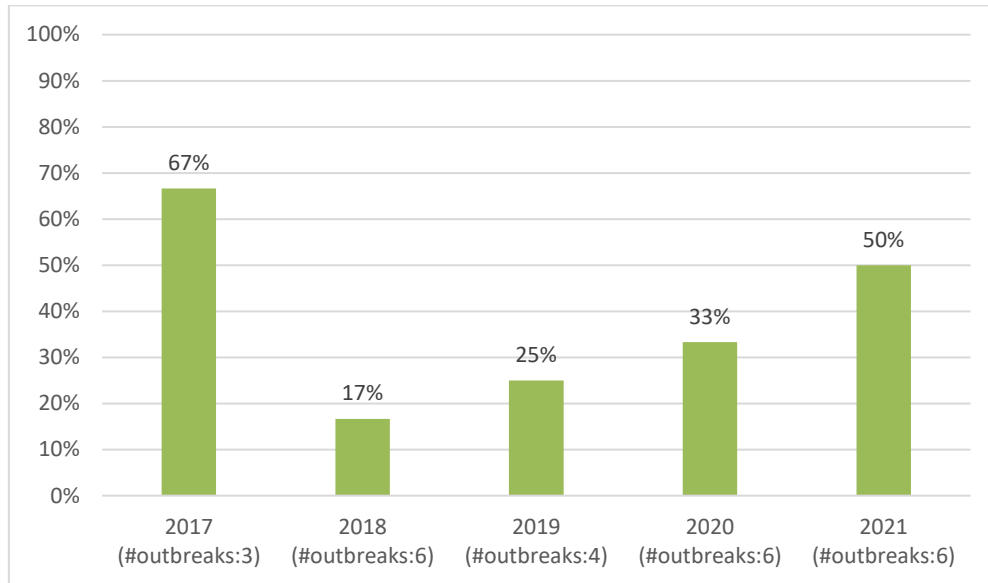
2020: average number of days for: 5 outbreaks in Nigeria, 1 in Ethiopia, 1 in Guinea, 1 in Senegal, 1 in South Sudan and 1 in Uganda,

2021: average number of days for: 2 outbreaks in Ghana, 1 in Chad

2022: average number of days for: 2 outbreaks in the Central African Republic, 1 in Chad, 1 in Cameroon and 1 in Kenya

Considering the proportion of outbreaks that started within 86 days over time, this has been an increasing trend since 2018, yet note the small numbers (Figure 40).

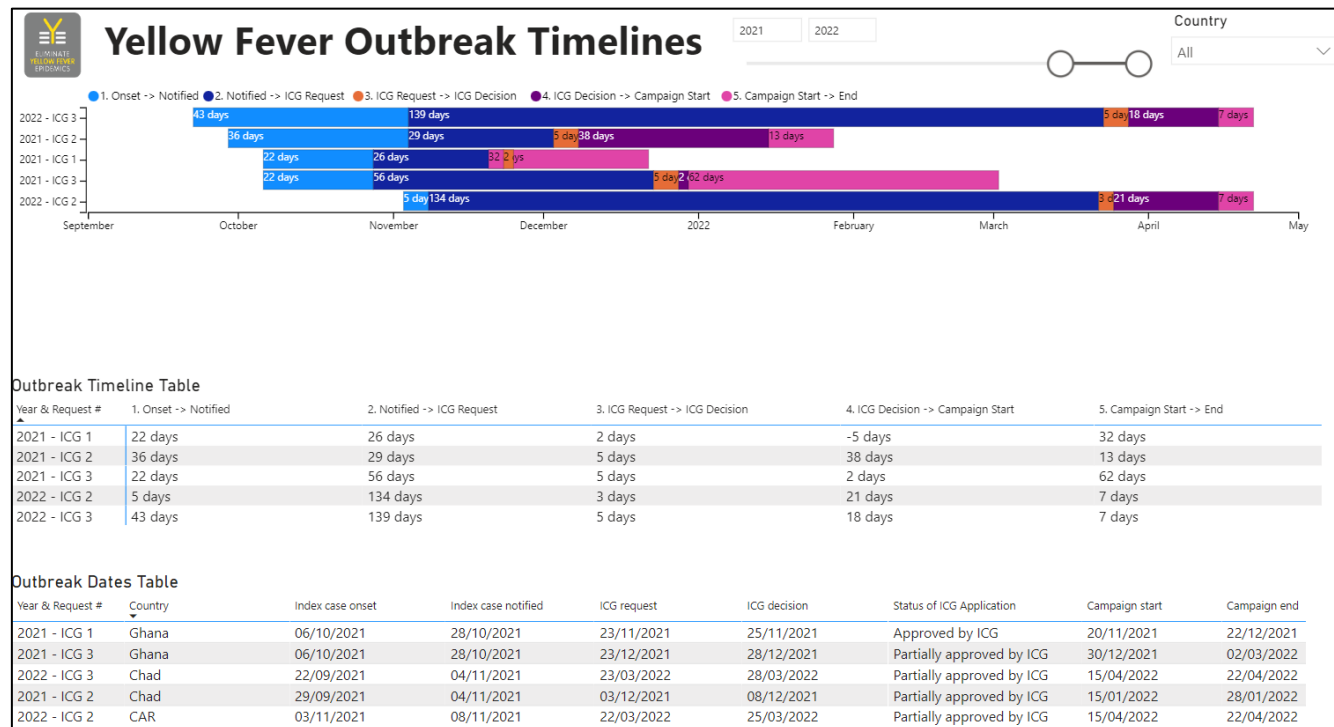
Figure 40: Proportion of yellow fever outbreaks with campaigns starting within 86 days



Source: EYE dataset, August 2022

Response delays during outbreaks in 2021 and 2022 were mainly attributed to the time between a notified case and the ICG request as shown in Figure 41 below. Key informants have mentioned that the ICG requests were often of poor quality and several revisions for the requests were needed before they could be approved, which have contributed to these delays. Country-level stakeholders have reported that that ICG request forms asked for very detailed data/information, which were often not easily available due to data limitations etc.

Figure 41: Yellow fever outbreak timelines 2021



Source: EYE dashboard, August 2022

Results of the mid-term evaluation online survey point to the following top five cited challenges related to responding to a yellow fever outbreak across the 40 high-risk countries, presented in descending

order: funding; inaccessible high-risk areas or hard-to-reach populations; human resource capacity; vaccine supply shortages; COVID-19; and community engagement/mobilization (Figure 42).

Figure 42: To what extent do you agree that the following are continuing challenges for yellow fever outbreak response including reactive vaccination campaigns in your country?

	STRONGLY DISAGREE	DISAGREE	NEUTRAL	AGREE	STRONGLY AGREE	TOTAL	WEIGHTED AVERAGE
Human resource capacity	3.17% 2	12.70% 8	14.29% 9	46.03% 29	23.81% 15	63	3.75
Funding	0.00% 0	4.69% 3	6.25% 4	43.75% 28	45.31% 29	64	4.30
Vaccine supply shortages	1.61% 1	16.13% 10	14.52% 9	45.16% 28	22.58% 14	62	3.71
Supply shortages of other commodities than vaccines	1.59% 1	17.46% 11	20.63% 13	47.62% 30	12.70% 8	63	3.52
Inadequate Guidelines/SOPs	6.25% 4	32.81% 21	31.25% 20	25.00% 16	4.69% 3	64	2.89
Laboratory capacity within your country	4.69% 3	31.25% 20	21.88% 14	31.25% 20	10.94% 7	64	3.13
Identification and reporting of suspected yellow fever cases	3.13% 2	23.44% 15	9.38% 6	53.13% 34	10.94% 7	64	3.45
Investigation of suspected yellow fever cases, including sample collection	4.69% 3	17.19% 11	10.94% 7	56.25% 36	10.94% 7	64	3.52
Sample transportation	4.76% 3	15.87% 10	12.70% 8	57.14% 36	9.52% 6	63	3.51
Confirmatory testing	3.17% 2	25.40% 16	23.81% 15	34.92% 22	12.70% 8	63	3.29
Decision making on whether to conduct a reactive campaign	1.56% 1	23.44% 15	25.00% 16	35.94% 23	14.06% 9	64	3.38
COVID-19	4.84% 3	12.90% 8	20.97% 13	37.10% 23	24.19% 15	62	3.63
Planning and forecasting for the reactive campaign including submission of request to ICG	7.81% 5	18.75% 12	31.25% 20	32.81% 21	9.38% 6	64	3.17
Response approval times from ICG (International Coordinating Group) for vaccine request	7.81% 5	21.88% 14	32.81% 21	29.69% 19	7.81% 5	64	3.08
Shipment of vaccine to country for reactive campaign response	6.25% 4	23.44% 15	28.13% 18	34.38% 22	7.81% 5	64	3.14
Organization and implementation of reactive campaign response	4.76% 3	11.11% 7	30.16% 19	47.62% 30	6.35% 4	63	3.40
Community engagement/mobilization	3.13% 2	12.50% 8	17.19% 11	53.13% 34	14.06% 9	64	3.63
Coordination among partners	3.13% 2	21.88% 14	23.44% 15	45.31% 29	6.25% 4	64	3.30
Inaccessible high-risk areas or hard-to-reach populations	1.56% 1	9.38% 6	14.06% 9	43.75% 28	31.25% 20	64	3.94
Vaccine hesitancy or vaccine resistance	4.69% 3	25.00% 16	25.00% 16	34.38% 22	10.94% 7	64	3.22
Data quality	3.13% 2	18.75% 12	17.19% 11	39.06% 25	21.88% 14	64	3.58

Source: MTE online survey Q19

Disaggregating results of the same survey question by region, large variations were noted. In the Americas, the top five challenges comprised (in descending order): human resource capacity; funding; inaccessible, high-risk areas or hard-to-reach populations; identification and reporting of suspected yellow fever cases; and investigation of suspected yellow fever cases, including sample collection. Among respondents from Africa, the top five challenges comprised (in descending order): funding; inaccessible, high-risk areas or hard-to-reach populations; vaccine supply shortages; data quality; and COVID-19/community engagement/mobilization.¹⁷²

¹⁷² MTE Online survey Q19

Milestones for the EYE strategy

Overall, the EYE programme has met or partially met most of its milestones, however, with some noted delays. A detailed overview is provided below in Table 14.

Table 14: Milestones for the EYE strategy, status overview¹⁷³

Milestone	Status	Sources
By end of 2017		
EYE governance body is fully operational	Partially achieved by set timeline – delays incurred, EYE governance body structure was set up, but not fully operational. Delays reported by some KIs. Amended to a more simplified multi-layered EYE governance structure in 2017 during EYE partners’ meeting, including “defining the ToRs for each group involved in the EYE strategy as well as operating procedures”. To be operationalized in 2018.	KII Report of the EYE strategy partners meeting 2017
The implementation plan, including indicators and deliverables, is ready	Partially achieved Regional endorsements in place by 2017, but delays in M&E framework and an implementation plan/roadmap for the Americas (still a draft version by August 2022) First M&E framework was ready in 2018, EYE dashboard created to track country implementation in 2019, M&E framework finalized in 2021 Regional endorsement in place by the end of 2017: Technical advisory group at PAHO endorsement of EYE in 2017 during the XXIV TAG Meeting Panama City, Panama WHO AFRO Regional Committee resolution in 2017 Strategic principles described therein were validated by the Strategic Advisory Group of Experts (SAGE) on Immunization in October 2016 and approved by the Gavi Board in December 2016. Roadmaps/implementation plans: Roadmap for EYE implementation in AFR = regional workplans <i>Roadmap for EYE implementation in Latin America and the Caribbean –draft version in 2022, not endorsed</i>	XXIV Meeting of the Technical Advisory Group (TAG) on Vaccine-Preventable Diseases Framework for implementing the global strategy to eliminate yellow fever epidemics, 2017–2026 in the African Region
At-risk countries are engaged in EYE strategy implementation	Partially achieved NB: which countries are considered “at-risk” and what does “engaged” refer to? This is not a well-defined milestone. EYE strategy partners’ meeting held in 9-10 May, 2017, 65 participants, 4 from at-risk countries: MoH Brazil, professor Nigeria, WHO NPO Eritrea, WHO NPO DRC. EYE regional kick-off meeting in Africa in April 2018: Representatives from 11 African countries at high-risk for	Report of the EYE strategy partners’ meeting 2017 2018 EYE annual highlights

¹⁷³ [A global strategy to Eliminate Yellow fever Epidemics \(EYE\) 2017 – 2026](#). Geneva: EYE Partnership; 2018.

	<p>yellow fever epidemics reiterated their commitment to the EYE strategy. The outcomes of the 3-day meeting included: a 3-year timeline for the implementation of immunization activities in Africa; the development of 3-year workplans to roll out the strategy at the national level; identification of bottlenecks and potential solutions to accelerate EYE implementation.</p> <p>“Member States will be engaged to endorse the strategy. For the Americas, the Technical Advisory Group will be the first contact with Member States to obtain regional representation. PAHO will channel the EYE strategy to individuals in the countries who will be responsible for its implementation.”</p> <p>Country EYE implementations plans started for 6 countries.</p>	<p>Report of the EYE strategy partners meeting 2017</p>
By end of 2018		
<p>3 African reference laboratories are fully functional with confirmatory diagnostic capacity</p>	<p>Partially achieved by set timeline – delays</p> <p>3 African subregional reference laboratories established by 2020 (Cameroon in 2020, Uganda in 2018), Senegal pre-existing. However only 2 of which are currently able to carry out confirmatory diagnostic testing</p>	<p>EYE strategy annual highlights 2018, 2020, KIIs</p>
By end of 2020		
<p>All African high-risk countries have introduced the YF vaccine into RI</p>	<p>Not yet achieved</p> <p>By August 2022, 2 countries of the 23 high-risk African Region had not yet introduced YF into RI; Ethiopia and South Sudan. Sudan introduced YF into RI in 2021 and Uganda in 2022.</p>	<p>WUENIC, and KIIs</p>
<p>Campaigns have been completed and are well underway in 3 EYE priority countries (including Nigeria)</p>	<p>Partially achieved by set timeline - delays</p> <p>Completed nationwide preventive campaigns by end 2020: Angola and Ghana</p> <p>Completed nationwide preventive campaigns by end 2021: Sudan</p> <p>Multiyear campaigns – ongoing since 2018-2019: DRC, Nigeria.</p> <p>Countries still to initiate campaigns: Ethiopia (initially planned for 2019, now 2025), Uganda (2022), Congo (launched in August 2022), Equatorial Guinea (2023), Gabon (2023), Guinea Bissau (2024), Chad (2024), Niger (2024), South Sudan (2025)</p>	<p>EYE strategy annual highlights 2018, 2019, 2020, 2021</p>
<p>6 African subregional reference laboratories are fully functional and external quality assurance/ quality control is fully functional for both serology and molecular diagnostic procedures</p> <p>Decision was later made to maintain target at 3 instead of 6.</p>	<p>Achieved</p> <p>3 African subregional reference laboratories established (Cameroon, Senegal, Uganda), however, only 2 are currently able to carry out confirmatory diagnostic testing,</p>	<p>EYE strategy annual highlights 2018, 2020,</p> <p>Progress reporting 2020 EYE Strategy workplan</p>
By end of 2022		

At least 50% of the target population of high-risk countries of Africa has been protected through national PMVCs	On track As of August 2022: 185 million (38%) people have been vaccinated through PMCV, RCV and catch-up campaigns since 2017. Currently below target of 50%, however, if all planned campaigns for 2022 are implemented: 54%	EYE Dataset 2022	M&E Aug
By end of 2024			
All African high-risk countries have diagnostic capacity to detect and confirm YF	N/A		
By end of 2026			
All high-risk countries have completed national PMVCs	N/A		
NB: Nine additional milestones were referred to in the M&E framework but without a timeline mentioned, all nine milestones were met by mid-term			

Having gone through the main results of the EYE strategy implementation to date, the related challenges and opportunities, we continue in the following section (EQ 3.2) to explore external contextual factors that have affected EYE implementation during the period 2017-2022.

5.3.2 Which external factors have influenced implementation of the strategy to date? (EQ 3.2)

Summary box of key findings – EQ 3.2
<p>Enabling external factors for implementation of the EYE strategy included:</p> <ul style="list-style-type: none"> - strong health systems before implementation of the EYE strategy, including lab and infrastructure - non-human primate “early warning mechanisms” in the Americas - COVID-19: specifically, lab/PCR infrastructure and global attention to health emergencies. <p>Hindering external factors for implementation of the EYE strategy included:</p> <ul style="list-style-type: none"> - competing public health priorities and emergencies (COVID-19, polio, measles, Ebola, cholera, meningitis, monkey pox etc.) - pre-existing weak and fragile health systems, insecurity and conflicts - Global Polio Eradication Initiative (GPEI) funding ramp down and Gavi transitioning countries - climate change, population movements and population growth.

Enabling external factors for EYE strategy implementation

Mid-term evaluation key informants consistently pointed to the advantage of a pre-existing robust health system (including for supply chain and national EPI) during the implementation of the EYE strategy. Informants also noted that countries of the Americas generally have a better lab infrastructure, more skilled lab workers, less challenges with cold chain and more fiscal space for domestic financing etc. The performance of routine immunization programmes in the yellow fever high-risk countries of the Region in the Americas is also generally higher than in the African Region (see Section 5.3.1) facilitating higher population immunity levels and less risk of outbreaks.

In countries of the Americas, most yellow fever cases have been detected via RT-PCR. This is a sign that yellow fever patients are detected early because viral RNA can generally only be detected by molecular methods in serum samples during the first 10 days since the onset of symptoms – yet in severe cases

longer than 10 days.¹⁷⁴ Early detection in the Americas is reported by key informants to be due to jaundice being easier to diagnose in American populations and perhaps, even more importantly, because of the non-human primate “early warning mechanism” in many countries of the Americas, including Brazil. The silence in forests of the normally noisy howler monkeys provides an early sign of a massive yellow fever outbreak. When yellow fever virus hits this primate species up to 90% will die and the forest goes silent. The unusual die-offs of non-human primates can be found by humans and tested for yellow fever virus as part of non-human primate sentinel surveillance. This usually happens before cases and casualties are reported in human beings. Such signals have prompted yellow fever surveillance, early detection, and vaccination campaigns among humans in surrounding areas. Such an “early warning system” is not present to the same extent among non-human primates in the African countries because these “old world” primates typically do not suffer fatal illness from yellow fever. A challenge to surveillance is that yellow fever cases in Africa are often discovered late, when more complex and time-consuming diagnostics, such as PRNT testing are needed to confirm yellow fever through detection of IgM antibodies.

Whereas COVID-19 has been disrupting many EYE activities and national immunization programmes, which will be discussed later in this section, on a more positive note, the literature and key informants also reported that COVID-19 resources/infrastructure (lab/PCR/vaccination campaigns) and the global attention to threats of health emergencies had offered opportunities for strengthening lab systems, IHR and multi-antigen vaccination campaigns.¹⁷⁵ Yet opportunities have not been fully leveraged or have not been sufficiently documented.

Hindering external factors for EYE strategy implementation

COVID-19 and other competing disease outbreaks

The EYE strategy implementation has faced challenges related to competing priorities in regions and countries (and among donors) - especially the impacts of the COVID pandemic, but also concurrent outbreaks of polio, measles, Ebola, cholera, meningitis, and the latest monkey pox outbreak were noted as distracting attention away from yellow fever.¹⁷⁶ According to key informants, yellow fever has historically been a lower priority for countries facing myriad other challenges, and many governments only react and prioritize yellow fever interventions when there is an outbreak.

The COVID-19 pandemic caused considerable challenges and impacted on EYE performance, by diverting attention and resources and incurring new operational challenges and cost increases. Risk related to COVID-19 was adequately identified by the EYE team¹⁷⁷ and in many instances the impact was reduced or mitigated by: ensuring personal protective equipment (PPE) to continue vaccination campaigns; developing mitigating procedures; and holding webinars with over 600 participants (by WHO IPC) to provide recommendations and guidance on how to run immunization sessions (fixed settings, outreach settings and campaign settings) and additional recommendations for IPC considerations, including personal protective equipment.¹⁷⁸

Despite mitigation measures, major impacts from the pandemic were noted,¹⁷⁹ which included: interruption/postponement of planned vaccination campaigns (in both regions) - where PMVC

¹⁷⁴ [Laboratory diagnosis of yellow fever virus infection](#). Pan American Health Organization; 2018.

¹⁷⁵ Fifth Eliminate Yellow fever Epidemics (EYE) Strategy Annual Partners' Meeting [unpublished report]. Geneva: World Health Organization; 2021.

¹⁷⁶ EYE Strategy 2022 Work Plan [PowerPoint]. EYE partnership; 2022.

¹⁷⁷ Eliminate Yellow fever Epidemics: Monthly Update-March/April 2020 [unpublished report]. World Health Organization; 2020.

¹⁷⁸ Eliminate Yellow Fever Epidemics: Monthly Update-May 2020 [unpublished report]. World Health Organization; 2020.

¹⁷⁹ [Global yellow fever update 2020: Weekly Epidemiological Update](#). World Health Organization; 2021.

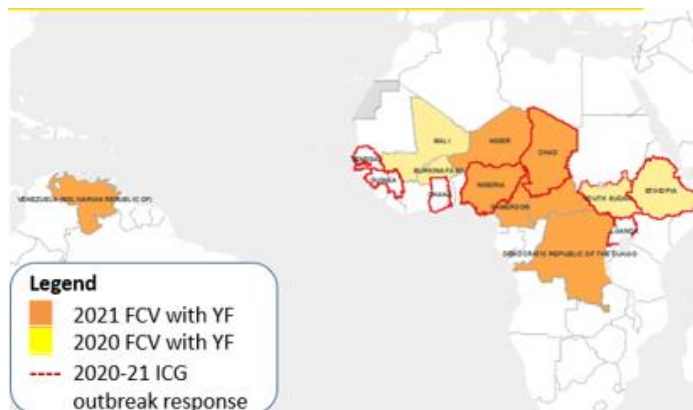
planned for 23.4 million persons was delayed;¹⁸⁰ decreased vaccine demand (through the PAHO revolving fund); and general delays on implementing the BMGF grant and EYE workplans. Looking at EYE M&E performance indicators, a decrease was noted in 2020 on several indicators, especially related to coverage rates of routine immunization and PMVCs. Routine immunization programmes were hard hit by COVID-19, with decreases in coverage noted between 2019 and 2020 and continuing into 2021 across almost all yellow fever high-risk countries, but also decreasing coverage levels of PMVCs have been noted since 2020 with no signs of improvement in 2021 (see Section 5.3.1). Major disruption of national routine immunization programmes, lower demand and vaccine hesitancy to injectable vaccines are possible explanations of this decreasing coverage.¹⁸¹ Another concern is data quality and data availability, which were also constrained by the COVID-19 pandemic and may have affected the coverage rates reported. However, despite the delays of PMVCs, 2020 remains the year with the highest reported number of people being vaccinated (46 million) across African countries throughout the strategy period (see Section 5.3.1).

The number of yellow fever suspect cases with a specimen taken also decreased significantly in 2020. Furthermore, key informants reported that transportation and shipments for yellow fever diagnostics were very challenging during the year 2020. A decline was observed in 2020 with regard to the proportion of specimens transported within 14 days from the local level to national reference laboratories and the average turnaround time for shipments from national reference laboratories to regional reference laboratories increased – yet with recovery noted for 2021 (Section 5.3.1).

Pre-existing weak and fragile health systems, insecurity, and conflicts

Many EYE countries are fragile, conflict-affected and vulnerable (FCV) settings, severely challenged by political instability, fragility, ongoing conflicts, and/or security issues. This is leading to disrupted health systems and considerable challenges in reaching underserved and displaced communities. In 2020-2021, 11 EYE countries reported outbreaks in fragile, conflict-affected and vulnerable settings (Figure 43). Access issues and security concerns are major challenges for operations. In such settings bundled services/integrated service delivery and engagement with community is reported to be critical.

Figure 43: Fragile, conflict-affected and vulnerable countries with yellow fever outbreaks



Source: Horton J. Eliminate Yellow fever Epidemics (EYE) Strategy [PowerPoint Slides], 2022 May [cited 2022 May 24]
Note: FCV= fragile, conflict-affected and vulnerable.

One example is the EYE “no-regret” country Nigeria. The poor security situation in many parts of Nigeria was identified as a major hindrance to planned campaigns and routine immunization in the country. Persistent armed conflict with Boko Haram in northeast Nigeria is resulting in widespread displacements, food insecurity, and many victims of violence. The number of people in need of urgent

¹⁸⁰ Eliminate Yellow Fever Epidemics: Monthly Update-March/April 2020 [unpublished report]. World Health Organization; 2020.

¹⁸¹ Fifth Eliminate Yellow fever Epidemics (EYE) Strategy Annual Partners’ Meeting [unpublished report]. Geneva: World Health Organization; 2021.

assistance in northeast Nigeria rose to 10.6 million since the onset of the COVID-19 pandemic.¹⁸² Many of the recent outbreaks observed in West Africa have also been noted in the context of vulnerability and insecurity¹⁸³ with weak health systems, including for routine immunization programmes, corruption and frequent turnover of government staff.

The Democratic Republic of the Congo is another “no-regret” country for EYE and is considered the largest “Internally displaced population situation” in Africa.¹⁸⁴ The overall security situation remains complex, with continued inter-ethnic conflicts and armed attacks, particularly in the eastern provinces of the country. Since 2019 and throughout 2020, increased violence has resulted in the continued internal forced displacement of more than 5.2 million people, according to the 2021 Democratic Republic of the Congo Humanitarian Response Plan.¹⁸⁵ The last EYE “no-regret country” is Ethiopia, where an extensive number of people are in need of humanitarian support and health care services due to the conflict that erupted at the end of 2020. An estimated 2.1 million people have been displaced and over half of all health facilities in Tigray are not operational.¹⁸⁶

Decreasing funding for vaccine-preventable disease control in some countries from international donors

The EYE strategy implementation is further impacted by the reduction in polio funding in several yellow fever high-risk countries and implementation support on the ground in some countries (for example, in Nigeria impacting funding, personnel, systems). Most countries in the African Region remain reliant on Gavi funding for their vaccines with some countries being further along the Gavi transition trajectory (see further discussion and elaboration on this aspect in Section 5.4.1).

Climate change, urbanization, population movements and population growth

Urbanization, large population movements, climate change and increasing exposure of workers to infected mosquitoes in jungles and forests (particularly those working in mining, oil extraction and forestry) – have been identified in the EYE strategy document as driving the change in yellow fever epidemiology.

Higher than normal temperatures, increased humidity, along with increased rainfall experienced in recent years, will lead to an increase in suitable habitats for mosquito larvae and increase the survival and transmission potential of mosquitoes.¹⁸⁷ Furthermore, droughts lead to animals and humans all being forced to share the few water sources that are available with higher risk of transmission.¹⁸⁸ More people are also moving to, and visiting, the forest ecosystems where monkeys dwell and deforestation causes primates to find new habitats. Deforestation and changing land-use also forces indigenous populations to move and while doing so they often get more exposed to arboviruses.¹⁸⁹

In addition, the large size of populations and large birth cohorts, as noted in Nigeria and the Democratic Republic of the Congo, for example, pose challenges to ensure that all new birth cohorts are targeted with routine immunization.

¹⁸² [Nigeria Crisis](#). World Health Organization; 2022.

¹⁸³ Overview, Progress, Challenges, and Next Steps [PowerPoint]. EYE Partnership; 2021.

¹⁸⁴ [The Democratic Republic of the Congo: Regional Refugee Response Plan \(RRRP\) – 2021](#). United Nations High Commissioner for Refugees; 2020.

¹⁸⁵ [The 2021 Humanitarian Response Plan for the Democratic Republic of Congo will provide urgent assistance to 9.6 million vulnerable people. A budget of US\\$1.98 billion will be required to meet these needs](#). UN office for the coordination of Humanitarian Affairs; 2020.

¹⁸⁶ [Crisis in Northern Ethiopia](#). World Health Organization; 2022.

¹⁸⁷ World Health Organization. Preparing for the next pandemic: tackling mosquito-borne viruses with epidemic and pandemic potential [Draft Report], n.d. [cited August 18].

¹⁸⁸ Episode 13: The Amazon, climate change, and yellow fever risk [audio file]. EYE Partnership; 2022 (<https://www.who.int/initiatives/eye-strategy/podcast>).

¹⁸⁹ Episode 13: The Amazon, climate change, and yellow fever risk [audio file]. EYE Partnership; 2022 (<https://www.who.int/initiatives/eye-strategy/podcast>).

Some pockets or settings within cities are poorer than many rural areas. The general perception that urban populations have more resources and greater access to health services masks the underlying truth of pockets of under-served or excluded populations in urban areas. Immunization rates and underweight rates are as low for the urban poor as for those in the rural areas.¹⁹⁰ Population movements between urban and rural areas of an unvaccinated person can induce transmission into urban settings. This is considered a risk for both EYE regions as remarked in meeting reports, and an example includes the following quote: “Re-urbanization of yellow fever continues to be a threat in the region, as reflected in the outbreak in Brazil”.¹⁹¹ Increased global travelling, open/porous borders, and mobile populations (including nomadic populations) are other challenges that remain risks to yellow fever control, a recent case being the outbreak among nomadic populations in Ghana (see Box 3 below and full Ghana country case study in Volume IV).

Box 3: Nomadic populations identified as the source of outbreak in Ghana in 2021

Nomadic populations identified as the source of outbreak in Ghana in 2021

Despite Ghana's generally high routine immunization coverage and concluded nationwide PMVCs, segments of the population remained at risk, which led to the continued silent transmission of the yellow fever virus and outbreaks observed in 2021. During the period 15 October 2021–27 November 2021, a total of 60 confirmed cases of yellow fever, of which 20% (12 people) died, was reported in Ghana. Cases were identified across 14 districts in five regions (Bono, Eastern, Northern, Savannah and Upper West regions) with most cases reported from the Savannah region. Further analysis undertaken found that the 2021 yellow fever outbreak began in a community of nomads who were predominantly unvaccinated and might have entered the country after the last PMVC. Nomadic populations reportedly had moved from Nigeria into a forest reserve in Ghana's Savannah region.

Source: Ghana MTE country case study, Final evaluation report Volume IV

EQ4: Has the EYE strategy developed plans/identified a framework to secure funding or to otherwise ensure sustainability of achievements post-2026? (Sustainability)

The fourth evaluation question explores sustainability aspects through two sub-questions relating to future financing prospects for yellow fever interventions and other measures taken to ensure sustainability, including integration with other programmes and initiatives.

5.4.1 What are the indications of future financing of yellow fever elimination efforts? (EQ 4.1)

Summary box of key findings – EQ 4.1

- A comprehensive “engagement strategy” was drafted for EYE in 2022, yet this strategy did not clearly stipulate how domestic resources are to be mobilized.
- There are uncertainties as to the commitments of international development partners to sustain yellow fever elimination in countries at risk beyond 2026 and even uncertainties of funding of critical human resources positions in regions for the next couple of years and ongoing human resources capacity gaps that needs to be addressed across both regions.

¹⁹⁰ Urban Immunization: A tool kit for those planning to address inequitable immunization coverage in the urban context, September 2018; World Health Organization (2020). Reaching Every District (RED): a guide to increasing coverage and equity in all communities in the African Region.

¹⁹¹ [International Coordinating Group on Vaccine Provision for Yellow Fever – Report of Annual Meeting 2017](#). Geneva: World Health Organization; 2017.

- There is generally limited political will for yellow fever prioritization and commitments towards domestic resource mobilization. Domestic resources have been allocated for yellow fever interventions mainly in the Americas and more scarcely across African countries. However, data were not available to assess country allocations of domestic budgets.
- There is a trend of increased co-financing of Gavi-supported vaccines. However, with continued high dependence on international donors for yellow fever/immunization activities particularly in Africa.
- Few EYE countries have resource mobilization plans for yellow fever interventions in place that are funded, and attention to resource mobilization efforts are needed particularly for countries transitioning out of Gavi support. There is further a high risk that the costs of yellow fever vaccines will increase with global inflation.
- The mid-term evaluation survey found indications of lower risk perception related to yellow fever outbreaks among national authorities in EYE high-risk countries, which is considered to affect prioritization of yellow fever interventions *vis-à-vis* other competing priorities.

Funding challenges for yellow fever interventions

The EYE secretariat developed a comprehensive EYE engagement strategy in 2021¹⁹² to mobilize additional funding from different sources, which included a donor mapping and profiles, and priorities for the regions. But the engagement strategy does not spell out mechanisms for sustaining gains through domestic financing and exiting from external finance over the long term.

Key informants and online survey respondents indicate that EYE resource mobilization and domestic investments for yellow fever interventions present continuing key challenges that strategy partners need to work on after the mid-term. Key informants repeatedly mentioned that resources and resource mobilization at the country level have presented challenges to implement the interventions needed - particularly in relation to securing domestic budgets for yellow fever investments. Overall, only 21% of the mid-term evaluation online survey respondents agreed that yellow fever prevention and response activities are sufficiently funded in their country. Furthermore, only 29% expressed the view that yellow fever interventions were largely funded by domestic resources.¹⁹³ By disaggregating data by region (Africa/Americas), results indicate variances across regions and domestic funding for yellow fever interventions are lower in the African countries targeted by EYE with only nine of 57 respondents (16%) reporting that yellow fever interventions were largely funded by domestic resources versus 15 of 28 (54%) in the Americas. However, more respondents from the African Region reported overall sufficient funding for yellow fever prevention and response activities than respondents from the Region of the Americas- yet taking into consideration the low sample size (Table 15 below). Data were not available for the evaluation team to assess actual allocations of domestic budgets as such data are not regularly compiled and not easily accessible.

The majority of online survey respondents are of the view that funding remains a challenge for: routine immunization programmes (84%); yellow fever surveillance (85%); yellow fever outbreak response (89%); and yellow fever mass preventive vaccination campaigns (78%), whereas one quarter (24%) of respondents believed that funding gaps specific to yellow fever was one of the main reasons for a prevailing gap between yellow fever coverage and MCV1 coverage. Results were more or less equal across the two regions, though with indications of more funding challenges in the Americas for PMVCs

¹⁹² EYE Partnership Non-Technical Stakeholders Engagement Strategy (2022-2026) [unpublished report]. EYE Partnership; 2022.

¹⁹³ MTE online survey, Q30.

than in Africa. This would also be expected due to the fact that almost all countries in the Americas are not eligible for Gavi support – the main donor of yellow fever vaccines (Table 15 below).

Table 15: Funding of yellow fever interventions, and funding challenges as perceived by EYE country-level stakeholders

	N (%) of respondents*		
	Total	Africa	Americas
Overall YF prevention and response activities at the country level are:			
Sufficiently funded	18 (21%)	16 (28%)	2 (7%)
Largely funded by domestic resources	25 (29%)	9 (16)	15(54%)
Funding remains a challenge for the following areas*:			
General RI	76 (84%)	49 (84%)	25(83%)
Gap between YF and MCV1	21 (24%)	16 (27%)	4 (13%)
YF surveillance	86 (85%)	53 (79%)	23 (72%)
YF outbreak response	57 (89%)	62 (92%)	14 (82%)
YF mass preventive vaccination campaign	29 (78%)	19 (76%)	10 (91%)

*replying: agree or strongly agree

Source: MTE online survey results (Qs 14,15,16, 19, 23, 30)

Human resource capacity sustainability concerns

The long human resources recruitment processes observed during the first half of EYE strategy implementation were mentioned by several key informants to have impacted on EYE implementation and further discouraged funders, which could have a negative effect on future financing prospects. In the event that BMGF support to AFRO staffing for yellow fever coordination is not continued (due to end in August/September 2022), this would be a great concern for implementation support in that region for the remainder of the implementation period. In addition, securing sustainable funding for human resource oversight and coordination at headquarters and regional levels for yellow fever interventions beyond the end date of the strategy needs to be planned for. It may be possible to capitalize on assessed contributions, flexible funds and integrated roles, but clear focal points for yellow fever, adequate level of efforts and performance indicators for staff on yellow fever are needed.

At the country level there are also concerns on the human resource capacity for key yellow fever interventions. The majority of online survey respondents are of the view that human resources capacity remains a challenge for routine immunization (82%); yellow fever surveillance (80%); outbreak response (70%) and mass preventive vaccination campaigns (65%). Respondents from the Region of the Americas generally and for all intervention areas reported more frequently human resource capacity challenges than the respondents from the African Region (Table 16).

Table 16: Human resources capacity challenges as perceived by EYE country-level stakeholders

	N (%) of respondents*		
	Overall	Africa	Americas
Human resource capacity remains a challenge for the following areas:			
General RI	74 (82%)	46(79%)	26(87%)
YF surveillance	81 (80%)	53(79%)	27(84%)
YF outbreak response	44 (70%)	28(63%)	15(88%)
YF mass preventive vaccination campaign	24 (65%)	14(56%)	10(90%)

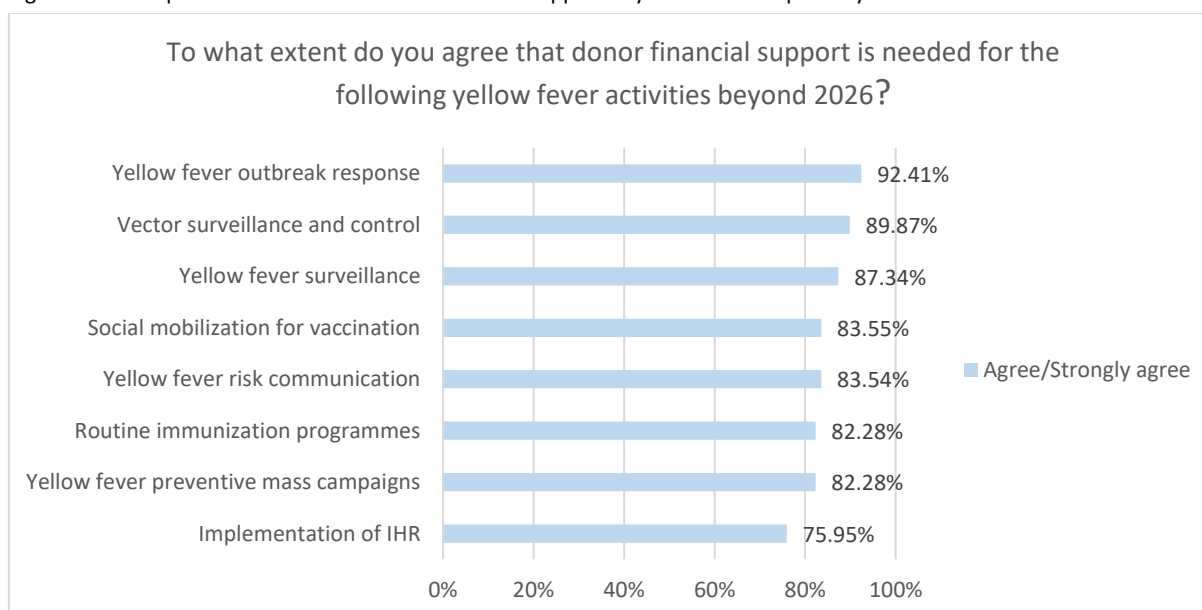
*replying: agree or strongly agree

Source: MTE online survey results (Qs 14,16, 19, 23)

Dependence on international donors

Key informants and the online survey results indicate that countries, specifically in the African Region, will rely on support from international development partners for key yellow fever interventions beyond 2026. The top three yellow fever intervention areas noted by respondents as requiring financial support from international donor communities beyond 2026 included: yellow fever outbreak response (92% agreed or strongly agreed); vector surveillance and control (90%); and yellow fever surveillance (87%) (Figure 44).

Figure 44: Perceptions on reliance on donor financial support beyond 2026 for specific yellow fever activities



Source: MTE online survey Q34

Disaggregating this data by region of respondents shows that more respondents from African countries report reliance on international donor support for almost every area investigated (Table 17). Likewise, respondents from the three “no-regret” countries for EYE (the Democratic Republic of the Congo, Ethiopia and Nigeria) reported high reliance beyond 2026 on almost all yellow fever intervention areas.

Table 17: Perceptions on donor financial support needed beyond 2026

Donor financial support is needed for the following YF activities beyond 2026	N (%) of respondents*			
	Total (n=79)	Africa (n=50)	Americas (n=27)	“No-regret” countries (DRC, Ethiopia, Nigeria)
YF surveillance	69 (87%)	47 (94%)	20 (74%)	DRC: 2 of 3 (66%) Ethiopia: 4 of 4 (100%) Nigeria: 6 of 6 (100%)
YF mass preventive vaccination campaign	65 (82%)	43 (86%)	20 (74%)	DRC: 3 of 3 (100%) Ethiopia: 3 of 4 (75%) Nigeria: 6 of 6 (100%)
YF outbreak response	73 (92%)	48 (96%)	23 (85%)	DRC: 3 of 3 (100%) Ethiopia: 4 of 4 (100%) Nigeria: 6 of 6 (100%)
RI programmes	65 (82%)	46 (92%)	17 (63%)	DRC: 3 of 3 (100%) Ethiopia: 2 of 4 (50%) Nigeria: 6 of 6 (100%)
YF risk communication	66 (84%)	43 (86%)	21 (78%)	DRC: 2 of 3 (66%)

					Ethiopia: 2 of 4 (50%) Nigeria: 5 of 6 (83%)
Social mobilization for YF vaccination	66 (84%)	44 (88%)	20 (74%)		DRC: 2 of 3 (66%) Ethiopia: 3 of 4 (75%) Nigeria: 5 of 6 (83%)
Implementation of IHR	60 (76%)	41 (82%)	17 (63%)		DRC: 3 of 3 (100%) Ethiopia: 3 of 4 (75%) Nigeria: 4 of 6 (66%)
Urban preparedness and readiness	57 (72%)	36 (72%)	20 (74%)		DRC: 2 of 3 (66%) Ethiopia: 0 of 4 (0%) Nigeria: 5 of 6 (83%)
Vector surveillance and control	71 (90%)	46 (92%)	24 (89%)		DRC: 2 of 3 (66%) Ethiopia: 3 of 4 (75%) Nigeria: 6 of 6 (100%)
YF case management	59 (75%)	37 (74%)	20 (74%)		DRC: 2 of 3 (66%) Ethiopia: 1 of 4 (25%) Nigeria: 3 of 6 (50%)

*Replying: agree or strongly agree

Source: MTE online survey results Q34

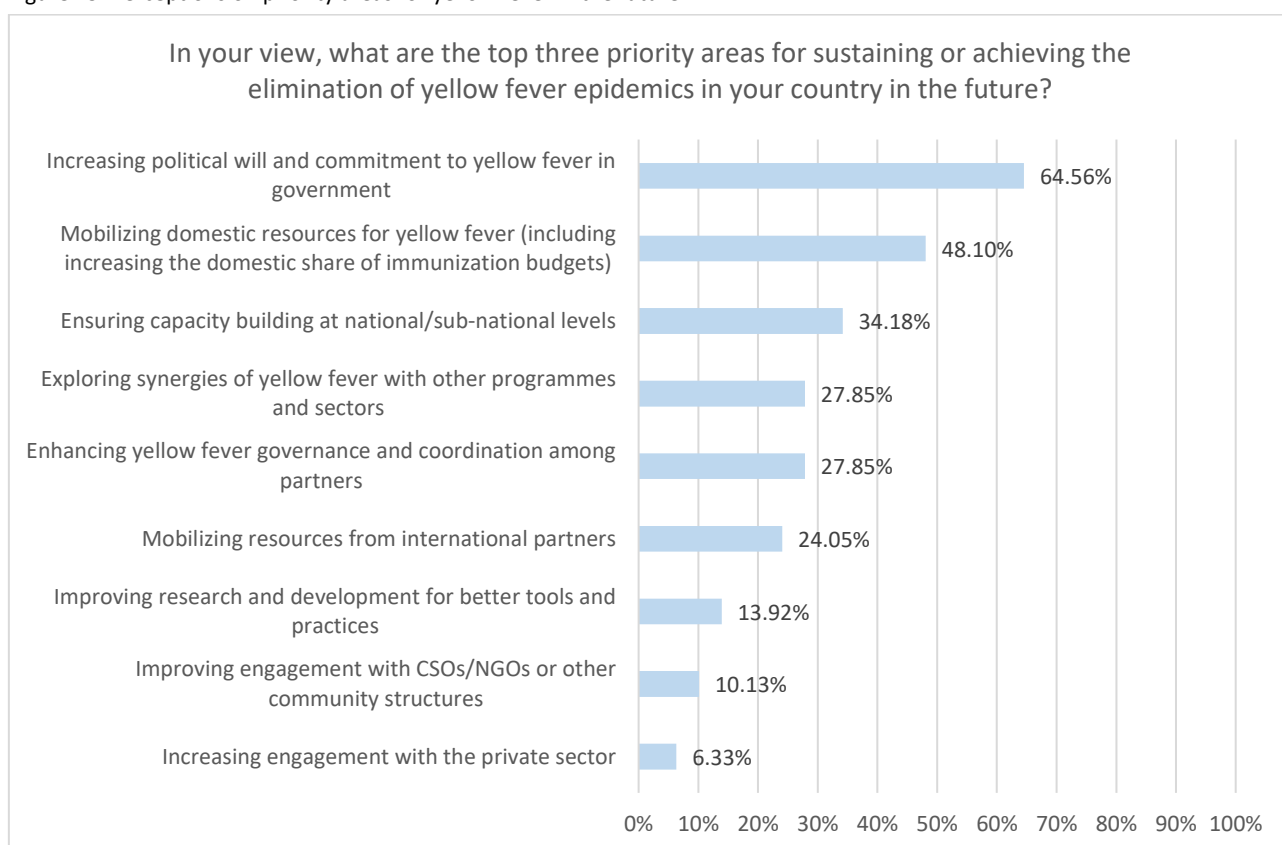
Informants further expressed the view that yellow fever high-risk countries in the Americas generally have a better infrastructure in place to detect and contain yellow fever and are less dependent on international donor support. PAHO works with countries to ensure yellow fever is reflected in national budgets – having a specific line item for immunization. According to the key informant interviews, the PAHO Revolving Fund helped countries to acquire yellow fever vaccines. Most countries in the region pay their contribution to the Revolving Fund, which has helped PAHO to raise significant levels of resources and get a minimum price for vaccines. This best practice at PAHO has helped countries to bring down prices. If countries do not pay their contribution within 60 days, they will not access vaccines. For instance, Venezuela could not contribute and was unable to access vaccines through PAHO. UNICEF Supply Division has however been supplying vaccines to Venezuela for four years now, with the first three years having support from other donors but the last year to 18 months coming from UNICEF's own funds. Another promising practice in PAHO is the development of a new co-agreement between Health Emergencies Department of PAHO and CDC, and the development and approval of specific funds for yellow fever detection and surveillance.¹⁹⁴

By contrast, there is more limited effort and potential in Africa towards mobilizing and allocating domestic resources for yellow fever and integrating efforts among countries. Countries in Africa continue to rely on external support (financial and technical) for implementing the strategy, but there are indications that high-risk countries in Africa can mobilize additional funding if strategically approached.

The limited political will and commitment towards domestic resource mobilization for yellow fever is repeatedly cited by key informants as well as online survey respondents as one of the critical challenges. More than 64% of the country-level online survey respondents noted that increasing political will and commitment in government should be a top priority area for sustaining/achieving elimination of yellow fever epidemics. This was followed by 48% who thought that mobilizing domestic resources for yellow fever should be one of the three top priorities for the coming years. (Figure 45).

¹⁹⁴ EYE retreat presentation, Update on yellow fever Situation in Americas [unpublished report]. EYE Partnership; 2019.

Figure 45: Perceptions on priority areas for yellow fever in the future



Source: MTE online survey results Q32

Disaggregating data by region for selected indicators shows somewhat similar responses across regions with respondents from the Americas and Africa alike noting that increasing political will and commitment would be the top priority area for sustaining/achieving yellow fever elimination of all listed priority areas, followed by mobilization of domestic resources. A marked difference between the regions is, however, noted with regards to mobilizing resources from international partners, with this being more pertinent for African respondents than for respondents from the Americas (Table 18).

Table 18: Perceptions on priority areas for sustaining/achieving elimination of yellow fever at country level

Priority areas for sustaining/achieving elimination of YF:	N (%) of respondents*		
	Total	Africa	Americas
Increasing political will and commitment	51(65%)	31(62%)	18(67%)
Mobilization of domestic resources	38(48%)	25(50%)	12(44%)
Mobilization of resources from international partners	19(24%)	16(32%)	3(11%)

*Replying: agree or strongly agree

Source: MTE online survey results Q32

The online survey findings indicate the need to focus more on resource mobilization at the country level. Only 19% of countries from the African Region reportedly has a resource mobilization plan in place versus 31% of countries in the Region of the Americas. However, there was much uncertainty among respondents and several contradictory answers. Even if a resource mobilization plan exists, the vast majority of respondents noted that this was not funded (35%) or only partially funded (57%).¹⁹⁵

¹⁹⁵ MTE Online survey Q33

Countries transitioning out of Gavi support

A recent Gavi report highlighted that African governments have increased their co-financing of Gavi-supported vaccines over the last 10 years – from US\$ 15 million in 2010 to more than US\$ 93 million in 2020.¹⁹⁶ The share paid by African countries doubled from 11% to 22% during the Gavi 4.0 strategic period (2016–2020). By the end of 2020, African governments had invested more than US\$ 700 million in co-financing of Gavi-supported vaccines. According to the same report, only six African countries received an exceptional waiver due to the COVID-19 pandemic in 2020 and all other countries fully met their co-financing obligations.¹⁹⁷ Key informants further relayed that Gavi-eligible countries, of which the vast majority are in Africa, continue to be dependent on Gavi for yellow fever diagnostic testing supplies.

Of the 40 yellow fever high-risk countries targeted by the EYE strategy, 24 are eligible for Gavi support based on the latest available data.¹⁹⁸ Countries become eligible if their average gross national income (GNI) per capita has been below or equal to US\$ 1 660 over the course of three years, in 2023 the threshold will be increased to US\$ 1 730.¹⁹⁹ The countries that fulfil this requirement can apply for Gavi support and will enter phase 1 of the financing scheme. A country moves to phase 2 once its three-year average GNI per capita is above the eligibility threshold, and financial support from Gavi will then reduce.²⁰⁰

As of 2021, 16 of the 24 eligible yellow fever high-risk countries were in phase 1 (initial self-financing), seven were in phase 2 (preparatory transition) and one in phase 3 (accelerated transition). An additional three countries have previously received financial aid from Gavi but had reached phase 4 – fully self-financing (Table 19).

Table 19: Gavi eligibility and transition phases for yellow fever high-risk countries

Country	Gavi support 2000-2019 for YF related activities	GNI 2021 or most recent	Transition phase (2021)	Gavi eligible as of 2022
Angola	None	1770	4 – Fully self-financing	No
Benin	Funding for RI and PMVCs	1370	1 – Initial self-financing	Yes
Burkina Faso	Funding for PMVCs	860	1 – Initial self-financing	Yes
Cameroon	Funding for RI and PMVCs	1590	2 – Preparatory transition	Yes
CAR	Funding for RI and PMVCs	530	1 – Initial self-financing	Yes
Chad	Funding for RI	650	1 – Initial self-financing	Yes
Congo	Funding for RI	1630	2 – Preparatory transition	Yes
Cote d'Ivoire	Funding for PMVCs	2450	2– Preparatory transition	Yes
DRC	Funding for RI	580	1 – Initial self-financing	Yes
Equatorial Guinea		5810		No
Ethiopia	None	960	1 – Initial self-financing	Yes
Gabon		7100		No
Gambia	None	800	1 – Initial self-financing	Yes
Ghana	Funding for RI and PMVCs	2360	2 – Preparatory transition	Yes
Guinea	Funding for RI and PMVCs	1010	1 – Initial self-financing	Yes
Guinea-Bissau	Funding for RI	780	1 – Initial self-financing	Yes

¹⁹⁶ [Gavi impact in Africa since 2000](#). Gavi; 2022.

¹⁹⁷ [Gavi impact in Africa since 2000](#). Gavi; 2022.

¹⁹⁸ [Eligibility](#). Gavi; 2020.

¹⁹⁹ [Eligibility](#). Gavi; 2020.

²⁰⁰ [Gavi Alliance Eligibility and Transition Policy: Version 3.0](#). Gavi; 2018.

Kenya	Funding for RI	2010	2 – Preparatory transition	Yes
Liberia	Funding for RI and PMVCs	620	1 – Initial self-financing	Yes
Mali	Funding for RI and PMVCs	870	1 – Initial self-financing	Yes
Niger	Funding for RI	590	1 – Initial self-financing	Yes
Nigeria	Funding for RI and PMVCs	2100	3 – Accelerated transition	Yes
Senegal	Funding for PMVCs	1540	2 – Preparatory transition	Yes
Sudan	Funding for PMVCs	670	2 – Preparatory transition	Yes
South Sudan	None	1090 (2015)	1 – Initial self-financing	Yes
Sierra Leone	Funding for RI and PMVCs	510	1 – Initial self-financing	Yes
Togo	Funding for RI and PMVCs	980	1 – Initial self-financing	Yes
Uganda	None	840	1 – Initial self-financing	Yes
Argentina		10050		No
Bolivia	None	3360	4 – Fully self-financing	No
Brazil		7720		No
Columbia		6160		No
Ecuador		5930		No
French Guyana		unknown		No
Guyana	None	9380	4 – Fully self-financing	No
Panama		14010		No
Paraguay		5340		No
Peru		6520		No
Suriname		4440		No
Trinidad and Tobago		15070		No
Venezuela		13080 (2014)		No

Sources: [Annual progress report 2021](#). Geneva: Gavi; 2021

GNI per capita, PPP (current international US\$). [World Bank](#); 2022

The eligibility of countries and the extent of financial support countries receive from Gavi have important implications for elimination of yellow fever epidemics. Particularly critical is the accelerated transition plan for Nigeria which coupled with a concurrent transitioning out of GPEI support could pose significant risks to yellow fever surveillance and response. These expected changes in availability of financial resources for EYE countries needs to be taken into consideration when planning for the remaining years of the EYE strategy and beyond.

Prioritization of yellow fever interventions and yellow fever risk perception

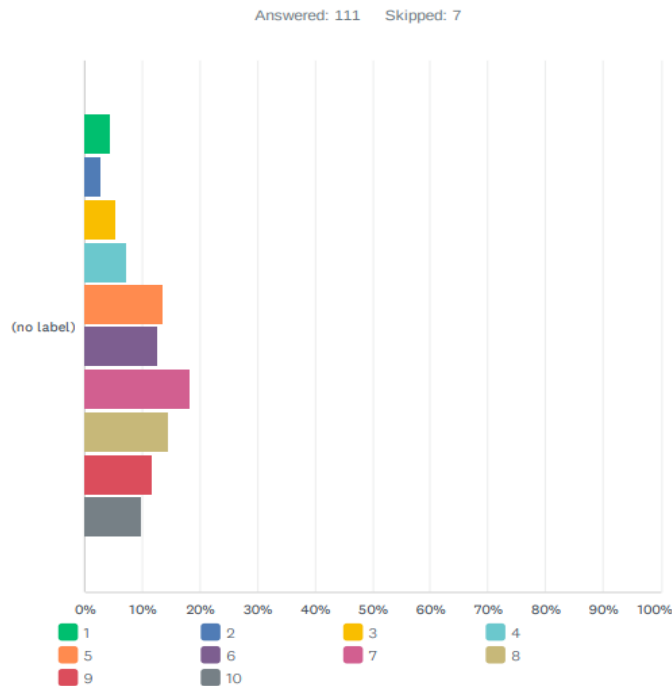
The emergence of various competing priorities such as COVID-19 and other health emergency outbreaks in countries affected by cholera, polio, measles, meningitis, and/or Ebola outbreaks (as mentioned earlier in this section) as well as the limited fiscal space, especially in Africa, have further limited the ability or willingness of countries to invest more in yellow fever. A recurring theme from the key informant interviews was that yellow fever is not perceived as a high priority in many countries – one key informant referred to yellow fever as the “stepdaughter of measles”. Several key informants mentioned that EYE strategy priorities have not been reflected as one of the priority strategies in many of the country health sector strategic plans, which may have limited the political financial commitments.

Key informants also noted that low risk perception related to the occurrence of yellow fever epidemics might be related to low prioritization. The online survey investigated yellow fever outbreak risk perceptions of key stakeholder at the national level and found that, despite the country being classified

as high-risk for yellow fever outbreaks and thus targeted by the EYE strategy, a somehow medium average range risk perception among country-level stakeholders was noted and with a very large spread (Figure 46 below). The average risk score from all respondents was 6.66 (with 1 representing lowest risk for yellow fever outbreaks and 10 the highest). When disaggregating data, the African Region respondents had a slightly higher risk perception of 6.95 versus the average of 5.97 as reported by respondents from the Region of the Americas.²⁰¹ Interestingly, respondents representing national health authorities reported a lower average risk score at 5.96 than other respondents (from United Nations agencies or development partners) at 7.34.

Figure 46: Yellow fever risk perception among country-level stakeholders in yellow fever high-risk countries

Q7 On a scale from 1-10 (1 being the lowest, 10 the highest), how would you rate the risk of yellow fever outbreaks in your country?



	1	2	3	4	5	6	7	8	9	10	TOTAL	WEIGHTED AVERAGE
Percentage	4.50%	2.70%	5.41%	7.21%	13.51%	12.61%	18.02%	14.41%	11.71%	9.91%	111	6.66
Count	5	3	6	8	15	14	20	16	13	11		

Source: MTE online survey Q7

Yellow fever vaccine supply and demand uncertainties

To date there have been few examples of global supply not meeting demand or vice-versa. Since drafting of the EYE strategy, supply capacity of manufacturers has increased significantly – with up to a 75% increase in UNICEF-procured vaccines (as mentioned under Section 5.3.1). One exception where challenges with the speed of supply availability existed were evident was during the yellow fever outbreak in Brazil in 2018, resulting in a dose-sparing strategy (using fractional dosing equivalent to one-fifth of a dose). Another example is a reported case from Ecuador (mentioned under Section 5.3.1), where a national yellow fever vaccine stock out situation prevented vaccination services. The ICG emergency stockpile has been depleted previously during outbreaks,²⁰² but reportedly not since 2016 and as a revolving stockpile of 6 million doses, it is replenished routinely and reportedly faster than before the EYE strategy was in place.

²⁰¹ MTE online survey Q7

²⁰² Chen L & Wilson M. Yellow fever control: current epidemiology and vaccination strategies. *Tropical Disease Travel Medicine and Vaccines*. 2020; 6:1. doi: <https://doi.org/10.1186/s40794-020-0101-0>

Annual forecasts for yellow fever vaccine are produced by UNICEF Supply Division and the DSWG with reportedly increased alignment between partners and various EYE working groups. The forecasts are adjusted based on financing (for example Gavi financing in a country and changing needs on the ground). Vaccine manufacturers generally found the forecasts helpful, however, key informants mentioned that accurate forecasting is particularly challenged by delays in implementation of PMVCs and Gavi funding availability.

However, if the EYE strategy accelerates implementation to meet its targets over the next four years (up to and including 2026), and if outbreaks continue to occur as seen over the last few years, a threat to an adequate and sustainable vaccine supply exists. This threat, if manifested, could affect EYE's ability to fulfil its implementation objectives. This identified risk is partly linked to market dynamics, and the global economic inflation.

There are currently four WHO prequalified vaccine suppliers with agreements with UNICEF Supply Division: Chumakov (Russia), Sanofi Pasteur (France), Bio-Manguinhos (Brazil), and Institut Pasteur (Senegal).²⁰³ The Americas (with exceptions including Venezuela) are supplied through the PAHO Revolving Fund, to which countries contribute, with Bio-Manguinhos of Brazil being the main supplier.

Additionally, yellow fever vaccine production is complex and might not appeal to many potential new manufacturers. The vaccine requires a very long production time and a difficult process using eggs, not to mention regulatory obstacles to the development of new vaccine types.²⁰⁴

The vaccine supply is thus not infinite and could present barriers to implementing some of the activities of the EYE strategy including PMVCs and routine immunization, mainly in high-risk countries in Africa. Demand may potentially outstrip supply globally if certain factors occur, for example: major outbreaks occurring and vaccines having to be allocated to response activities; countries ramping up their PMVC and routine immunization efforts with yellow fever creating spikes in demand (As an example, Uganda recently added yellow fever vaccine into its routine immunization, which will increase demand by millions). These concerns were also noted in a recent publication on demand and supply.²⁰⁵

The evaluation team therefore concludes, and agrees with the 2017 EYE strategy document, that supply will “remain relatively inflexible to increased demand”²⁰⁶ due to the factors mentioned above. That said, scenarios exist that could reduce demand for the vaccine including potential continuing delays in PMVCs and limited country access to funding through Gavi. The latter also presents a sustainability risk. If Gavi funding is not available to countries (for example, those transitioning away from Gavi support and those ineligible for Gavi support), governments may be unable or unwilling to procure the vaccine with their own funds, especially if prices increase. This scenario presents another threat to achieving and sustaining results outlined in the EYE strategy.

It is not clear what specific mitigation efforts and plans are being undertaken by EYE partners to address the potential future uncertainties and risks to the supply of and demand for yellow fever vaccine as described above, beyond ongoing discussions.

²⁰³ UNICEF SD data [unpublished data]. United Nations Children's Fund; n.d.

²⁰⁴ Hansen C & Barrett A. The Present and Future of Yellow Fever Vaccines. *Pharmaceuticals*. 2021; 14(9):891. doi: <https://doi.org/10.3390%2Fph14090891>.

²⁰⁵ Lindsey NP, Horton J, Barrett ADT, Demanou M, Monath TP, Tomori O, et.al. Yellow fever resurgence: An avoidable crisis? *NPJ Vaccines*. 2022 Nov 2;7(1):137. doi: [10.1038/s41541-022-00552-3](https://doi.org/10.1038/s41541-022-00552-3).

²⁰⁶ [Eliminate Yellow fever Epidemics \(EYE\) 2017 – 2026](#). Geneva: EYE Partnership; 2018.

5.4.2 What measures are being taken to ensure sustainability, including future integration with country programmes, and coherence with other programmes, disease areas and vaccination campaigns? (EQ 4.2)

Summary box of key findings - EQ 4.2

- In total, 12 of 14 targeted countries in the African Region have completed the development of their national EYE implementation plans, yet only five plans have been validated by the respective ministries of health and there is a general low visibility of yellow fever national plans among key stakeholders.
- Introduction of yellow fever within routine immunization programmes in yellow fever high-risk countries is crucial to sustainability. Of the 40 yellow fever high-risk countries, 38 countries have introduced yellow fever vaccine into routine immunization. Accelerated efforts will be critical to get remaining targeted countries onboard.
- The chronic suboptimal coverage rates of routine immunization across the majority of yellow fever high-risk countries threaten the gains of conducting large-scale yellow fever vaccination campaigns. Efforts need to be doubled to improve routine immunization programmes in countries with suboptimal performance.
- Good examples exist on integration and synergizing with other diseases programmes, and there is growing interest on integration aspects and IA2030 linkages and synergies. However, yellow fever is still largely viewed as a vertical programme, especially at the global level and there is scope to enhance a broader health system strengthening lens and apply multisectoral approaches, including vector surveillance and control, sentinel surveillance for non-human primates where applicable, strong linkages to international health regulations, and urban preparedness programmes.
- Multi-antigen vaccination campaigns have been carried out across 13 yellow fever high-risk countries, yet most are still to be documented, with lessons shared and possibly scaled up. Catch-up vaccination campaigns are at present not systematically supported, but increasingly important due to the re-emergence of yellow fever outbreaks in areas that previously benefited from large-scale campaigns. Such catch-up activities could potentially benefit from an integrated approach with other antigens.
- A shift in mindset from 'response' to 'prevention and preparedness' as well as ensuring engagement of communities/CSOs in the implementation of the EYE strategy will be important for sustainability.

National plans for yellow fever

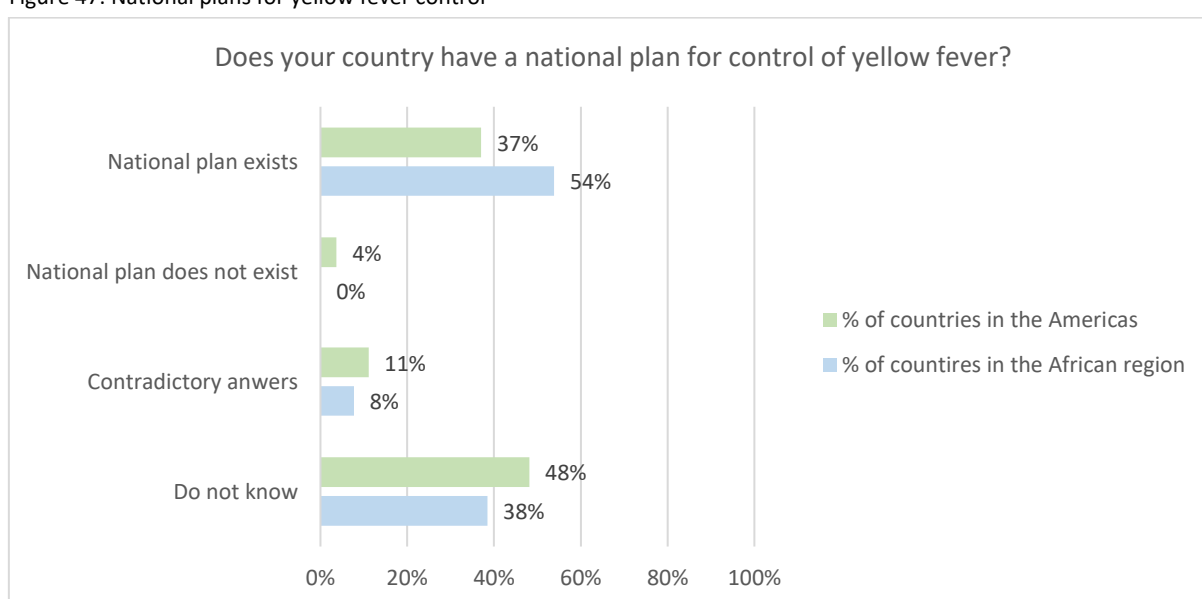
Sustainability aspects are dependent on the level of involvement and participation of countries and country-level stakeholders in the design and implementation of the strategy (as described under sections 5.2.1 and 5.3.1) as well as the level of shared accountability of the strategy progress. But there have been limited opportunities for country-level stakeholders to report on accountability/ progress, challenges, opportunities etc.

In the early strategy days, initial good efforts were made on translating the global EYE strategy into national plans for EYE implementation or integrating yellow fever into other health plans at the national level. Several high-risk countries had developed national plans, but the momentum reportedly was hard to sustain over the years and some of the plans suffered from not being endorsed, funded or implemented and then needing revision, especially in the context of COVID-19 and related delays. The aspiration was that 14 highest-risk countries in the African Region developed national EYE implementation plans and, as of end 2021, 11 countries had completed the development of their EYE implementation plans (Angola, Congo, the Democratic Republic of the Congo, Equatorial Guinea, Ethiopia, Gabon, Ghana, Niger, Nigeria, South Sudan, and Uganda). The EYE plan of Chad had been

delayed by the COVID-19 pandemic but advanced in 2022 with a national plan and complementary PMVC application to Gavi.²⁰⁷ As per May 2022, the completed plans of five countries have been validated by their ministries of health (Angola, Congo, Equatorial Guinea, Ethiopia, and Gabon). Yet, even if plans are validated by the ministries of health, critical delays in implementing the plans were noted in some countries, including in Ethiopia (explored more in the following section). In some countries having a national plan had reportedly supported implementation, whereas other countries had progressed without a plan, or a plan had not facilitated progress significantly. A few countries had successfully integrated yellow fever interventions into other multiyear national plans (EPI programmes, national health strategies etc) which seems important for sustainability. It is unknown to what extent high-risk countries of the Region of the Americas are aiming to develop plans for EYE implementation, and there is no commonly shared EYE target in this regard.

As part of the online survey, individuals were asked to indicate whether a national yellow fever plan exists for their country of residence. Figure 47 below shows the percentage of countries whose respondents answered within the given options.

Figure 47: National plans for yellow fever control



Source: MTE online survey Q8

A large proportion, however, answered that they did not know if a national plan for yellow fever exists, despite the informants being selected/nominated as key informants for yellow fever in their country. This trend was more prevalent in the Region of the Americas (48%) than in the African Region (38%). Special attention should also be given to the percentage of countries in the category “contradictory answers on whether national plan exists”. Here individuals from the same country contradicted one another, one indicating that a plan exists while someone else claimed that no such plan exists. It appears that even when a national plan is in place it is not clearly communicated to all relevant stakeholders, neither in the Region of the Americas nor in the African Region. Furthermore, key informants expressed that accountability for targets and milestones of national plans were not sufficiently addressed through systems or regional accountability structures.

Strengthening of yellow fever within routine immunization programmes for improved sustainability

²⁰⁷ Fifth Eliminate Yellow fever Epidemics (EYE) Strategy Annual Partners’ Meeting [unpublished report]. Geneva: World Health Organization; 2021.

As of August 2022, (also mentioned under Section 5.3.1 (EQ 3.1)) of the 40 (27 in Africa, 13 in the Americas) yellow fever high-risk countries, 38 countries have introduced yellow fever vaccine into routine immunization. There are uncertainties about when Ethiopia and South Sudan will embark on this despite several years of planning towards introducing yellow fever within routine immunization, including in national plans for yellow fever.²⁰⁸ In Ethiopia, the barriers include competing priorities and a perception of low risk for yellow fever outbreaks²⁰⁹ as exemplified in this quote: “There is a feeling that Ethiopia can eliminate yellow fever through responding to small scale outbreaks that can occur infrequently.” Furthermore, funding challenges seems to also represent a barrier for introduction of yellow fever in routine immunization in Ethiopia, since Gavi has co-financing requirements for routine immunization (and not for PMVCs, which may cause a perverse incentive to introduce yellow fever into routine immunization programmes). Key informants further mentioned that there needs to be a stronger push from regional and global levels to the concerned governments for this to be accelerated. Some countries that have integrated yellow fever into routine immunization have started paying for the cost of vaccines. A key informant interview indicated that around 50% of countries are paying for the costs of vaccines, but there is no further evidence available to support this estimate.

The observed chronic suboptimal coverage rates of routine immunization across the majority of yellow fever high-risk countries (as described in Section 5.3.1) threatens the gains of conducting large-scale yellow fever vaccination campaigns. The COVID-19 pandemic caused an even more deteriorating trend on routine immunization coverage rates, but also sparked new initiatives by Gavi and others to bolster routine immunization and reach zero-dose communities. This includes the Gavi Zero-dose Immunization Programme (ZIP). This initiative aims to reach operationally complex contexts in the African Region across eight yellow fever high-risk countries (Burkina Faso, Cameroon, CAR, Chad, Ethiopia, Niger, Nigeria, Sudan), investing more than US\$ 100 million over the next few years to find and serve missed communities with vaccination services, including populations such as cross-border communities and other communities living in fragile and conflict-affected settings.

Integrating and synergizing with other disease programmes to improve sustainability

There is growing interest on integration aspects and multi-antigen vaccination campaigns that have been carried out across several yellow fever high-risk countries. Notable efforts have taken place to improve on integration and synergies, which includes examples such as: a yellow fever surveillance system being built on the measles laboratory network, using vaccine-preventable disease surveillance for yellow fever; applying yellow fever components of flavivirus diagnostic tests originally developed as part of global response to the 2015-2016 Zika epidemic; and other efforts to promote integration and reduce siloed approaches, including a good example from the Democratic Republic of the Congo where yellow fever PMVCs were linked to zero-dose measles case finding and corrective action.²¹⁰ While integrated service delivery approaches have great potential to increase optimal use of resources and thus improve sustainability prospects, they also benefit the communities by covering their needs in one visit.

In 2021, an ad hoc task team was requested by the EYE leadership group to review IA2030 and identify how the EYE strategy interprets itself through the IA2030 seven strategic priorities and the four core principles, and how EYE can strengthen linkages with other vaccine-preventable disease initiatives and programmes. The report²¹¹ identified several opportunities for better alignment with representation

²⁰⁸ EYE country work plan 2018-2020: South Sudan [unpublished report]. World Health Organization; n.d.; EYE country work plan 2018-2020: Ethiopia [unpublished report]. World Health Organization; 2018.

²⁰⁹ MTE online Survey results Q7

²¹⁰ Overview, Progress, Challenges, and Next Steps [PowerPoint]. EYE Partnership; 2021.

²¹¹ Optimizing Immunization Agenda 2030 (IA2030) implementation to support achievement of Global Strategy to Eliminate Yellow fever Epidemics (EYE) objectives. Geneva: World Health Organization; 2021

of EYE, which will be critical to implement, but also warrants more human resource capacity and improved coordination and information flow. The report mentions several existing gaps, including limited formal channels for interaction between the EYE strategy and other programmes, for example, to facilitate the early adoption of evidence-based approaches or to share mutually beneficial programme or country data. EYE engagement with the “IA2030 disease-specific working group” and the “IA2030 research and innovation working group” will create new opportunities to leverage work and innovations from disease-focused programmes (for example, cholera, malaria) and other research groups. Examples include vaccination strategies and approaches to missed opportunities for vaccination, as well as promoting the recording and sharing of data between programmes, for example, data on unvaccinated communities.

Key informants further mentioned that there is a good chance of new vaccines being introduced in the coming years for Dengue and chikungunya, providing another opportunity for integration and coordination at country, regional and global levels.

Recently, efforts have been made to integrate more in WHO AFRO - including changing staff positions from being disease-specific to discipline-specific - for example, from yellow fever technical officer to epidemiologist. But integration has been difficult when funds are earmarked, and donors need to pay attention to this. The shift from earmarked funding towards a more sustainable and flexible financing needs acceleration. Strengthening efforts towards integration will also enhance the efforts towards harmonizing resource mobilization strategies.

Multi-antigen vaccine campaigns have been implemented in several EYE countries since 2017 with Nigeria implementing predominantly multi-antigen campaigns in the period 2021-2022.²¹² In the online survey administered to country-level stakeholders, 12 countries reported that they have used this approach. This included seven countries in the African Region and five countries in the Region of the Americas. The most frequently reported antigen to be delivered combined with yellow fever was measles, followed by polio, COVID-19, meningitis, cholera, rotavirus and hepatitis B²¹³ (Table 20).

Table 20: Multi-antigen vaccination campaigns including yellow fever vaccine

Yellow fever vaccine delivered integrated with other vaccination campaigns						
Countries of implementation	Measles containing vaccine	Meningitis vaccine	Polio vaccine	COVID-19 vaccine	Cholera vaccine	Other vaccines
Colombia	x			x		
Congo	x					
DRC	x	x	x			
Ghana			x	x		
Nigeria	x	x	x	x		
Paraguay	x					
Peru	x	x	x	x		
South Sudan	x	x	x	x	x	
Sudan	x		x		x	
Togo	x	x	x	x		x (Rotavirus and hepatitis B)
Uganda	x		x	x		
Venezuela	x		x			

Source: MTE online survey Q22

(<https://www.who.int/publications/m/item/optimizing-immunization-agenda-2030-implementation-to-support-achievement-of-global-strategy-to-eye-objectives>).

²¹² Overview, Progress, Challenges, and Next Steps [PowerPoint]. EYE Partnership; 2021.

²¹³ MTE online survey Q22.

Challenges to dual or multi-antigen campaigns include the fact that this is new territory. Countries have had extensive dialogue on the feasibility and debate on the most appropriate way forward for multi-antigen vaccination campaigns and the risk that yellow fever is deprioritized.²¹⁴ In addition funding challenges have been described, because conducting multi-antigen campaigns by experience requires extra funds compared to a single antigen approach. Gavi does not cover any additional operational costs for multi-antigen campaigns, which may create a perverse incentive to conduct separate single-antigen campaigns since countries would then be entitled to operational costs for two campaigns.

Few countries have documented the multi-antigen campaign approach and shared learnings with other countries on delivering a dual or multi-antigen vaccination campaign. One exception is Nigeria, where learnings were shared in the annual EYE partners' meeting in 2021. The partners noted in particular: efficiencies gained in relation to collective resources and social mobilization activities; the importance of supportive supervision on the ground for all districts when implementing an integrated campaign; and clear labelling of vaccines and other supplies when cross-vaccination is undertaken.²¹⁵ Experiences from Ghana from delivering an integrated vaccination campaign is provided in Box 4 below.

Box 4: Integration of COVID-19 vaccination with yellow fever reactive vaccination campaigns in Ghana

Integration of COVID-19 vaccination with yellow fever reactive vaccination campaigns in Ghana

In October 2021, a yellow fever outbreak began in the Savannah region extending into several other regions. The Ghana Health Service (GHS) and its partners launched reactive subnational vaccination campaigns in December 2021 and February 2022. Some regional and district-level health teams used the opportunity to offer COVID-19 vaccinations through the roll-out of the yellow fever reactive campaigns, by offering available COVID-19 vaccines to the targeted population.

The initiative of the dual antigen campaign was led by regional and district health authorities of the target subdistricts. The simultaneous administration of two life-saving vaccines was initiated to benefit the population, while also saving on operational costs by using the same personnel and logistics, and by sharing cold chains among other resources.

Experiences from integrating COVID-19 and yellow fever vaccination campaigns in Ghana showed the risk of a lower uptake of the vaccinations if precautionary measures are not implemented. Results of the campaigns showed that the yellow fever vaccination coverage remained high and comparable to other single-antigen reactive campaigns implemented in other subdistricts of Ghana, despite vaccine hesitancy and conspiracies related to the COVID-19 vaccine. The key enablers and lessons learned from delivering the dual antigen campaign included the need for: comprehensive training while ensuring staff motivation and commitment which requires extra funds/renumeration; clear communication strategies; effective community engagement and outreach activities; uninterrupted vaccine supply and separation of vials; and robust monitoring of campaign activities.

Source: Ghana MTE country case study, Final evaluation report Volume IV

Despite integration efforts, yellow fever is still largely viewed as a vertical programme at the global level, missing out on the broader health system strengthening lens and insufficiently applying multisectoral approaches. Key informant interviews and the document review further showed that there is inadequate appliance of multisectoral approaches to addressing the drivers of the yellow fever transition at the country level, including for vector control, urban risks, primary health care, school health programmes, etc. Hence, it is critical to review the degree to which yellow fever indicators and

²¹⁴ Overview, Progress, Challenges, and Next Steps [PowerPoint]. EYE Partnership; 2021.

²¹⁵ Fifth Eliminate Yellow fever Epidemics (EYE) Strategy Annual Partners' Meeting [unpublished report]. Geneva: World Health Organization; 2021.

activities are reflected in existing country plans/strategies for these areas and then to document best practices and challenges, in order to provide evidence and accelerate progress towards integration.

Most informants expressed the view that the focus of investment so far is more on eliminating yellow fever - and mostly on responding to outbreaks - rather than country health systems strengthening that can ensure sustainability. The EYE strategy does not present as an emergency response strategy but is largely a preventive strategy with the main focus and main activities centred on achieving high and sustainable vaccination coverages. Yet, a repetitive theme occurring through interviews is that the mindset is to respond to outbreaks and most attention has been focused on this, which to some extent has been warranted due to the occurrence of multiple outbreaks. Increased efforts need to be placed on: accelerating the planned PMVCs; focusing on urban readiness planning; getting yellow fever into routine immunization programmes; and exploring opportunities for yellow fever to strengthen the performance of routine immunization.

The EYE secretariat is housed in WHO's Health Emergency Programme, this may be warranted, given that the yellow fever programme is an elimination disease programme facing multiple outbreaks and that there is a risk of insufficient attention being given to it if it were to be mainstreamed into other departments. Yet there is a need to optimize collaboration and communications and to increase authority and ownership of certain EYE interventions (particularly routine immunization) within other departments such as IVB in WHO (as mentioned under Section 5.2.2). The evaluation team finds that while the EYE strategy might continue under the Health Emergency Programme during the remainder of the strategy, steps should be taken to start transferring responsibilities more towards vaccine-preventable disease partners and departments.

Engagement of communities for improved sustainability

The need for engaging communities is recognized by EYE partners as expressed in the most recent EYE annual partners meeting: "We will not improve health emergency preparedness and response unless we fundamentally recognize that epidemics begin and end in communities. The community is the front line."²¹⁶ Contrastingly, the online survey results did not identify that engagement with CSOs or other community structures is one of the perceived top priority areas for sustaining or achieving elimination of yellow fever epidemics.²¹⁷

There was only limited evidence available to the evaluation team on the work at community levels. Some key informants have mentioned that efforts in this regard remain fragmented and most likely inadequate. Countries and subnational districts may very well have good experiences around working and engaging communities, but this has not been well documented through EYE monitoring and reporting. The mid-term evaluation identified best practice examples of engagement of communities for yellow fever interventions through the two country case studies conducted in Brazil and Ghana, with an example from Ghana provided below in Box 5.

Box 5: Engaging civil society and communities in yellow fever vaccination campaigns in Ghana

Engaging civil society and communities in yellow fever vaccination campaigns in Ghana

CSOs have played a significant role in promoting yellow fever vaccination campaigns in Ghana by helping with social mobilization efforts at all levels, from the national to the local. Their representatives further served on the national-level committee providing technical support for planning and implementation, while their members, who are well-known in the communities they live and work in, organized residents for vaccination campaigns.

²¹⁶ Fifth Eliminate Yellow fever Epidemics (EYE) Strategy Annual Partners' Meeting [unpublished report]. Geneva: World Health Organization; 2021.

²¹⁷ MTE online survey Q32.

Civil society was an integrated and key player in the initial planning of PMVCs at national, regional, and district levels. PMVCs were planned for through collaborative efforts by multiple key partners, including the Ghana Health Service (GHS), WHO, UNICEF, CDC, the Ghana Coalition for NGOs in Health (a CSO), and other partners such as district assemblies, the Food and Drugs Authority, John Snow Inc. and PATH (an international NGO). A national intersectoral committee chaired by the Director of Public Health of GHS and including CSOs, oversaw every aspect of the campaign, while subcommittees organized the technical aspects, such as planning and coordination, communication and social mobilization, training, vaccine and logistics, and monitoring and evaluation.

To mobilize communities more successfully for campaigns, GHS and its partners made extensive use of the expertise and support of CSOs. CSOs are active at all levels of the healthcare system, in particular the Ghana Coalition for NGOs in Health. WHO and UNICEF have supported GHS to build the capacity of CSOs to promote and create demand for vaccination campaigns.

Community entry was facilitated by community leaders such as chiefs and queen mothers. *Durbars* (ceremonial community meetings) were held to inform community stakeholders about the campaigns. Information about the campaigns was disseminated through channels such as community information centres, churches, mosques, local radio stations and through village criers and gong-gong beaters. Religious leaders allowed vaccination teams to use their premises as vaccination posts. For each locality, context-specific factors were considered before selecting the best community engagement approach. Community members were also utilized to address rumours relating the PMVCs in 2020 to December 2020 elections.

Source: Ghana MTE EYE country case study, Final evaluation report Volume IV

It will be important to have CSOs involved in EYE at all levels, including for coordination efforts and relevant country guidance at global and regional levels, and very critical at the country level for coordination, advocacy and social mobilization. The fact that CSOs are not an integrated part of the EYE partnership at the global level, beyond a few CSOs mainly as representatives of the ICG, is considered a missed opportunity for more substantial collaboration and attention to engaging communities and CSOs. The evaluation team finds that ownership and commitment of the strategic activities by the community, particularly for vector control, community-based surveillance, detection, outbreak response and reporting ensuring strong connections to national public health systems represent a strategic shift at global level and will require tailored investments to ensure yellow fever is controlled and eliminated over the long term.

EQ5: To what extent has the EYE strategy included and addressed gender, equity and human rights concerns to ensure that activities are consistently and meaningfully informed by considerations of overall equity?

The final evaluation question explores through two sub-questions the extent to which gender, equity and human rights aspects have been addressed in the design phase (first sub-evaluation question) and during implementation of the EYE strategy (second sub-evaluation question).

5.5.1 Did the strategy by design consider and incorporate aspects of gender, equity and human rights (GE+HR)? (EQ 5.1)

Summary box of key findings - EQ 5.1

- There is limited explicit GE+HR narrative or sensitivity to such issues in the EYE strategy. The EYE strategy does not explicitly address GE+HR in relation to elimination of yellow fever epidemics; the same is true of the first and subsequent iterations of the M&E framework.
- There is also limited evidence of any relevant GE+HR expertise and analysis being applied in planning or design and no cross-cutting or intersectional GE+HR focus in the EYE strategy.
- The EYE M&E framework is at best nascent in terms of providing relevant guidance for data collection, while there are definite aspirations to track and monitor.

- Such lack of attention stands in sharp contrast to many other concurrent immunization strategies and programmes, as well as many civil society and private sector actions. In 2016-2017 when the EYE strategy was developed there was recognition in the immunization community of the relevance of a GE+HR focus, for example, to support “finding the final fifth”.
- A number of mid-term evaluation key informants consider the EYE strategy text on hard-to-reach and vulnerable groups to stand somehow as a proxy for consideration of GE+HR.

Application of a gender, equity and human rights lens in the EYE strategy and other core EYE documents

The EYE strategy and its M&E framework do not explicitly address GE+HR in relation to elimination of yellow fever epidemics (see also Section 5.1.1). No evidence has been found of expertise being sought or applied during the design of the EYE strategy and any relevant analysis being undertaken to inform its development (a finding based on analysis of literature and key informant interviews).

The EYE strategy action 2 (vaccinate every child) under strategic objective 1 (protect at-risk populations) is entirely without any attention to gender, equity and/or human rights criteria that might inform engagement, community mobilization or uptake. Strategic objective 2 is “Prevent international spread”. Its action 3 is to build resilient urban centres, yet here too there is no consideration of GE+HR. While other arboviruses such as Zika are mentioned²¹⁸ there is no consideration of the significant gender and equity imbalances (such as access to vaccination, let alone well-known links to sexual and reproductive health and rights) already spotlighted by the Zika epidemic profile in cities and other locations in Latin America and the Caribbean around the time of the strategy design.²¹⁹

Part 6 of the strategy addresses EYE governance, yet here too there is no attention to GE+HR. No iteration of the M&E framework has included indicators and/or targets that require disaggregated data for groups at high risk of, or vulnerable to, yellow fever. This is as true for the current version, dated May 2022, as for the first version 1.0.

There is no cross-cutting focus in the EYE strategy or related documents such as the M&E framework in any of its iterations (most recently May 2022), for example, on how life stage, or issues of forced migration or poverty, may intersect with aspects of GE+HR barriers and challenges. Nor is there a focus on whether and how these might have any impact on access to, and uptake of, yellow fever vaccine and control of outbreaks for different groups of people at various ages and in different national or subnational contexts.

The EYE M&E framework is at best nascent in terms of providing relevant guidance for even limited data collection on at-risk populations, while there are said to be definite aspirations to track and monitor these data (Table 21) but with uncertainty on how to improve this. Strategic objective 1, actions 1 and 2 (where risk is high, vaccinate everyone; vaccinate every child) are not specifically addressed in the M&E framework. Yet there is abundant inequity across countries in terms of routine immunization coverage, for instance, with pockets of under-immunized communities as mentioned under Section 5.3.1. Strategic objective 1, action 3 (evaluate risk to prioritize resources) is partially included in the M&E framework (in strategic objective 1.1.4a and 1.4.1b), albeit with no baselines and

²¹⁸ for example, on pp. 18 and 20

²¹⁹ González Vélez A, Diniz S. Inequality, Zika epidemics, and the lack of reproductive rights in Latin America. *Reproductive Health Matters*. 2016; 24 (48): 57-61. doi: [10.1016/j.rhm.2016.11.008](https://doi.org/10.1016/j.rhm.2016.11.008) For a later, trenchant critique, including focus on global health security (increasingly addressed applying a GE+HR lens), see Wenham C, Nunes J, Correa Matta G, de Oliveira Nogueira C, Aparecida Valente P, Pimenta D. Gender mainstreaming as a pathway for sustainable arbovirus control in Latin America. 2020; *PLoS Negl Trop Dis* 14(2): e0007954. doi: <https://doi.org/10.1371/journal.pntd.0007954>.

an unrealistic target for the latter of 100% (presumably by 2026). Strategic objective 2, action 2 is listed, but without baseline evidence.

Table 21: the EYE strategy M&E framework attention to vulnerable/marginalized/at-risk populations

The M&E framework	Current status (as described in the M&E framework of May 2022)
SO 1.4 (outcome - result) Vulnerable and marginalized populations protected through vaccination	Indicator baseline: To be determined (TBD); Target 100% No common definition of 'vulnerable, marginalized populations'; vulnerable and marginalized populations can be different by country and geographical context.
SO 1.4a (outcome - result indicator) Proportion of yellow fever vaccination activities in yellow fever high-risk countries that include vulnerable, marginalized populations	Discussion and agreement on the definition of vulnerable, marginalized populations in the EYE context will be necessary with partners.
SO 1.4.1 (output/deliverable) Vulnerable and marginalized populations protected through vaccination...	Baseline: TBD; Target: 100%
SO1.4.1a (milestone indicator) Inclusion of guidance...[for] mobile, internally displaced and refugee populations in the yellow fever toolkit	No information provided
SO1.4.1b (Output/deliverable indicator) Proportion of GAVI applications or campaign roll-out plans...[including] vulnerable, marginalized populations	Baseline: TBD; Target: 100% Not all yellow fever high-risk will go for GAVI applications (might not be eligible): If no GAVI application is available the campaign roll-out plan will be used
SO 2.1 (outcome/result) Protect at-risk workers...	Indicator baseline: TBD; Target: 100%
SO 2.1a (outcome/result indicator) # confirmed [sylvatic exposure] yellow fever cases...	
2.1.1 (output/deliverable) Protect at-risk workers... protected through vaccination	Indicator baseline: TBD; Target: 100%
2.1.1a (output/deliverable indicator) Proportion of ...major industry employers engaged, reporting...	No baseline yet for number of relevant major industry employers Currently aspirational indicator (as of 2021).

Note to table: SO: Strategic objective

Thus, there is no evidence to indicate that the design of the EYE strategy was informed by any form of GE+HR analysis, or an analysis that addressed all of these aspects. There is also no evidence of attention to intersectional analysis, that is, consideration of how, when and why an individual or a group may experience more than one vulnerability to yellow fever (as just one example of many: a young male forced migrant who engages in informal mining). Therefore, there is no explicit GE+HR narrative or sensitivity to such issues in the EYE strategy, in terms of consideration of targeted, national, and subnational focus on key vulnerable groups experiencing GE+HR barriers to access to immunization services or actual uptake, or the value of disaggregated data.

The lack of attention to GE+HR stands in sharp contrast to many other immunization strategies and programmes current in 2016-2017, the period when the EYE strategy was designed and finalized. It was very much the case in 2016-2017 that there was recognition in the immunization community of the relevance of such focus to support “finding the final fifth”. For example, the vaccine goal of the fourth Gavi strategy for 2016-2020 to “accelerate equitable uptake and coverage of vaccines.” Such approaches were widely applied in strategy and policy design and programme planning and implementation when the EYE strategy was designed.

Such challenges had, and continue to have, relevance to implementation of the EYE strategy specific to yellow fever high-risk countries.²²⁰ Just one example of challenges that were daunting in 2016 and

²²⁰ [Finding the Final Fifth: inequalities in immunisation](#). Save the Children. 2012. This report considered children not fully immunized, using DTP3 as proxy and addressed barriers to uptake. [WHO recommendations for routine immunization - summary tables](#). World Health Organization; 2021.

remain so in 2022 is reducing the numbers of zero-dose children (ZDC). The Gavi website calculates there are 12.5 million zero-dose children globally as of July 2022.

It is noteworthy that neither the EYE strategy nor the first iteration of the M&E framework (nor any subsequent version) addresses **civil society** and the role gatekeepers, traditional leaders and CSOs might play in work towards the elimination of yellow fever epidemics. There are many global immunization initiatives in partnership with civil society that have had to grapple with often adverse GE+HR challenges; a recent example is the roll-out of the human papillomavirus vaccine in the African continent. The same is true with respect to **the private sector** (while it should be noted that there are fewer active partnerships specific to immunization or indeed specifically to yellow fever).

The absence of an explicit, coherent focus on GE+HR in the EYE strategy design might have resulted in opportunities lost for synergies and added value, as well as entry points for close engagement with communities and specific vulnerable groups.²²¹

Evidence suggests that a minority of mid-term evaluation key informants who discussed GE+HR specific to the design of the EYE strategy (itself a small subset of the sample) consider its text (always in aggregate and undefined) on hard-to-reach and vulnerable groups to stand somehow as (implicit and partial) proxy for consideration of GE+HR. This important point will be further expanded in Section 5.5.2.

5.5.2 Has attention been given to gender, equity and human rights considerations during implementation of the strategy? (EQ 5.2)

Summary box of key findings EQ 5.2

- There is acknowledgement by EYE partners that reaching 'vulnerable and marginalized populations' is a major challenge in implementation of the strategy with recent outbreaks located among vulnerable, at-risk and hard-to-reach populations.
- Mid-term evaluation evidence suggests that equity is perceived as being primarily addressed through EYE implementation focus on protection of at-risk populations (strategic objective 1) and strategic objective 2, especially action 2 (protect high-risk workers, defined in the aggregate as those working in the extractive, construction and forestry industries and the transportation sector). No definitions are given for 'vulnerable', 'high risk', or 'marginalized'.
- There is limited attention to GE+HR in the EYE implementation literature, the EYE communication materials, and among key informants, with few exemptions such as some of the developed EYE country toolkits and the subnational risk assessments.
- The EYE strategy governance, programme and technical groups, and management do not appear to require any inclusion of GE+HR expertise.
- The mid-term evaluation online survey results provide (limited) quantitative data and more nuanced consideration of which groups are seen as being the most at-risk groups, as well as

²²¹ The papers listed in this footnote represent a tiny sample of publications on specific groups and yellow fever, written from various perspectives, including civil society involvement and the private sector. While some of the papers post-date the EYE strategy design, they represent ongoing additions to an existing body of literature and debate. Tattevin P, Depatureaux A, Chaplain J, Dupont M, Souala F, Arvieux C, et.al. Yellow fever vaccine is safe and effective in HIV-infected patients. *AIDS*. 2004 Mar 26;18(5):825-7. doi: 10.1097/00002030-200403260-00020; Gayer M et al. Conflict and Emerging Infectious Diseases. *Emerging Infectious Diseases*. 2007; 13 (11). doi: [10.3201/eid1311.061093](https://doi.org/10.3201/eid1311.061093). NB: all authors (then) worked for WHO; Anaf J, Baum F, Fisher M & London L. The health impacts of extractive industry transnational corporations: a study of Rio Tinto in Australia and Southern Africa. *Global Health*. 2019; 15:13. doi: <https://doi.org/10.1186/s12992-019-0453-2>; Desai A, Ramatowski J, Marano N, Madoff L & Lassmann B. Infectious disease outbreaks among forcibly displaced persons: an analysis of ProMED reports 1996–2016. *Confl Health*. 2020; 14:49. doi: <https://doi.org/10.1186/s13031-020-00295-9>; Baum S & Benschad-Tolonen A. Extractive Industries and Gender Equality. *Review of Environmental Economics and Policy*. 2021; 15 (2). doi: <https://doi.org/10.1086/715525>.

briefly indicating potential gender variations and perceptions at country level on related challenges.

- Nonetheless, there is much that is being done by EYE partners especially at the country level that has considerable relevance for a GE+HR focus; these actions and examples of best practices in reaching vulnerable communities provide entry points for course correction. The challenge is to apply expertise to integrate such actions and an explicit GE+HR focus as standard in the implementation of the EYE strategy towards 2026.

Considerations of gender, equity and human rights concerns during EYE implementation

There is acknowledgement by EYE partners that reaching 'vulnerable and marginalized populations' is a major challenge in implementation of the strategy. The recently developed EYE engagement strategy²²² sets out in detail both the innovative steps to be taken to enhance engagement, for example, working more with the private sector, but nowhere is there reference to GE+HR aspects. There is similarly limited discussion of the potential role of civil society in seeking, or indeed achieving, enhanced engagement and, through that, closing the yellow fever immunization gaps. These are oversights that need rectifying - and implementing partner expertise is available.²²³

The 2021 EYE communication strategy update is similarly GE+HR blind - none of its 'key messages' refers to any such issues. The 16 EYE on yellow fever podcasts to date also lack explicit, strategic and implementation-focused discussion of GE+HR; perhaps the most frequent word used to define key populations is "people". Thus, none of the podcasts discuss GE+HR as cross-cutting issues of relevance to achievement of the strategic objectives. This is as true when the topic is, for example, urban resilience, humanitarian emergencies or climate change. Yet, work to address all these from the perspectives of public health and immunization has increasingly integrated focus on GE+HR.²²⁴

The EYE strategy governance, programme and technical groups and management do not appear to require any inclusion of GE+HR expertise. Documentation and key informant interviews indicate that the two EYE governing bodies (the leadership group and the EYE programme management group) do not explicitly require any inclusion of GE+HR expertise. The same seems to be true for the seven 'EYE implementing bodies' and also for the risk analysis working group. Human resource requirements for 2022 (consultancies) do not include any GE+HR expertise.²²⁵

However, there are examples of efforts with considerable relevance for GE+HR focus: individual high-risk country actions (for example, catch-up campaigns targeting vulnerable populations in Darfur, Ghana, and parts of Nigeria); and the work done by the global immunization community and by the RAWG on the development of subnational risk assessments and the EYE secretariat on the EYE country toolkits.

Below aspects of equity, gender and human rights considerations are presented separately.

Equity

Mid-term evaluation evidence suggests that equity is perceived as being primarily addressed through the EYE implementation focus on the protection of "at-risk populations". At-risk populations are discussed in strategic objectives 1 and 2, especially action 2 (protect high-risk workers, defined in the aggregate as those working in the extractive, construction and forestry industries and the transportation sector). The quotes given here are only a small representation of quite widespread views regarding the relative significance of GE+HR for yellow fever.

²²² EYE Partnership Non-Technical Stakeholders Engagement Strategy (2022-2026) [unpublished report]. EYE Partnership; 2022.

²²³ For just two examples of EYE strategy partners' separate focus on issues of equity and gender (but less often explicitly human rights), see WHO (2021). Health Equity Monitor. Compendium of Indicator Definitions. September 2021, e.g. p.35 on 'inequality dimensions', which include aspects of people's lives that are frequently shaped by inequalities and inequities of gender and human rights, such as level of education; [Why Gender Matters: Immunization Agenda 2030](#). Geneva: World Health Organization; 2021.

²²⁴ Just one example linked to humanitarian emergencies: [IASC Gender Handbook for Humanitarian Action](#). Inter-Agency Standing Committee. 2018.

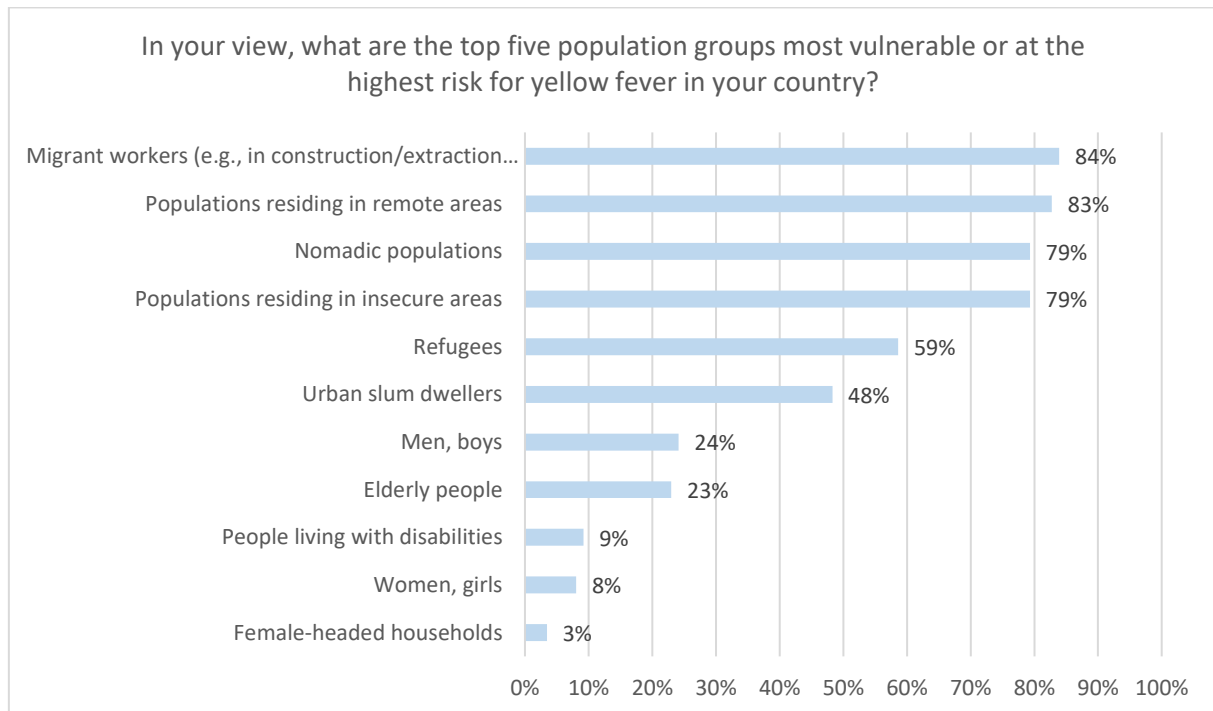
²²⁵ EYE Strategy 2022 Work Plan [PowerPoint]. EYE partnership; 2022.; WHO HQ YF Technical Team/EYE Secretariat Personnel [excel sheet]. World Health Organization; 2022.

“Equity was implicit in the strategy through risk classification etc. Gender and human rights were not focus subjects, but equity in terms of geographical equity was focused on in EYE, including allocating vaccines to, for instance, one large country or several smaller countries etc.”

“Equitable access – [this is] most targeted at young children and communities are familiar with it; when [we] grow it to older ages, people working/not working, etc. [then] equitable access gets more complicated.”

One significant challenge to effective measurement of interventions supported by EYE strategy implementation is that no definitions are given for 'vulnerable', 'high risk', or 'marginalized', all of which may well have different interpretations at regional, individual country and subnational levels. The online survey for this mid-term evaluation provides limited quantitative data (due to sample size) on consideration of which groups are seen as the most vulnerable and at-risk across the 40 high-risk countries (Figure 48 and Table 22 below). Migrant workers, populations residing in remote areas, populations residing in insecure areas, nomadic populations and refugees were considered the top five most vulnerable and at-risk groups.

Figure 48: Populations most vulnerable or at highest risk for yellow fever



Source: MTE online survey Q28

There is more to draw from the responses when disaggregating data by type of respondent (Table 22) while those population groups vary in terms of position, the same top five groups always figure. Of interest is that 'urban slum dwellers' are nowhere placed in the top five categories, despite increasing attention being given to the importance of urban preparedness and resilience in yellow fever intervention planning and response.

In addition, one general finding, based on disaggregated analysis, is that a large number of online survey respondents in all four categories view reaching vulnerable/underserved/hard-to-reach/inaccessible populations as an ongoing and significant challenge. This is true for all types of prevention and response to yellow fever; (see Table 22 – online survey results for Qs 14, 16, 19, 23, 25) where relative weighting of specific answers regarding various aspects of yellow fever activities is set out in terms of online survey respondents' prioritization. It is apparent that consideration of what might be done to improve access to vulnerable populations is a high priority for many survey respondents; this presents a real opportunity for 2023-2026 EYE implementation actions to have an

increased focus on such matters, working especially with regional and national GE+HR and immunization experts.

These concerns pertain despite the acknowledgement, again consistently across the board, that there have been improvements since 2017 specific to reaching vulnerable/otherwise defined populations (Qs 12, 21 and 26). The survey provides indications of EYE strategy partners' work on yellow fever actions specific to high-risk/vulnerable populations. A total of 65 of 107 (61%) respondents agreed or strongly agreed that there had been improvements in yellow fever interventions since 2017 in regard to reaching under-served/vulnerable populations.²²⁶ Of the respondents, 56 of 96 (58%) agreed or strongly agreed that WHO/UNICEF/Gavi had provided adequate support to countries in terms of targeting of high-risk/vulnerable populations.²²⁷ Of course any such improvements are not claimed to be solely due to EYE strategy implementation, but this will undoubtedly have played its significant part. Differences across respondent groups when disaggregating data are shown in Table 22.

Table 22: Disaggregated quantitative data from the online survey relevant to vulnerable populations

MTE ONLINE SURVEY QUESTIONS	Africa (n= 80)	Americas (n= 34)	Respondents from national health entities (n=56)	Respondents from UN agencies, CSOs (n= 60)
Q12 (improvements in YF interventions since 2017 in regard to reaching under-served/vulnerable populations)	65% agree or strongly agree	48% agree or strongly agree	66% agree or strongly agree	55% agree or strongly agree
Q14 (continuing challenge specific to RI for 'inaccessible areas or hard-to-reach populations')	77% agree or strongly agree	73% agree or strongly agree	71% agree or strongly agree	81% agree or strongly agree
Q16 (continuing challenges for YF surveillance in country specific to 'inaccessible areas or hard-to-reach populations')	73 % agree or strongly agree	71% agree or strongly agree	75% agree or strongly agree	71% agree or strongly agree
Q19 (YF outbreak response challenges continue specific to 'inaccessible high-risk areas or hard-to-reach populations')	71% agree or strongly agree	82% agree or strongly agree	69% agree or strongly agree	77% agree or strongly agree
Q21 (Have PMVCs been informed by up-to-date risk assessments to guide target areas/populations?)	Yes: 88%	Yes: 64%	Yes: 69%	Yes: 83%
Q23 (continued PMVC challenge specific to 'inaccessible high-risk areas or hard-to-reach populations')	76% agree or strongly agree	100% agree or strongly agree	77% agree or strongly agree	58% agree or 25% strongly agree
Q25 (re. YF outbreak prevention + preparedness - risk assessment plan/tool)	49% implemented in 17% in development	37% implemented in 7% in development	41% implemented in 18% in development	52% implemented in 10% in development
Q 26 (adequate support since 2017 from WHO, UNICEF, Gavi specific to targeting high-risk/vulnerable populations)	63% agree or strongly agree	45% agree or strongly agree	52% agree or strongly agree	66% agree or strongly agree

²²⁶ MTE online survey Q12.

²²⁷ MTE online survey Q26.

Q28 (top 5 most 'vulnerable/high-risk population' groups in country)	1. Populations in 'insecure areas' (86%) 2. Nomadic populations (81%) 3. Populations in 'remote areas' (79%) 4. Migrant workers (77%) 5. Refugees (65%)	1. Migrant workers (96%) 2. Populations in 'remote areas' (92%) 3. Nomadic populations (76%) 4. Populations in 'insecure areas' (64%) 5. Refugees (44%)	1. Nomadic populations (87%) 2. Migrant workers (79%) 3. Populations in 'insecure areas' (76%) 4. Populations in 'remote areas' (74%) 5. Refugees (68%)	1. Populations in 'remote areas' (91%) 2. Migrant workers (87%) 3. Populations in 'insecure areas' (80%) 4. Nomadic populations (74%) 5. Refugees (48%)
Q29 (any difference in male/female YF vaccination coverage)	56% no 9% yes 18% not tracked 17% don't know	12% no 36% yes 11% not tracked 36% don't know	53% no 16% yes	33% no 17% yes

Source: MTE online survey Qs12, 14, 16, 19, 21, 23, 25, 26, 28, 29

Gender

There is minimal explicit, described attention in the EYE implementation literature, the EYE on yellow fever communication materials and podcasts, the key informant interview notes, the SWOT analysis and the online survey to gender as a barrier to access to information and vaccination services. There is similar silence on how implementation (or indeed, for example, cooperation with CSOs and the private sector) might support work to mitigate such challenges.

It is important to note that evidence across all sources indicates that for EYE strategy implementers, “gender” most often equals women and girls. Yet men and boys will of course also potentially experience gender-specific barriers to access to yellow fever immunization and related health services. A few relevant examples among very many are that young men in particular are frequently influenced by social norms shaping (often poor) health-seeking behaviours; male forced or illegal migrants in insecure environments will often be fearful of travelling to a health centre due to fears of deportation or physical violence (this is of course a fear that is in itself often gender-based, for example many women and girls in such circumstances being primarily worried about sexual violence and/or abduction); male informal miners will all too often face significant challenges in gaining access to any health services.

The following quotes from key informants are representative of wider views on attention to, or lack of prioritization of, gender specific to yellow fever: “In real life vaccination against yellow fever does not have a bias regarding gender” and “Gender is not on the radar to be honest; equity is a much bigger focus area, which can have a gender component.”

A minority of key informants do highlight the importance of a more nuanced approach: “GE+HR: for yellow fever, this needs to be discussed and reinforced with EYE. We need to have more gender disaggregated data, research this more... many diseases affect individuals differently depending on age, gender, pregnancy. We need to explore more when and where the infections happen.”

Online survey results from the mid-term evaluation indicate potential gender variations in vaccination coverage (Table 22). Respondents from the Americas are most definite that there are differences in yellow fever coverage dependent on sex. This impression corresponds with the epidemiological data presented in Section 5.3.1, where yellow fever cases in the Americas predominantly are found among male agricultural workers, whereas yellow fever cases in the African Region are more evenly spread between the sexes (1.2 male-to-female ratio, see Section 5.3.1).

While the majority of core EYE documents are silent on GE+HR, or on the importance of disaggregating data, whether by sex, age, or place of residence, some exceptions include the later developed country

toolkits²²⁸ and sub-national risk assessments. One good example is Toolkit Card 4, “Tailoring campaigns to reach vulnerable and at-risk populations”, which notes the importance of collecting data on vulnerable groups through indicators that address gender, ethnicity, displacement, etc. and which also implicitly includes the definition of 'genders' through an intersectional lens. Toolkits 6, 7 and 8 also refer to the importance of for instance gender variables among vulnerable populations.

Human rights

There is also no explicit, informed attention paid to human rights, or to a human rights-based approach in the EYE implementation literature, the EYE communication materials or the EYE communications strategy, the key informant interview notes, the SWOT analysis or in the results of the online survey. Epidemiological profile work can provide a wealth of data that could stand as a platform for a more detailed, targeted focus on GE+HR, yet this requires that disaggregated data of all M&E indicators where available, (by sex, age, location) is monitored closely, which is currently not the case. Yet the varied response regarding the highest risk groups from online survey respondents in the African Region and in the Region of the Americas as well as the epidemiological trend on new yellow fever cases indicates the need to undertake regular, subnational risk assessments that take proper note of human rights issues.

Examples of GE+HR sensitive approaches under EYE

There is nonetheless much that is being done by EYE partners that has considerable relevance for a focus on GE+HR; these actions provide entry points for course correction. One such activity is the development of subnational risk assessments. The work by the EYE RAWG on development of subnational risk assessments (pilot tested in, for example, Nigeria and Uganda as of May 2022) represents a potential further tilt towards more specific attention to GE+HR issues, although there is a pressing need for explicit inclusion of GE+HR expertise and a scale up of the approach. This is truly necessary in order to fully address granular, localized aspects of ensuring gender and other equitable coverage that takes into account the immunization access of marginalized groups whose human rights may be less prominent in a health care context.

Key informants, the literature and country case studies conducted during this mid-term evaluation also provide information on individual high-risk country actions (see Box 6 and Box 7 below). These represent a focus on GE+HR issues in the context of yellow fever and could provide leverage for future attention, making optimal use of the work already done and the commitment shown by EYE partners, including at the country level. The challenge now is how best to recognize, disseminate, discuss and act more widely upon specific GE+HR lessons learned and good practices emerging from such actions, so as to support any necessary course corrections.

Box 6: Examples of subnational campaigns and other actions with a focus on GE+HR

Examples of subnational campaigns and actions with a focus on GE+HR

There is evidence from the literature of subnational campaigns and national actions that focus on high-risk groups. Here are relevant extracts from 3 sources:

- A yellow fever outbreak that is challenging due to low population immunity, a large unimmunized refugee population, high mobility and porous borders with neighbouring countries having limited vaccination coverage (South Sudan and DRC)...A reactive campaign [is] targeting over 1.6 million people in five Ugandan districts²²⁹
- “Sudan has implemented catch-up yellow fever vaccination campaigns in five states to date, and has engaged in innovative outreach to vaccinate refugees.” (p. 13)²³⁰

²²⁸ EYE County Guide, 15 toolkits to answer key questions on Yellow fever, draft version 2022

²²⁹ Eliminate yellow fever Epidemics: Monthly Update-February 2020 [unpublished report]. World Health Organization; 2020;

²³⁰ Fifth Eliminate Yellow fever Epidemics (EYE) Strategy Annual Partners' Meeting [unpublished report]. Geneva: World Health Organization; 2021

- “[There are] synergistic approaches for greater efficiency and full alignment with IA2030, IA2030: multi-antigen, integrated campaigns – for example, Nigeria, yellow fever and Meningitis A vaccine, 2020; Sudan, yellow fever and polio vaccine, 2021 – refugees also protected. Using yellow fever campaigns as an opportunity to catch-up measles zero-dose children, in DRC 2020”²³¹

Box 7: Best practices from Ghana and Brazil in reaching vulnerable populations

Reaching and studying nomadic populations in Ghana

The 2021 yellow fever outbreak in Ghana was traced to have started in nomadic populations. Nomadic communities are often untraceable by service providers, and porous borders and extensive cross-border movements of these populations exacerbates the risks of international spread. Apart from their migratory lifestyle, nomadic communities tend to settle in remote, forested areas of the country that are largely unknown or underserved by health care providers, making it difficult to include nomadic populations in vaccination campaigns even during periods of settlement.

Through the implementation of targeted reactive campaigns, Ghana managed to contain an outbreak in 2021 with one additional confirmed case reported in 2022. As part of the preparation to the targeted reactive campaigns, districts conducted rapid assessments on barriers to communication and mapped stakeholders and channels. This helped teams to formulate appropriate messages and channels of risk communication. Vaccination sessions in both reactive campaigns took place in health centres and provisional vaccination posts in markets, transportation hubs and stations, schools, churches and municipal and district assemblies. Some teams also travelled to island and riverine communities to ensure target communities received vaccines. The reactive campaigns built on the good experience of engaging communities and CSOs. Sub-district teams organized advocacy and sensitization meetings with traditional, religious leaders and other community leaders (for example, local assembly leaders, school managers, youth leaders and women’s groups). The Savannah Region in addition to these groups also engaged with butchers and nomad herdsmen to reach nomadic populations.

In light of the 2021 outbreak epidemiology, opportunities, gaps and challenges faced during the PMVC and reactive campaigns, UNICEF requested and funded research to establish the movement patterns of nomads in Ghana and, identify and map their locations. This helped to determine their health-seeking behaviours and establish context-appropriate social and behaviours-change approaches. The research found that in the early phases of the reactive vaccination campaign, nomadic communities generally tended to avoid health authorities. However, using community leaders and key respected locals as entry points to nomadic communities and involving their leaders in the campaign and social mobilization, the health authorities won the trust and support of the community. The Ghana Health Services, WHO, UNICEF and other partners relied on local stakeholders such as butchers, proprietors of community pharmacies and chemical stores, as well as cattle owners for mobilizing the nomadic community to yellow fever vaccination services. Leaders of nomadic communities were engaged, and their capacities were built in order to support both the planning and the implementation of the reactive vaccination campaign. Evidence is currently being used to develop a framework to guide vaccination campaigns in Ghana among this special population for yellow fever as well as for other vaccine-preventable diseases.

Source: Ghana MTE country case study, Final evaluation report Volume IV

Reaching vulnerable and at-risk populations in Minas Gerais, Brazil

To implement the massive ramping up of vaccinations in Minas Gerais, over 70 vaccinators and drivers were contracted to support the regional health secretariats. This included targeting work to cover special groups including communities in rural and indigenous regions as well as camps and settlements of landless rural workers (mainly men working in forest regions). This was done by working with the District Indigenous Health Services, state administration departments (fisheries, agriculture, social assistance), cooperatives and big companies to name a few. The overall efforts saw the distribution of 5.4 million doses in 2017 and 1.76 million in 2018.

Source: Brazil MTE country case study, Final evaluation report Volume III

²³¹ Global EYE Strategy Update [PowerPoint]. Cibrelus L; 2021

6. Conclusions

The EYE strategy and its planned actions were designed in a way that was overall appropriate and relevant to needs, and with proper and comprehensive high-level and technical engagement and endorsement, yet there are some identified gaps that need attention as the strategy moves forward.

The design of the EYE strategy was not sufficiently informed by gender, equity and human rights expertise, including targeted approaches to reaching marginalized and vulnerable populations. Other areas to develop include a focus on integrated approaches, concrete linkages to ongoing vector surveillance and control programmes, and increased attention towards approaches to embed and consolidate ownership at the country level. Further revision to the M&E framework is needed to improve data availability/quality, to include milestones on EYE strategic indicators, to set more realistic targets and to create stronger linkages to other relevant M&E indicator frameworks (for example, IA2030, SDGs, Gavi 5.0 etc.).

EYE is built on a strong and comprehensive partnership, with inputs from technical experts, vaccine producers and the involvement of regions and selected countries, yet full involvement and ownership at the country level was less evident. The EYE strategy is managed by a clearly defined governance structure, which functions well at the global level, but with challenges at the regional level, and with limited engagement from the country level. **Yellow fever has historically been a lower priority for countries facing myriad other challenges, more recently including the shock of the COVID-19 pandemic.** The lack of country engagement, influence and accountability within the governance structure can be seen as a limiting factor in ownership, understanding and commitment to the EYE strategic objectives at the country level. Opportunities for improved and streamlined collaborative engagement of countries within the EYE governance structure and joint work planning processes should be elaborated and included as critical elements of the strategy as it moves forward.

The design of the EYE strategy incorporated a significant number of features and mechanisms allowing for course correction and adaptation to changing conditions. In practice, these mechanisms have been useful and facilitated operational changes. However, at a strategic level the EYE design and core documents have not adapted to emerging development with the same level of flexibility.

Adjustments/course corrections undertaken were mainly in response to risk assessments and changing environments associated particularly with COVID-19, and yellow fever outbreaks. New research findings are being monitored but have not yet been reflected in EYE core documents. Reflecting on needed adjustments/flexibilities in core documents of the strategy will be important. This includes systematically applying a gender, equity and human rights lens in all actions, developing tailored approaches for reaching vulnerable populations, and promoting integrated approaches and synergies. Adjustments should also include a re-examination of the prioritization of high-risk countries for the next years, taking into consideration changing environmental and contextual factors, coupled with future funding from Gavi, which may affect the ability of countries to finance yellow fever vaccines.

During the first six years of implementation, concerted efforts to address challenges and yellow fever risks, including low population immunity levels, vaccine availability, diagnostic commodities and processes/capacity, yellow fever lab networks and sample transportation, have been undertaken successfully with important achievements against EYE strategic indicators observed at mid-term. This achievement is notable with regard to the number of people vaccinated for yellow fever, the availability of vaccines and the decreased turnaround time for confirmatory results in Africa. However, challenges have been observed: for example, persistent suboptimal routine immunization coverage in the majority of yellow fever high-risk countries; declining coverage levels through large-scale yellow fever vaccination campaigns; immunity gaps among vulnerable, hard-to-reach and high-risk populations; and increased time from outbreak to response in Africa. The relevance and importance of coordinated and multifaceted surveillance efforts for a rapid response and yellow fever outbreak containment was demonstrated across outbreaks in Brazil between 2017-2018. In Africa, complex diagnostics still limit a rapid response to outbreaks but new diagnostic tools in the pipeline

look promising. Some important activities of the strategy are yet to fully commence (for example: protecting high-risk workers; urban readiness plans; and strengthening IHR for yellow fever) - activities that are critical to avoid international spread and that need attention. Advocacy efforts, EYE annual partners' meetings and numerous communication products, including an impressive podcast series, have given more visibility to yellow fever, yet there is room for broader dissemination of products, and increased activity on social media as well as a perceived need to rejuvenate the commitments to the EYE strategy.

Despite advances with EYE strategy implementation, yellow fever outbreaks continued to affect countries in Africa and the Americas. Twenty-two large yellow fever disruptive outbreaks have been reported in the period 2017 to 2021 across 11 countries (9 in Africa and 2 in the Americas), some of which were in close proximity to urban centres. In total, 4039 confirmed yellow fever cases have been reported across Africa and the Americas from 2016 to 2022, however with a decreasing annual number of yellow fever cases since 2019 in the Americas. **Yellow fever outbreaks are generally observed among high-risk workers, in populations that have not been reached by routine immunization services/large-scale vaccination campaigns, in mobile or hard-to-reach populations, as well as among people living in areas with compromised security.** Almost all recent yellow fever cases from the Americas were found among male agricultural workers, whereas cases in African countries were more equally distributed across men and women, and more cases observed among infants in Africa. This points to the urgent need to establish guidance and funds for catch-up activities to reach high-risk and vulnerable populations (including adults when relevant) in the Americas and Africa through catch-up vaccination activities and improving coverage of routine immunization programmes.

The widespread perception to emerge from the mid-term evaluation is that attention to risk and 'vulnerable populations' addresses equity and overall GE+HR concerns. However, while such focus may be implicit, and even on occasion applied, without any common EYE strategy framework monitoring of disaggregated, contextualized indicators or performance requirements specific to GE+HR (and relevant intersectionality) and without clear efforts and strategies to target vulnerable population, such attention will not be optimal, coherent across all partners nor effectively documented. There is scope to disseminate, discuss and use lessons learned and good practices more effectively for necessary course corrections as well as a need for immunization gap analyses and implementation research of hard-to-reach communities and tailored outreach strategies with community engagement.

Human resource challenges have severely constrained implementation of the EYE strategy. This holds true at all levels from global and regional to the countries themselves. The EYE secretariat has ensured a strong coordination and strategy monitoring role, but has limited capacity in terms of number of staff, and this has caused delays. The engagement of regional staff, as well as all EYE working group members, presents a mixed picture and is also affected by a limited allocation of human resources. This under-resourcing, coupled with challenges related to long recruitment processes, affects both efficiency and effectiveness of implementation. There is compelling evidence to support revisiting human resource requirements for implementation of the strategy and scaling up staff at all levels for the remaining period of the EYE strategy to reach the target of eliminating yellow fever epidemics before 2026.

Furthermore, monitoring and reporting of the progress on strategic M&E indicators to the leadership group is mainly presented as an aggregate and cross-sectoral snapshot of the situation, with limited trend analysis and monitoring of disaggregated data, thus limiting focus on outlier countries, vulnerable populations and the ability to provide informed oversight and strategic course corrections. The investments into developing an impressive EYE M&E dashboard can be further leveraged by making it publicly available to governments at the country level.

Enabling external factors for EYE implementation included a pre-existing robust health system, non-human primate “early warning/surveillance system”, COVID-19 resources/infrastructure and related global attention to threats of health emergencies. Hindering externalities for implementation of the EYE strategy included: competing public health priorities (in particular COVID-19), pre-existing weak and fragile health systems, insecurity and conflicts, climate change, large population sizes and population movements, urbanization, and decreasing international funding for vaccine-preventable disease control in some countries.

EYE partners have complemented each other well and provided substantial coordination and technical assistance to support implementation of the EYE strategy. This appears to be well received by national governments in EYE countries. Yet more substantial complementarity and coordination would be required with organizations, departments and teams working on vaccine-preventable diseases (including IVB in WHO), urban health, health system strengthening, vector surveillance and control, and IHR. This includes improving a sense of ownership and entrusting accountability of various aspects and targets of the strategy to such departments/initiatives/partners. Diversifying the EYE partnership, for instance with the extractive industries (for example, the oil and mining industries) and other sectors (for example, agricultural, construction and forestry) will be important to tap into corporate social responsibility agendas and to access high-risk workers with preventive activities. To strengthen efficient implementation, especially in fragile and conflict-affected settings, efforts should also focus on building working links with civil society organizations and community structures involved in surveillance and vaccination/routine immunization activities or hard-to-reach communities.

Increased focus on alignment, complementarity and opportunities for efficiencies with other interventions, such as IA2030 and the GLAI have been initiated. Synergies are acknowledged and there is active attention to developing such engagement; this will be important to pursue and implement for the years to come. However, the alignment has not yet been evident with respect to GE+HR and there is scope for retrofitting of the EYE strategy to align it even more robustly with other key global initiatives and interventions (for example, SDGs, UHC and Gavi 5.0) considering complementarity, efficiencies and potential economies of scale. **Despite efforts to drive synergies and integration, EYE is largely viewed as a vertical programme at the global level.** At the country level, integrated approaches are being implemented and several good practices exist, yet there has been inadequate attention to sharing lessons learned, for instance on conducting multi-antigen vaccination campaigns. The verticalization at the global level misses out on the broader health system strengthening lens and complete application of multisectoral approaches to address yellow fever. Maximizing synergies between the strengths of a “vertical programme” and those of other programmes (VPDs, UHC, urban health, IHR, sentinel surveillance for non-human primates where applicable, and vector control efforts) will be important areas to explore further and would constitute critical preparations to end the EYE strategy in 2026.

Strengthening routine immunization programmes needs urgent attention and collaborative effort across all EYE partners in order to ensure sustainable results and returns on the heavy investments of PMVCs. The observed chronic suboptimal coverage rates of routine immunization across the majority of yellow fever high-risk countries threaten the gains of conducting large-scale yellow fever vaccination campaigns. The COVID-19 pandemic caused an even more deteriorating trend in routine immunization coverage rates, but also sparked new initiatives by Gavi and others to bolster routine immunization and reach zero-dose communities.

Funding uncertainties and human resource challenges threaten successful implementation of the EYE strategy. The EYE strategy is costed with clearly defined assumptions, however, limited prioritization to track expenditures compromises its ability to demonstrate efficiency and in turn determine the sustainability of its efforts beyond 2026. There is a good effort to mobilize domestic resources in PAHO through the Revolving Fund, including domestic procurement of vaccines. However, in Africa, significant reliance on external support for the yellow fever response remains and threatens sustainability of ongoing efforts. There are indications of limited political will for yellow fever

interventions including commitments towards domestic resource mobilization. Therefore, attention to developing and realizing resource mobilization plans for yellow fever interventions during the remainder of the strategy is critical. In addition, the looming uncertainty of commitments by international development partners, including BMGF and Gavi (including the transition trajectory affecting some of the high-risk countries), places future regional and country yellow fever efforts in a compromised position.

Major risks to successful implementation of the strategy remain and need to be addressed over the next four years. These include: changing vector patterns; substantial human and financial resource gaps; low prioritization of yellow fever interventions versus other competing priorities; insufficient prospects of sustainable financing for yellow fever interventions; and a potential supply constraint of yellow fever vaccines to meet global demand if PMVC and routine immunization coverage increases and/or major outbreaks occur. There is a critical need for EYE leadership to ensure such risks are assessed and that mitigation measures are in place to address these risks.

If expected targets on the number of people vaccinated for yellow fever in Africa are met in 2022, and if earlier recommendations to increase coverage levels of vaccination campaigns, reaching missed communities and maximizing on synergies, are successful, with a strong advocacy push and substantial additional human resource allocation over the next four years, **it should be possible to phase out the EYE strategy by the end of 2026.** This transition however requires detailed preparation and identification of specific programmes/teams/departments/partners/donors that could take over some of the EYE activities, and increased country ownership to ensure sustainability.

7. Recommendations

In total, eight high-level recommendations and related sub-recommendations are proposed based on evaluation findings and conclusions. A suggested prioritized list of specific recommended activities is provided at the end of this section. The first recommendation (human resources) is critical and urgent to address, as all following recommendations rely on advances in addressing this recommendation. In the event this first recommendation is not fully and timely addressed, the evaluation team would recommend a complete revisiting of EYE targets (assessing if “elimination of yellow fever epidemics” would still be feasible at all), reducing EYE scope to focus of fewer countries and/or adjusting timeframes for EYE.

Recommendation 1: Address critical capacity requirements for effective implementation of the EYE strategy by reviewing resources available at all levels (global, regional and country) based on the experience of implementation up to the mid-term and engage in joint (WHO/PAHO, UNICEF, Gavi) resource mobilization efforts.

Sub-recommendations:

- a) **Review human resource requirements and accelerate approval/recruitment processes** of existing planned and funded EYE strategy positions that remain vacant at global secretariat and regional levels. Ensure matching of human resource capacity with strategic and epidemiological needs. (Responsible: global and regional levels with input from country levels)
- b) **Develop joint resource mobilization proposals for human resources to ensure dedicated funding for staff from all partner organizations (WHO/PAHO, UNICEF, Gavi) at all levels** (full time/part time as applicable) and include other funding gaps for programmatic activities for EYE through to 2026. (Responsible: global, regional and country levels).
- c) **Ensure that gender, equity and human rights expertise is made available to the EYE secretariat.** (Responsible: the global level)
- d) **Expand regional implementation support teams in Africa and the Americas with potential support from Gavi senior country managers and other partners (Africa CDC, civil society organizations, etc.) as applicable.** Responsibilities should be linked to complementary yellow fever performance indicators at the regional level in Africa (WHO, UNICEF, CDC), and should be a key accountability mechanism from EYE strategy to country responses and to those responsible for implementation at the country level. This will further foster relations between regional and country levels particularly in high-risk countries. (Responsible: global and regional levels)
- e) **Streamline/integrate yellow fever into other work with related programmes/funding sources (for example, related to vaccine-preventable diseases, health emergencies, PHC, urban health, vector control) at country levels as applicable to the context, while ensuring clear staff performance indicators related to yellow fever for all relevant staff at the country level.** For the three yellow fever “no-regret” countries, fundraising for a part-time position/full time position to accelerate implementation in these countries until the end of the EYE strategy could be considered. (Responsible: regional and country levels)
- f) **Track expenditures of EYE activities and human resources,** and to the extent possible track domestic financing
- g) **Prioritize key interventions for the next two years of EYE implementation** taking into account the current insufficient human resource allocation, while maximizing on synergies and accountability of all partners, resulting in a realistic and appropriate EYE 2023-2024 workplan with appropriate intermediary milestones. (Responsible: the global level)

Rationale for recommendation 1 (key findings)

- Scarce human resources at all levels were identified as the main impediment to successful implementation of the EYE strategy (for example, at present there is a small, not fully equipped, EYE team in the EYE secretariat and the African Region and several EYE working group members are in full-time positions with EYE engagement adding to that workload.)
- Initial costing for human resources (and communication) for EYE strategy implementation appears insufficient and the strategy relied mostly on in-kind support from partner organizations.
- Only WHO has dedicated external funding for human resources for EYE implementation and protracted recruitment processes for funded positions have been observed.
- Massive appreciation should be given to the efforts of a small but very dedicated EYE secretariat, as well as the efforts of EYE programme management and working groups to drive strategy implementation forward, yet there are gaps in expertise related to gender, equity and human rights in the EYE secretariat.
- The EYE team at the regional level in Africa as well as in PAHO have been understaffed/unequipped to carry out their mandate of supporting countries for EYE implementation as the key link/bridge from global to country levels.
- Staff at the country level have difficulties dedicating enough time to yellow fever interventions and there are no dedicated yellow fever intervention staff in any of the country offices in the three “no-regret” countries.
- EYE workplans are developed on an annual basis but with some delays in their approval. This delays the onset of activities at the beginning of each year. EYE workplans are comprehensive and to some extent considered too ambitious given the human resources available to support their implementation.
- Expenditure tracking for EYE strategy implementation (including for human resources) had not been prioritized.

Recommendation 2: Relaunch the EYE strategy for renewed political commitment and increased attention from all stakeholders to YF and Global Health Security by developing strong business cases, organizing high-level events and disseminating advocacy and communication materials more broadly.

Sub-recommendations:

- a) **Develop strong business cases for yellow fever interventions** expressing investments needed and lives saved as an instrument for increased political will and accountability, ideally in collaboration with other vaccine-preventable diseases/vector control programmes etc. (Responsible: global, regional and country levels)
- b) **Engage in global/regional relaunch event(s) of the EYE strategy, building on lessons learned over the first six years of implementation to renew visibility to yellow fever.** Such events would present opportunities for regions and countries to highlight achievements and challenges and to further build and renew political will and investment, including for domestic resource allocation (related to recommendation 9). Furthermore, it could serve as a medium to discuss opportunities for integration across vaccine-preventable diseases and other programmes, including IA2030, Gavi 5.0, GLAI, primary health care, IHR, urban health initiative etc. (related to recommendation 5) and the possible introduction of new EYE partners (recommendation 3) and, in PAHO, to launch the roadmap for EYE implementation. (Responsible: global, regional levels)
- c) **Disseminate developed EYE communication materials (podcasts, videos, EYE website etc.) more broadly and with targeted dissemination in PAHO** (potentially in different languages, addressing different audiences), for example, through social media, partners’ web sites, WHO announcements. Monitor unique visitors/clicks in order to inform future dissemination efforts. (Responsible: the global level)
- d) **At the country level, conduct high-level advocacy efforts using the communication products and developed business cases (mentioned under a) above) to communicate the**

importance/urgency of yellow fever and to build country buy-in and political commitment while ensuring engagement of civil society organizations. Ideally start with highest priority “no-regret” countries (Nigeria, Ethiopia, the Democratic Republic of the Congo) followed by other high-risk countries. (Responsible: the country level supported by the regional level)

- e) **Engage, as an urgent step, Ethiopia and South Sudan to integrate the yellow fever vaccine into routine immunization by conducting high-level multi-partner (WHO/IVB, UNICEF, Gavi) advocacy efforts.** These advocacy efforts to introduce yellow fever into routine immunization in high-risk countries should ideally be led and closely coordinated by IVB (WHO), UNICEF and Gavi, ensuring mutual accountability for this component of the EYE strategy. (Responsible: global, regional and country levels)
- f) **Encourage yellow fever high-risk countries to include EYE strategy activities in their multi-year health sector plan and national immunization plan as well as their emergency preparedness plans/urban resilience plans** (in contrast to developing a stand-alone plan for yellow fever). (Responsible: regional and country levels)
- g) **Explore engagement with municipalities for improved accountability for yellow fever interventions in urban centres/urban readiness plans.** Learn from examples across EYE countries on working with municipalities (for example, Burkina Faso) for urban resilience planning and accountability. This includes: involving municipalities in planning and awareness to get interventions embedded in plans for municipalities; annual meetings with municipality networks; using business cases developed for municipalities (including investments needed to save how many lives in a given municipality if vaccination coverage is x,y,z, if vector control measures are improved etc). (Responsible: the country level supported by the regional level based on framework developed by the global level)

Rationale for recommendation 2 (key findings):

- There is generally low prioritization of yellow fever interventions versus other competing priorities and indications of limited political will for yellow fever interventions - not least of all reflected in limited commitments towards domestic resource mobilization.
- It has proven difficult to sustain momentum for implementation of the EYE strategy over the first six years, especially during COVID-19 and other recent external shocks and there is a perceived need to rejuvenate the commitments to the EYE strategy as expressed by multiple key informants. At the country level, there is a tendency to focus on yellow fever mainly when outbreaks happen; more emphasis on prevention and sustainable strategies is warranted.
- Few countries have a Ministry of Health-endorsed national plan for implementation of the EYE strategy and even if developed and endorsed, the country plans have in most cases not been implemented or are outdated. Business cases for yellow fever interventions have not been developed.
- Substantial EYE advocacy and communication materials have been developed, including through the EYE podcasts series and EYE videos, yet the indications are that their dissemination has not reached their full potential.
- Two yellow fever high-risk countries in the African Region (Ethiopia, South Sudan) have yet to introduce yellow fever into routine immunization, despite many years of planning towards this. Uganda finally introduced yellow fever vaccination into routine immunization during October 2022.
- PMVCs have reportedly been deprioritized due to other competing public health priorities, including COVID-19, and delays in implementation have been noted due to lack of financial resources/funding, as well as a lack of vaccines and challenges with political commitment at the country level.
- There is opportunity and scope for learning (for example, from Ouagadougou) on how to improve accountability from municipalities.

Recommendation 3: Expand and diversify the EYE governance structure (coordination and decision-making bodies) and the EYE partnership for improved ownership, effectiveness and efficiency.

Sub-recommendations:

- a) **Revisit the existing governance structures of the EYE leadership group, the programme management group and the working groups to include representatives of yellow fever high-risk countries as permanent members** of these coordination and decision-making bodies (for example, involving national public health representatives such as EPI managers, other ministry of health staff, labs, supply chain managers, community health, etc.) in the EYE leadership, programme management and working groups. In turn, countries should present progress and barriers at the leadership/programme management/working group meetings and discuss corrective actions. (Responsible: global and regional levels)
- b) **Make better use of the leadership group as a strategic decision-making forum**, moving away from the current model focused on providing the leadership group with status updates to leveraging the leadership group to validate decisions presented by the programme management group, address challenges, and provide strategic direction. (Responsible: the global level)
- c) **Ensure inclusion across relevant working groups of relevant expertise on IHR, urban health, vector surveillance and control and gender, equity and human rights** to ensure emphasis on these critical areas. (Responsible: global and regional levels)
- d) **Explore whether some of the existing EYE working groups would better fit under IA2030 working groups** (related to recommendation 5). (Responsible: the global level)
- e) **Expand the EYE partnership to include additional private sector relevant partners/organizations** in order to capitalize on the corporate social responsibility agenda of companies employing at-risk workers. (Responsible: global, regional and country levels)
- f) **Expand the EYE partnership to further include/engage civil society at all levels**, to drive demand for, and enhance the reach of, yellow fever interventions and to foster ownership and commitment of the strategic objectives/activities by the community. Ensure substantial involvement of CSO partners at all levels that have experience and expertise in engaging in fragile and conflict-affected settings, including those involved in the Gavi Zero-dose Immunization Programme (ZIP) initiative. (Responsible: global, regional and country levels)

Rationale for recommendation 3 (key findings):

- The EYE strategy is managed by a clearly defined governance structure that functions well at the global level but with challenges at the regional and country levels. The EYE governance structure is reported to be centred largely at the global level with limited engagement of countries. Lack of country engagement and influence within the governance structure can be seen as a limiting factor in ownership, understanding, and commitment to the EYE strategic objectives at the country level.
- There is further scope to improve the EYE leadership group as an actual decision-making forum.
- The EYE governance structure, especially the working groups, has in some cases lacked the required expertise on IHR, urban health, vector surveillance and control, and gender, equity and human rights aspects. In addition, selected EYE working groups could, for efficiency purposes, be integrated with existing IA2030 working groups.
- The EYE partnership at the global level has minimally engaged with CSOs – beyond ICG partners, and not yet engaged with extractive industries (for example, the oil and mining industries) and other relevant sectors (for example, construction, agricultural and forestry).
- A significant number of yellow fever priority countries are currently experiencing some degree of conflict and/or fragility. Within such contexts the risk of yellow fever outbreaks is elevated, but EYE activities addressing these challenges have been limited so far. Building working links with CSOs involved in vaccine/routine immunization activities or with hard-

to-reach communities/ or in conflict/humanitarian settings will strengthen efforts to reach the last mile and improve effective use of resources.

Recommendation 4: Scale up the use of subnational risk assessments, conduct immunization gap analyses and implementation research of hard-to-reach communities and develop tailored outreach strategies to improve targeting of underserved, high-risk and vulnerable populations.

Sub-recommendations:

- a) **Support the scale up of subnational risk assessments** across yellow fever high-risk countries tapping into lessons learned from the pilot exercises, and ensure involvement of civil society, and expertise in gender, equity and human rights throughout their development and application. (Responsible: the country level supported by regional and global levels)
- b) **Promote sharing of data and lesson learned between programmes**, for example, sharing data from measles strategic immunization activities and data on immunity gaps, unvaccinated communities and unmapped settlements across initiatives/partners, including Gavi. (Responsible: global, regional and country levels)
- c) **Engage in immunization gap analyses and support implementation research** at the country level building on existing data sets and above-mentioned (under b)) programme/partners data. (Responsible: the country level supported by regional and global levels)
- d) **Develop tailored gender and equity-responsive communication and outreach strategies and implement catch-up vaccination (including for adults) at the country level** based on the gap analyses and implementation research to efficiently target vulnerable, high-risk and missed communities (including adults) in coordination with related existing routine immunization/EPI strategies focusing on both health care providers and targeted communities. (Responsible: the country level supported by regional and global levels)
- e) **In Africa, ensure alignment with and leveraging fully on the Gavi Zero-dose Immunization Programme (ZIP)** to reach underserved and hard-to-reach communities across yellow fever high-risk countries. (Responsible: the country level supported by regional and global levels)
- f) **Increase priority to targeting peri-urban and urban areas for urban preparedness planning and other risk reduction efforts** in areas with history of yellow fever vaccination campaigns due to the potential detrimental effects of an urban outbreak with potential of international spread. (Responsible: country levels with support of global and regional levels)
- g) **Introduce a specific standing agenda/session on gender, equity and human rights aspects at annual EYE partners meetings** to improve sharing of best practices, challenges and opportunities. (Responsible: the global level)

Rationale for recommendation 4 (key findings):

Even in contexts achieving high yellow fever coverage of vaccination efforts through routine immunization and campaigns, ongoing pockets of unimmunized vulnerable and high-risk groups exist. These include forestry, agricultural, mining and migrant workers, people in urban slum areas, and residents of security-compromised communities. Lack of vaccination among these groups leads to accumulated risk of outbreaks and potential international yellow fever spread.

- Twenty-two large yellow fever disruptive outbreaks have been reported in the period 2017-2021 across 11 countries (9 in Africa and 2 in the Americas), some of which were near urban centres.
- Recent yellow fever outbreaks have generally been observed in populations with existing immunity gaps, including in populations that have not been reached by routine immunization services and hard-to-reach and mobile populations, as well as among people living in areas with compromised security and people missed in large-scale vaccination campaigns. Almost all recent yellow fever cases from the Americas were found among male agricultural workers and extractive industry workers, whereas yellow fever cases in African

countries were more equally distributed across men and women and more cases were observed among infants in Africa than in the Americas.

- Subnational risk assessment tools were recently developed by the EYE risk assessment working group and piloted in a few countries, however their full roll-out and scale-up is still pending.
- EYE partners are not optimally sharing data and documenting and sharing good practices on reaching the last mile or working in complex environments.
- The design of the EYE strategy was not sufficiently informed by gender, equity and human rights expertise, including targeted approaches to reaching marginalized and vulnerable populations, despite such expertise existing in EYE partner organizations (for example, IVB with a gender focal point, and Gavi with a strategic focus on zero-dose communities and a specific gender strategy).
- EYE partners acknowledge that reaching 'vulnerable and marginalized populations' is a major challenge in implementation of the strategy. Yet, gender, equity and human rights aspects are not being systematically addressed and included in EYE implementation, and there is a lot to learn from partners across diverse settings. There have been limited efforts, or not well-documented efforts, since EYE inception to develop tailored strategies to reach highest risk and vulnerable populations with information and vaccination services.
- In Ghana, implementation research on nomadic communities and their movement patterns, attitudes and barriers towards yellow fever vaccination and a potential entry point for vaccination campaigns have provided important insights.
- It will be important for EYE to leverage fully on the Gavi ZIP, which aims to reach operationally complex contexts in the African Region across many yellow fever high-risk countries (Burkina Faso, Cameroon, CAR, Chad, Ethiopia, Niger, Nigeria, Sudan), investing more than US\$ 100 million over the next few years to find and serve missed communities with vaccination services. This includes populations such as cross-border communities and other communities living in fragile and conflict-affected settings.

Recommendation 5: Improve integration and synergies for maximum impact by: ensuring EYE representation in IA2030 structures; capitalizing on broader vaccine-preventable disease surveillance and vaccination efforts; and, at the same time, increasing linkages to vector control programmes and mapping other opportunities for multisectoral approaches.

Sub-recommendations:

- a) **Implement identified opportunities from the recent EYE IA2030 task team report**, including EYE representation on the IA2030 monthly Coordination Group/Partnership Council (Director level) and EYE representation on the IA2030 working groups (disease-specific, commitment and demand, life course and integration, coverage and equity, research and innovation, primary health care/universal health coverage, outbreaks and emergencies, and supply security). This requires allocation of enough human resources (related to recommendation 1) yet some existing EYE working groups could potentially be integrated into IA2030 working groups - this needs to be explored further. (Responsible: the global level)
- b) **Ensure that yellow fever is integrated in all relevant IA2030 and Gavi 5.0 implementation efforts and roadmaps**, including catch-up vaccination, IA2030 data strategy efforts, the Gavi ZIP and the digital health information strategy for Gavi 5.0. Consider also co-branding certain initiatives and communications with the IA2030 to highlight integration and partnership progress. (Responsible: the global level)
- c) **Review routine immunization normative guidance, standard operating procedures, health worker trainings, vaccine stocks etc. for strengthening yellow fever in routine immunization programmes in countries with low coverage of routine immunization indicators or coverage gap between measles-containing vaccine and yellow fever vaccine.** Improving yellow fever within routine immunization/EPI requires: robust national

guidelines (inclusive of policies for catch-up vaccination ensuring that children aged under 12 months have opportunities to receive routine yellow fever vaccination); developing health worker awareness and capacity; strong social mobilization and community engagement mechanisms; and identifying and supporting gaps in capacity for routine immunization at the national level. Ideally to be led by IVB (WHO) and in close collaboration with partners. (Responsible: the global level)

- d) **Capitalize on activities and achievements of EYE strategy implementation for strengthening routine immunization.** Use yellow fever life course immunization experience (referring to the experience of conducting campaigns that extend beyond childhood through adolescence, to adults and to the elderly) to inform EPI strategies across WHO and international health partners. Use yellow fever PMVCs and catch-up vaccination as a mechanism to address zero-dose children and adolescents for measles, the human papillomavirus (HPV) and other vaccine-preventable diseases. (Responsible: global, regional and country levels)
- e) **Leverage catch-up vaccination efforts by partners to close yellow fever immunity gaps** (for example, polio and measles campaigns etc, school entry catch-up activities, etc.). These efforts should ideally be led and closely coordinated by IVB (WHO), UNICEF and Gavi, ensuring mutual accountability for this component of the strategy. (Responsible: global, regional and country levels)
- f) **Gather and analyse data and lessons learned from conducting preventive mass vaccination campaigns and multi-antigen campaigns, investigate reasons for declining coverage trends, and develop country guidance/toolkits on multi-antigen campaigns,** while also exploring opportunities for coverage of additional operational costs (from Gavi) when conducting multi-antigen campaigns. (Responsible: the global level)
- g) **Capitalize on broader vaccine-preventable disease surveillance and outbreak responses** (polio, measles, COVID-19 etc.) to close yellow fever immunity gaps. (For example, use measles cases and outbreaks as a tracer to identify immunization programme weaknesses and to guide yellow fever programmatic planning, coordinated surveillance efforts). (Responsible: regional and country levels)
- h) **Tap into experience from the Americas and the Global Arbovirus Initiative, including research on vector surveillance and control and modelling** and provide rolling updates through the EYE programme management group. (Responsible: global and regional levels)
- i) **Ensure strong linkages and synergies to the newly launched Global Arbovirus Initiative by ensuring EYE representation in governance structures of the Global Arbovirus Initiative** and explore opportunities for synergies in implementation (including examining emerging findings from research/studies around vector control, efforts to control spread of *Aedes aegypti* mosquito and removing breeding areas) to better understand the spread of yellow fever vectors in order to enhance targeting of interventions. (Responsible: global and regional levels)
- j) **Investigate opportunities of working across sectors, further integrating yellow fever vaccination campaigns with humanitarian interventions** (for example, food distribution, reception centres for migrants/refugees; school health programmes; vector control efforts, etc.) This could be done through mapping and linking existing in-country interventions supported by UNICEF, Gavi and other United Nations partners (for example, the World Food Programme (WFP), the United Nations High Commissioner for Refugees (UNHCR), the International Organization for Migration (IOM)), CSOs and communities. (Responsible: the country level)
- k) **Consider investment in innovations including electronic immunization registries** (to include COVID-19, measles, yellow fever and other vaccine-preventable diseases) to enhance enforcement of IHR and to build better records for tracking individual and population coverage, **and strengthen implementation of international health regulations at land crossings and seaports.** (Responsible: the global level)

Rationale for recommendation 5 (key findings):

- The leadership group, programme management group and working groups have enabled good coordination of partner efforts, yet there is room for closer coordination and complementarity with organizations, departments and teams working on vaccine-preventable diseases (for example, IVB), urban health, health system strengthening, vector surveillance and control, and IHR, and a need to define coordination mechanisms among them. Yellow fever is still largely viewed as a vertical programme at the global level with insufficient bonds to other relevant programmes despite integration efforts.
- Recently an ad-hoc EYE/IA2030 task team was formed to look at opportunities for improved integration of EYE within IA2030. The report from 2021 summarizes several clear opportunities which need to be prioritized for implementation.
- There is scope to retrofit the EYE strategy to align it even more robustly with other key global initiatives and interventions (for example, SDGs, universal health coverage, GLAI, and Gavi 5.0) considering complementarity, efficiencies and potential economies of scale.
- Limited systems are in place for sharing data between programmes and immunization data quality concerns persists. The IA2030 data strategy and the digital health information strategy for Gavi 5.0 are important platforms where synergies should be identified.
- Critical challenges and gaps related to routine immunization are observed – for example, routine immunization is declining and in most cases are suboptimal coverage levels through routine immunization and immunity gaps among vulnerable, hard-to-reach and high-risk populations. According to WUENIC data, only 5 of the 23 yellow fever high-risk countries in Africa had national routine immunization coverage estimates for the yellow fever vaccine above the target of 80% in 2021 (Burkina Faso, Ghana, Niger, Senegal, Sierra Leone) and Angola, the Central African Republic, Chad, Guinea and Liberia are in the lowest tier of below 50% coverage. In the Americas, only 3 (Columbia, Guyana and Trinidad and Tobago) out of 12 reporting countries reached national coverage estimates of more than 80% in 2021, with Brazil, Peru and Suriname in the lowest tier (all three below 62% coverage). MCV1 coverage is higher than yellow fever coverage in seven yellow fever high-risk countries that have fully introduced yellow fever into routine immunization nationwide. The largest differences are noted in Peru, Brazil and Chad where MCV1 coverage was 17, 15 and 10 percentage points (respectively) higher than for the yellow fever vaccine in 2021.
- Multi-antigen campaigns have been conducted by several high-risk countries, yet with limited global guidance and sharing of lessons learned between countries.
- There have been declining coverage rates of yellow fever PMVCs over the past few years, and there are indications of lower coverage of multi-antigen vaccination campaigns versus single antigen campaigns. These points need to be explored in more depth and the challenges need to be addressed.
- Gavi does not cover additional operational costs for multi-antigen campaigns. This may create a perverse incentive to conduct separate single-antigen campaigns since countries would then be entitled to operational costs for two campaigns.
- Catch-up vaccination for polio, measles and other vaccine-preventable diseases represent an underutilized platform for integrating yellow fever vaccination.
- Outbreak responses are often siloed to specific diseases, however, there are recent examples of integrating outbreak vaccination campaigns including with COVID-19 vaccination, but certain conditions may apply.
- The Americas have great experience with vector surveillance and control, including systems and structures for risk modelling, coordination, research etc. (Brazil is an example of this.)
- GLAI implementation is in its inception phase and will soon start its implementation phase, EYE has had connections to GLAI throughout, but the areas of synergies are not clearly spelled out.
- Persistent risk of urban outbreaks with considerable risk of international spread is a continuous threat. Critical related activities of the strategy are yet to fully commence (for example, urban readiness planning, strengthening IHR for yellow fever, and protecting high-

risk workers by engaging industries). Brazil has an electronic system for COVID-19 vaccine, which in the future will be expanded to include all vaccination records.

- Gaps noted on implementation of IHR at land-crossings and seaports, useful experience could be gained from the screenings done at informal, land border crossing during the West Africa Ebola outbreak in 2014-2016.
- There have been limited efforts so far on EYE implementation in terms of working across sections (beyond the health sector), but opportunities exist that could be particularly relevant in humanitarian/conflict situations.

Recommendation 6: Continue efforts to ensure robust supply chains, including clear mitigation plans to address risk of inadequate vaccine supply, and improve attention to surveillance and coordination for improved detection and faster response to outbreaks.

Sub-recommendations:

- Develop mitigation plans for a continued steady supply of yellow fever vaccines through 2026 and beyond.** (Responsible: global and regional levels). This should include considerations of:
 - total potential (and likely) global production and demand under various assumptions and scenarios including considerations of the potential for greater demand through accelerated roll-out of PMVC, routine immunization scale-up and outbreak responses;
 - possible increased vaccine costs;
 - efforts to shape the market for vaccine supplies;
 - the extent of wastage rates for yellow fever vaccines and implementing methods to reduce wastage rates for vaccines to stretch supply, (vial presentations, health worker SOPs).
- Focus on continued barriers to rapid detection and response,** including transportation of samples from local level to national reference labs in countries experiencing delays, and reducing time to confirmed diagnosis by accelerating the approval and roll-out of novel yellow fever diagnostics tools. (Responsible: global, regional, and country levels)
- Enhance integration efforts for supply chain improvements by building synergies with other programmes/strategies** (for example, measles, polio, EPI) and experience with COVID-19 response, in order to push the agenda on shared cold chains, supply chain infrastructure and staff, and diagnostic capacity in regions and countries. Update analysis of PCR platforms across the high-risk countries in Africa including assessing the availability of closed versus open PCR systems for HIV/COVID-19 and others that could be used for yellow fever diagnosis and considering synergies with other country programmes using PCR technologies and resources. (Responsible: global, regional, and country levels)
- Scale up community-based surveillance and coordinated multifaceted surveillance systems** (human, epizootic, and entomological surveillance) where applicable for a rapid response and prompt outbreak containment. (Responsible: global, regional, and country levels)
- Assure good complementary actions and coordination between the EYE secretariat, regional offices, outbreak countries and outbreak response mechanisms of the International Coordinating Group (on vaccine provision)** (for example, by supporting countries in their development of ICG requests and consider revisiting/simplifying ICG request forms. (Responsible: global, regional and country levels)

Rationale for recommendation 6 (key findings):

- Through EYE implementation the supply of vaccines, as procured by UNICEF, increased by approximately 75% with fewer reported country-level stockouts. However, at the subnational level there are indications of yellow fever vaccine supply shortages - or fear of shortages – reportedly hindering some yellow fever interventions.

- Potentially increased global demand if coverage of PMVCs and routine immunization increases and/or major outbreaks occur.
- Generally high wastage rates for lyophilized vaccines (which do not contain preservatives and need to be thrown away soon after opening according to the multi-dose open vial policy of WHO), with examples found also for yellow fever. It will be important to examine wastage rates more closely and use methods to reduce wastage rates for vaccines in order to stretch supply.
- Major progress is noted in the African Region on the time from onset of disease/suspected case to confirmatory results - the weakest link is transportation of samples from local levels to national reference labs.
- Complex diagnostic processes still cause delays in rapid detection and response, especially in Africa. Novel yellow fever diagnostics currently under development/evaluation are described as potential game changers for early detection and response.
- Underutilized opportunities for building synergies with other programmes for shared cold chains, infrastructure (including PCR platforms) and optimizing on laboratory staff synergies/integration.
- Continued barriers to yellow fever surveillance comprised: funding challenges, commodity supply constraints, human resource capacity, inaccessible/hard-to-reach communities and limited community engagement.
- Countries of the Americas (for example, Brazil) have invested extensively in sophisticated yellow fever surveillance systems including human, epizootic, and entomological surveillance of yellow fever. The relevance and importance of coordinated and multifaceted surveillance efforts for a rapid response and yellow fever outbreak containment was demonstrated across outbreaks in Brazil in 2017-2018.
- Response delays during outbreaks in 2021 and 2022 in Africa were mainly attributed to the time between a notified case and the ICG request. Several revisions of the ICG request forms were needed before requests could be approved due to low quality and missing data. Countries have reported that ICG requests require detailed data/information, which are often not easily available due to data gaps and limitations.

Recommendation 7: Revise the EYE M&E framework and its monitoring approach before mid-2023 and address new research findings to guide and adapt implementation.

Sub-recommendations:

- a) **Revise the M&E framework ideally before mid-2023** to include relevant, appropriately disaggregated targets, milestones and indicators with adjusted targets based on mid-term progress, and annual milestones. Refer to IA2030 indicators and the SDGs/universal health coverage within the framework and ensure involvement of gender, equity and human rights expertise in this exercise. Consider adding and tracking an indicator of vector surveillance and control as part of the strategic EYE indicators. (Responsible: the global level)
- b) **Finalize the suggested theory of change for EYE within the EYE partnership** (proposed theory of change is available in Volume II – Annex 3) and align with the M&E framework (Responsible: the global level)
- c) **Ensure data from the Americas is monitored through the selected EYE strategic indicators in the EYE dashboard** by endorsing the roadmap for EYE implementation in the Region of the Americas and structuring the coordination between EYE M&E team and the PAHO data management team. (Responsible: global and regional levels)
- d) **Present M&E trend data systematically to EYE governance structures**, including the leadership group, and with country disaggregation to gauge implementation progress over time and outlier countries for improved adjustments and course corrections. (Responsible: the global level)

- e) **Refine the M&E EYE dashboard to show progress against strategic EYE indicators in the existing prototype country dashboards and ensure public access.** (Responsible: the global level)
- f) **Ensure that M&E data drives action** (for example, country ministries of health could be asked to validate annually the country dashboard). (Responsible: Global, regional and country levels)
- g) **Finalize and disseminate the EYE learning strategy.** (Responsible: the global level)
- h) **Monitor technical/scientific research findings closely and continuously consider any technical amendments/adaptations to the EYE strategy design, interventions and targets.** For example: research related to people living with HIV and other immunocompromised people; optimal coverage rates; potential waning immunity post-vaccination in infants/children and the potential need for booster vaccinations; efficacy of fractional dosing; and the development and assessment of new rapid diagnostic tests. (Responsible: the global level)

Rationale for recommendation 7 (key findings):

- The current EYE M&E framework has data gaps, several baseline values are missing, and data quality concerns persist. Milestones on strategic indicators are generally lacking, there is limited monitoring of disaggregated data (by gender, age, location etc.), and several aspirational/unrealistic targets for many strategic indicators. There is further scope for stronger linkages to other relevant M&E indicator frameworks (for example, IA2030, Gavi 5.0 and SDGs).
- The EYE M&E dashboard presents with great data visualization elements yet with missed opportunities for country involvement, ownership and accountability. Simple “country dashboards” exist, but these are not continuously presenting all 16 EYE strategic indicators. The EYE M&E dashboard is not publicly available, thereby restricting usability by country stakeholders.
- M&E data is presented regularly to EYE governing bodies, yet mainly in aggregate and cross-sectional snapshots to the leadership group. This hampers the possibility of gauging outlier countries and assessing trends to properly adjust and correct course.
- The roadmap to implement the EYE strategy in the Americas (and related M&E indicators) is yet to be endorsed and the 16 EYE strategic indicators monitored through EYE and presented to governance structures often lack data from the Americas.
- Documenting best practices and lessons learned has not been prioritized sufficiently during the first six years of EYE implementation. The EYE secretariat is working on a learning strategy that will hopefully address this concern.
- New research findings related to the recommended level of vaccine coverage, possible waning immunity and adverse events/contraindications, as well as research on efficacy of fractional dosing, will need close monitoring and possible adjustments to EYE approaches and targets.

Recommendation 8: Develop a three-year “EYE transition and sustainability framework” for the period 2024-2026 to prepare for the end of the EYE strategy by 2026

If expected targets on the number of people vaccinated for yellow fever in Africa are met in 2022, and if earlier recommendations to increase coverage levels of vaccination campaigns, reaching missed communities and maximizing on synergies, are successful, with a strong advocacy push and substantial human resource allocation over the next four years, it should be possible to phase out the EYE strategy by the end of 2026. This transition however requires detailed preparation and identification of specific programmes/teams/departments/partners/donors that could take over some of the EYE activities, and increased country ownership to ensure sustainability.

To effectively plan for this transition, it is recommended that a three-year “EYE transition and sustainability framework” be developed for the period 2024-2026. The framework should:

- a) **Include a resource mobilization plan for yellow fever interventions through 2026** (linked to recommendation 1 on joint resource mobilization) building on the already developed EYE engagement strategy. (Responsible: the global level)
- b) **Embed relevant yellow fever activities (for example, surveillance, vaccination campaigns, trainings, routine immunization) within IA2030** (NB: this integration to be initiated as soon as possible - detailed under recommendation 5). Prepare to move away from a standalone vertical disease control approach to one that is more integrated within the broader IA2030 and UHC/PHC where applicable, while still allowing the disease-specific nature of yellow fever to be addressed. This could build on learnings from the IA2030 measles and rubella partnership to be rolled out early 2023 and include implementing report recommendations of the EYE/IA2030 report and conducting a mapping of linkages and synergies with Gavi 5.0/zero-dose communities' agenda/ZIP. (Responsible: the global level)
- c) **Prepare for integration of additional EYE activities into other initiatives:** for example, the work of the IHR secretariat, the WHO urban health initiative, and specific linkages to GLAI - spelling out specifically how EYE will capitalize on these initiatives/platforms from present to 2026 and eventually transition by 2027. (Responsible: the global level)
- d) **Assess the possible need and resource implications for an EYE “lite” strategy beyond 2026 (or dedicated yellow fever prevention and control activities).** Certain EYE activities (for example, emergency outbreak response activities, work with industries/private sector, yellow fever risk modelling etc.) would potentially need a continued “vertical” focus beyond 2026 with a limited timespan EYE “lite” strategy. (Responsible: the global level)
- e) **Sharpen country planning and forecasting to address the increasing number of yellow fever high-risk countries that will transition out of Gavi support over time,** including specifying strategies for domestic resource mobilization and co-financing activities. This would require increased engagement with countries to guarantee sufficient resources and sustained investment for “all” vaccines (including yellow fever). Yellow fever should be part of the narrative at all levels on country political commitment to immunization (related to recommendation 2). (Responsible: global, regional and country levels)
- f) **Develop strategies to consolidate ownership of yellow fever interventions at the country level** (linked to recommendation 2- business cases and advocacy events and recommendation 3 on enhancing ownership in EYE governance structures of national governments). (Responsible: global, regional and country levels)
- g) **Consider incentives to accelerate the completion of planned preventive mass vaccination campaigns before 2026,** for instance by issuing co-financing requirements for PMVCs undertaken after 2026. (Responsible: the global level)
- h) **Revisit the list of the 40 yellow fever high-risk countries** based on risk assessments and definition of “moderate risk” countries. Consider adapting the risk assessment tool (and subnational risk assessment tool) to allow for its use in countries with limited data and consider potential for adjustment or reprioritization of EYE-targeted countries based on results and risk modelling to 2026. Consider identifying the highest priority “no-regret” country(ies) of the Americas. (Responsible: the global level)

Rationale for recommendation 8 (key findings):

- Significant reliance on external support for the yellow fever response (especially in Africa) remains and threatens sustainability of ongoing efforts, yet the current EYE engagement (funding and advocacy strategy) does not spell out a mechanism for sustaining gains through domestic financing and exiting from external finance over the long term.
- Several yellow fever high-risk countries are planning to transition out of Gavi support in the near future, this needs careful attention as it may threaten the gains achieved if not sustainably planned for in due time.
- Primary health care and system strengthening is the basis for IA2030; but this emphasis is not as clear in the EYE strategy. Furthermore, the EYE strategy and priorities are not yet represented in all comprehensive planning initiatives at global, regional, and national levels including IA2030, alignment with Gavi 5.0 and focus on missed communities. EYE

implementation linkages to the WHO urban health initiative, the IHR secretariat and GLAI also need more exploration and specific activity descriptions.

- PMVCs have been postponed in many high-risk countries due to competing priorities and at present Gavi has co-financing requirements only for routine immunization and not for PMVCs. This may present a disincentive for adding yellow fever vaccines into routine immunization for the few countries that have not yet introduced them into routine immunization.
- Countries currently categorized as “moderate” or “low risk” for yellow fever have not recently been assessed for yellow fever risk levels, despite an increase in the yellow fever vector distribution worldwide and climate change, which will further advance its spread.

Suggested prioritization of specific recommended activities:

Based on the evaluation findings and conclusions, the evaluation team below provides the suggested prioritization of recommendations. It will however be necessary that EYE governance structures, additional senior managers of partner organizations and affected country stakeholders are involved in the final prioritization exercise.

1. **Review EYE human resource plan/needs and start joint fundraising activities** (detailed in recommendation 1)
2. **Develop a realistic EYE workplan (2023-2024) given the expected human resources** (related to recommendation 1)
3. **Expand and diversify the EYE governance structure and the EYE partnership** (detailed in recommendation 3)
4. **Organize advocacy events, develop business cases and disseminate EYE communication products** (detailed in recommendation 2)
5. **Endorse the draft roadmap to implement the EYE strategy in the Americas**, ensure alignment to the global strategy, including indicators of the EYE M&E framework. (detailed in recommendation 7)
6. **Revise the EYE M&E framework and its monitoring approach** (detailed in recommendation 7)
7. **Develop a risk mitigation strategy** for a reliable and sustained vaccine supply (detailed in recommendation 6)
8. **Accelerate yellow fever vaccination introduction in routine immunization schemes** in the remaining few high-risk countries and **strengthen yellow fever vaccination implementation through routine immunization** through **embedding EYE in IA2030 activities and platforms** (detailed in recommendation 5)
9. **Investigate reasons for declining coverage levels** of yellow fever PMVCs and multi-antigen campaigns in applicable countries. (detailed in recommendation 5)
10. **Conduct immunity gap analysis and implementation research of hard-to-reach communities and develop tailored strategies to reach underserved communities** in high-risk countries, starting with “no-regret” countries (the Democratic Republic of the Cong, Ethiopia, Nigeria). (detailed in recommendation 5)
11. **Accelerate implementation of planned PMVCs and catch-up campaigns** to build population immunity in high-risk areas based on gap analyses if possible, with specific attention to high-risk subnational areas as well as peri and urban areas (detailed in recommendation 4) reinforced by high-level advocacy activities (detailed in recommendation 2) and consider a possible requirement of government co-financing of PMCVs beyond 2026 to incentivize immediate implementation of campaigns (detailed in recommendation 8)
12. **Implement planned activities of engaging major industries/targeting at-risk workers** and developing urban readiness plans along with capacity-building for international health regulation focal points in all high-risk countries, starting with “no-regret” countries (as detailed in recommendations 2 and 3)

13. **Support improvements of yellow fever surveillance activities and roll out new yellow fever diagnostic tools** when evaluation reports are deemed acceptable and address local sample transportation gaps (detailed in recommendation 6)
14. **Revisit the list of the 40 high-risk countries** based on risk assessments and definition of “moderate risk” countries (detailed in recommendation 8)
15. **Plan for EYE activities under existing vector control programmes and map other opportunities for multisectoral approaches** (related to recommendation 5)
16. **Finalize and disseminate the draft EYE learning strategy** to document best practices, gaps, key enablers, potential for scaling up and transferability (detailed in recommendation 7)
17. **Develop a three-year “EYE transition and sustainability framework” for the period 2024-2026** (detailed in recommendation 8)

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