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Prioritization of future new vaccines introduction: The experience of the Ethiopian National Immunization Technical Advisory Group

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ABSTRACT

Background: As Ethiopia faces growing demands to introduce new vaccines amid constrained resources and declining donor support, evidence-based prioritization is essential. This paper describes the experience of Ethiopian National Immunization Technical Advisory Group's (ENITAG) in using a structured, multi-criteria decision analysis (MCDA) approach—the New Vaccine Introduction Prioritization and Sequencing Tool (NVI-PST)—to guide new vaccine introduction and sequencing for the 2026–2030 period.

Methods: ENITAG, in collaboration with the Federal Ministry of Health (FMoH) and partners, adapted the NVI-PST to Ethiopia's context. Six candidate vaccines were shortlisted—hexavalent, rubella (MR), multivalent meningococcal conjugate (MMCV), typhoid (TCV), cholera (OCV), and respiratory syncytial virus (RSV) vaccines. Thirteen criteria across importance and feasibility domains were selected and weighted. Data were gathered by thematic working groups and used to score and rank each vaccine through a participatory process involving ENITAG members and stakeholders.

Results: The hexavalent and rubella vaccines were prioritized the highest for early introduction due to their combined public health importance and programmatic feasibility. RSV and MMCV were ranked as medium priorities, while TCV and OCV were deemed lower priorities for routine immunization. The recommendations considered existing programmatic constraints, such as upcoming introductions (e.g., malaria, yellow fever, hepatitis B birth dose) and supplementary campaigns. ENITAG also emphasized strengthening its secretariat, improving data systems, and integrating community perspectives in future prioritization efforts.

Conclusion: This exercise marks a pivotal shift in Ethiopia's immunization decision-making—from reactive, one-off vaccine assessments to a strategic, systematic approach aligned with national priorities and health system capacity. Despite challenges related to data quality and resource limitations, the process offers a replicable model for other low-income countries seeking to optimize immunization investments in a transparent, evidence-informed manner.

1. Introduction

Vaccine-preventable diseases (VPDs) remain significant contributors to child morbidity and mortality in low- and middle-income countries (LMICs) [1]. Over the past two decades, childhood immunization programs have expanded substantially, now offering protection against

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more than 30 life-threatening diseases [2]. Notably, vaccination efforts targeting ten pathogens–including hepatitis B virus (HepB), *Haemophilus influenzae* type B (HiB), human papillomavirus (HPV), Japanese encephalitis, measles, *Neisseria meningitidis* serogroup A, *Streptococcus pneumoniae*, rotavirus, rubella, and yellow fever–are estimated to have averted 69 million deaths between 2000 and 2030 [1].

In Ethiopia, a low-income country with Africa's second-largest population, the Expanded Program on Immunization (EPI) was launched in 1980, initially providing six antigens against common childhood diseases: diphtheria, pertussis, tetanus, tuberculosis, poliomyelitis, and measles [3,4]. Over the past decade, the program has incorporated additional vaccines, including those for HiB, HepB, pneumococcal conjugate vaccine (PCV), rotavirus (RV), and HPV [4]. As of 2021, Ethiopia's EPI offers a total of 13 antigens, encompassing newer additions like the COVID-19 vaccine [4].

Recognizing the pivotal role of immunization in enhancing global health, the World Health Assembly (WHA) has consistently advocated for the integration of new and underutilized vaccines into national immunization programs. This strategy aims to address both persistent and emerging public health threats [5]. Moreover, countries often navigate a complex landscape of advocacy efforts from diverse stakeholders influencing their national immunization programs (NIPs). Pharmaceutical manufacturers may engage in lobbying to promote the adoption of their vaccines, providing scientific information and highlighting the benefits of their products. International partners and global health organizations advocate for the inclusion of specific vaccines to align with regional or global health agendas, aiming to address pressing public health concerns. Simultaneously, civil society organizations and media outlets play a pivotal role in shaping public opinion and policy decisions. This multifaceted advocacy environment requires policymakers to balance scientific evidence, public sentiment, and ethical considerations when formulating immunization strategies [6].

Despite Ethiopia's substantial disease burden, the country's healthcare resources remain limited. As of 2019/2020, the per capita total health expenditure was approximately US$35, reflecting constrained fiscal capacity to meet the population's health needs [7,8]. This limited domestic investment has led to a significant reliance on external funding sources, which account for 34 % of Ethiopia's total health financing, while government contribution is only 31 % [8]. In the realm of immunization, this dependency is even more pronounced. More than 60 % of immunization expenditures were financed by development partners, predominantly through Gavi, the Vaccine Alliance. Over the past four years, Ethiopia has received more than US$500 million in Gavi funding to support its EPI, encompassing routine immunization services, vaccine procurement, and health system strengthening initiatives [9].

As major donors such as the United States, the United Kingdom, and the European Union implement significant reductions in foreign aid, countries like Ethiopia are confronting severe challenges in financing essential health services. The abrupt withdrawal of support from key international partners has disrupted critical health care programs, jeopardizing the well-being of millions [10,11]. The situation underscores the urgent need for diversified and sustainable health care financing in Ethiopia. While the country has made strides in developing health infrastructure and services, challenges persist due to low health care funding and high out-of-pocket expenses for citizens [8]. The current crisis highlights the vulnerability of health systems heavily reliant on foreign aid and the necessity for resilient, locally supported healthcare solutions.

In the context of limited health care resources, it is imperative to adopt evidence-based decision-making to ensure that available resources are utilized effectively, maximizing overall health outcomes and prioritizing the needs of the most vulnerable populations. Evidence-based decision-making involves the systematic use of data and research findings to inform policies and practices.

With the rapid development and availability of new vaccines, countries are confronted with increasingly complex decisions in shaping their immunization programs. For Gavi-supported nations like Ethiopia, this complexity is particularly pronounced. As Ethiopia embarks on developing its National Immunization Strategy (NIS), in alignment with World Health Organization (WHO) recommendations, the country faces critical decisions regarding the introduction of new vaccines into its national immunization program. This process involves determining which vaccines to add and establishing the sequence of their introduction to maximize public health impact and ensure efficient resource utilization.

Ethiopia has recently approved the inclusion of the yellow fever vaccine into its routine immunization schedule, a significant step in protecting populations at risk and aligning with the Eliminate Yellow fever Epidemics (EYE) Strategy [12]. Additionally, the country is considering the introduction of other vaccines, such as those for malaria and the HepB birth dose, to address prevalent health challenges and reduce morbidity and mortality associated with these diseases [13]. Integrating new vaccines into existing programs presents challenges, including ensuring adequate infrastructure, training healthcare workers, and securing sustainable financing.

The Ethiopian National Immunization Technical Advisory Group (ENITAG) was established in 2016 to provide the Ministry of Health with independent, evidence-based guidance on immunization policies. Composed of national experts, ENITAG plays a pivotal role in evaluating vaccine-preventable disease epidemiology, assessing vaccine characteristics, and reviewing programmatic capacities to inform decisions on vaccine introductions and routine immunization strategies [14]. Since its establishment, the *E*-NITAG has consistently and promptly provided scientific and practical recommendations for introducing new vaccines into the routine immunization program, including guidance on emerging issues such as the introduction of COVID-19 vaccines. In addition, the *E*-NITAG has recommended introducing the HPV vaccine, a second dose of measles-containing vaccine (MCV2), malaria and HepB birth dose vaccines, a switch from PCV10 to PCV13, a second dose of inactivated polio vaccine (IPV2), and a transition from tetanus toxoid (TT) to tetanus-diphtheria (Td) vaccine [14].

Each country has a unique set of priorities and initiatives to consider with differential impact on disease burden, lives saved, health system cost savings, and feasibility/programmatic complexities. As countries consider new vaccine introductions, they must weigh their priorities in the context of increasing coverage of existing antigens, while also optimizing current programs in the context of limited domestic funds and decreasing support from partners resulting in competing priorities. By strategically planning new vaccine introductions, ENITAG aims to enhance Ethiopia's immunization program's effectiveness, its reach to underserved populations, and strengthen overall health system resilience.

2. Methods

2.1. The NITAG and its Usual Evidence-Informed Recommendations

In most countries, the introduction of new vaccines is a complex political and technical process, involving decisions by government authorities and national immunization programs on vaccine approval, distribution, and administration. NITAGs play a central role in this process by providing evidence-informed and independent recommendations to support policy and decision-makers.

Traditionally, NITAGs assess new vaccines individually, reviewing available evidence and recommending their introduction based on their respective benefits. However, this approach often results in the simultaneous recommendation of multiple vaccines without a broader prioritization process. This can strain national immunization programs by overlooking key implementation challenges, such as financial sustainability, cold chain capacity, and human resource constraints. Additionally, this approach contradicts the latest recommendations from the Strategic Advisory Group of Experts (SAGE), which emphasize the

importance of NITAGs using multi-criteria decision analysis (MCDA)—a structured process for evaluating and prioritizing new vaccine options based on multiple, often conflicting, criteria [15].

2.2. The Development of a Step-by-Step Tool Based on MCDA Tailored for Vaccine Prioritization for NITAGs

The Global NVI Prioritization and Sequencing Consortium—comprising Development Catalysts, JSI Research and Training Institute (JSI), the International Vaccine Access Center (IVAC) at Johns Hopkins Bloomberg School of Public Health, and McKing Consulting Corporation—developed a new, NITAG-led framework for prioritizing vaccine introductions. The tool is grounded in MCDA and was designed to be evidence-based, easy to implement, and highly adaptable to individual country contexts. Its purpose is to support NITAGs in moving from reactive, one-off decisions to a more strategic, proactive, and programmatic approach to new vaccine introductions. It encourages the consideration of multiple, weighted criteria—ranging from disease burden to programmatic feasibility—and guides the creation of realistic, sequenced introduction plans that reflect both national priorities and system capacity.

The New Vaccine Introduction Prioritization and Sequencing tool (NVI-PST) was piloted in 2023 and 2024 in the Democratic Republic of the Congo (DRC) and Niger under the CHOICES 1.0 consortium [16]. These pilots demonstrated the tool's feasibility and value, enabling the respective NITAGs to make informed, context-sensitive decisions using both global evidence and country-specific data. The tool has proven to be a practical and impactful mechanism to support NITAGs in transitioning toward a more strategic, forward-looking role in vaccine policy planning—ensuring that future vaccine introductions are aligned with national priorities and health system capabilities. The methodology allows countries to take an iterative and transparent approach to vaccine prioritization. It supports better alignment with long-term program planning while remaining flexible enough to adapt to changing health system dynamics.

2.3. Description of the Process by ENITAG

In Ethiopia, the process was initiated at the request of the MoH's Expanded Program on Immunization (EPI) and supported by the Gates Foundation. An initial virtual orientation with ENITAG confirmed strong interest in using the approach, particularly as the country prepares its next NIS for 2026–2030. The NVI-PST is a structured, NITAG-driven framework built around three key phases: framework adaptation; assessment, prioritization, and sequencing; and recommendations (Fig. 1).

2.4. Framework Adaptation

The process began with ENITAG customizing the NVI-PST tool to align with Ethiopia's context. This included identifying a list of candidate vaccines (available and upcoming vaccines), defining the relevant timeframe, selecting importance and feasibility criteria, and determining weightings for each criterion. The initial phase included a brief virtual kickoff, followed by a two-day in-person workshop held on October 24–25, 2024. Participants included 11 NITAG core members and 20 representatives from the EPI Secretariat, Ethiopian Public Health Institute (EPHI), Armauer Hansen Research Institute (AHRI), Ethiopian Pharmaceutical Supply Service (EPSS), Ethiopian Food and Drug Authority (EFDA), and partner organizations such as WHO, UNICEF, JSI, CHAI, PATH, and the US CDC. Out of 22 potential vaccines, ENITAG shortlisted six for prioritization and sequencing exercise: the hexavalent vaccine (DTwP-HepB-Hib plus IPV), rubella (MR) vaccine, multivalent meningococcal conjugate vaccine (MMCV), typhoid conjugate vaccine (TCV), oral cholera vaccine (OCV), and respiratory syncytial virus (RSV) vaccine. The transition from the DTwP-HepB-Hib plus IPV schedule to a hexavalent vaccine formulation was primarily considered an optimization exercise rather than a NVI. However, the group decided to include it in the prioritization process, recognizing its significant programmatic relevance. The switch has important implications for logistics, cold chain management, and reducing the burden on the health workforce by streamlining vaccine administration and potentially improving coverage and compliance.

From the 71 criteria identified by the team who developed NVI-PST through literature review, ENITAG selected 13 for use in the prioritization process. Subsequently, a total of 32 measurable indicators were identified for the 13 criteria. The criteria were categorized into three levels—absolutely critical, essential, and important—with varying weights assigned accordingly. Eight criteria focused on assessing the importance of each vaccine, while five assessed the feasibility of introduction into the routine immunization program. A five-year timeframe was adopted for the prioritization and sequencing exercise. Table 1 below presents the selected prioritization criteria and corresponding indicators, along with their assigned weights.

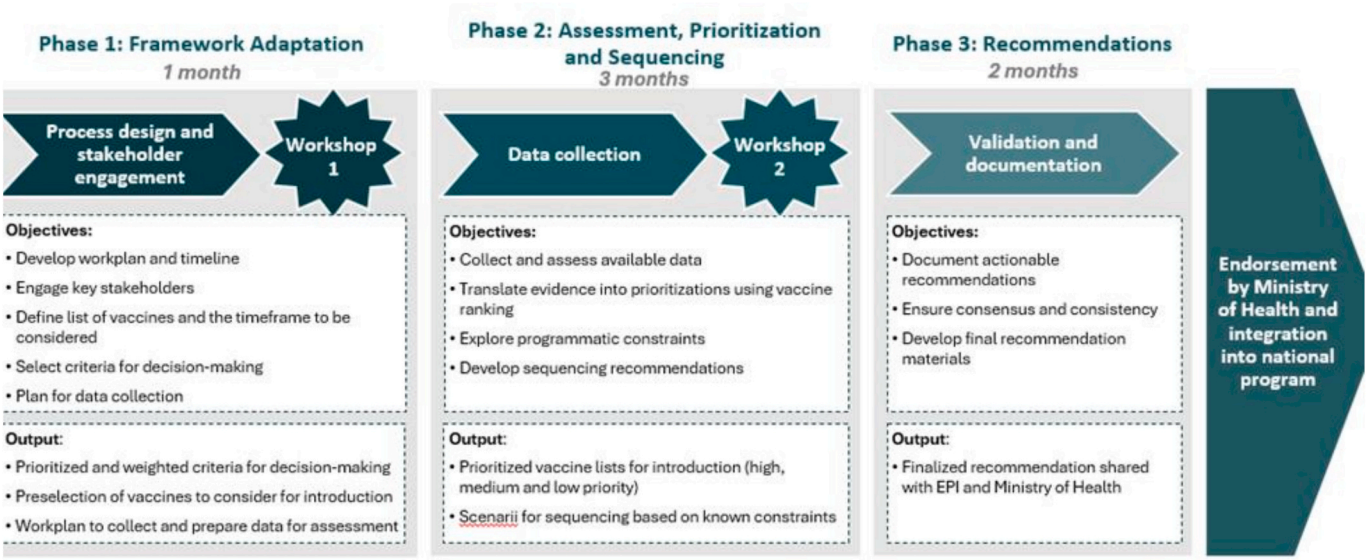

Fig. 1. A structured three-phase approach for new vaccine introduction prioritization and sequencing.

Table 1
Criteria, weights and indicators selected for prioritization of new vaccine introduction in Ethiopia.

Importance Criteria			
Criteria	Classification	Weight	Indicators
Incidence	Absolutely critical	3	Number of new cases per year (last 3–5 years).
Prevalence	Essential	2	Proportion of the population affected by the disease or infected with the antigen, etc.
Mortality and lethality		2	Number of deaths from the disease per year. Case fatality ratio.
Contribution to goals	Essential	2	How does the vaccine contribute to national / regional / global goals?
Effectiveness of the vaccine	Absolutely critical	3	Reduction in disease incidence in general population. Reduction in disease incidence in risk population. Reduction in disease severity in risk population. Reduction in mortality in risk population. Reduction in transmission for vaccinated populations.
Duration of protection	Important	1	Minimum duration of protection according to most recent studies (in years)
Serogroup coverage	Absolutely critical	3	Is the disease a serogroup- or serotype disease? (Yes/No). Serogroup distribution in the country according to most recent studies. Serogroup coverage by vaccine considered.
Existence and accessibility of satisfactory alternatives	Essential	2	Existence of alternatives to prevent the disease. Availability/accessibility of such alternatives. Cost of such alternatives.
Feasibility Criteria			
Criteria	**Classification**	**Weight**	**Indicators**
Risk at individual level	Essential	2	List of severe adverse events following immunizations (AEFIs) with corresponding occurrence in the vaccinated population. Overall availability of drugs allowing to treat known AEFIs.
Availability and sustainability of funding	Essential	2	Estimated total cost of the program. Estimated cost per person vaccinated. (For GAVI eligible countries) GAVI eligibility (yes / no) and funding amount.
Market availability of the vaccine	Essential	2	Number of available suppliers (total number of suppliers or accessible suppliers only e.g. contracted by UNICEF for UNICEF dependent countries). Estimated number of doses required for a national introduction. Evolution of global demand over the selected time period.
Availability of adequate cold chain equipment	Important	1	Net additional cold chain volume required for the vaccine at central, hub and district level (net = volume required for the new vaccine - occupied volume by previous vaccines replaced by the new one). Availability of cold chain volume at central, hub and district level. Current occupation of cold chain at central, hub and district level.
Expected impact on human resource	Important	1	Is the target population already reached by existing immunization programs (yes/no)? Number of additional contacts required for target population. Impact of introduction on workload (in time per Health Personnel). Expected requirements in terms of training for the existing personnel.

2.5. Assessment, Prioritization, and Sequencing

Over a three-month data collection phase, thematic working groups gathered and reviewed evidence related to each criterion. During a two-day workshop held on March 3–4, 2025, NITAG members and key stakeholders used the collected data to score and rank the candidate vaccines.

2.6. Data Collection

Data collection was organized into four thematic groups: (1) Disease burden, including incidence, prevalence, mortality, case fatality, and circulating serogroups; (2) Vaccine characteristics, such as effectiveness, individual-level safety and risk, duration of protection, coverage of active serogroups, and the absence of satisfactory alternatives; (3) Economic and social factors, including the availability and sustainability of funding, market availability of the vaccine, and its contribution to global, regional, or national goals; and (4) Programmatic considerations, such as the availability of adequate cold chain equipment and the impact on human resources. Each thematic area was led by core NITAG members, who identified relevant indicators for each criterion and corresponding data sources. For each of the six vaccines, an independent consultant extracted and analyzed data for all selected indicators. Details of data sources are presented in Table 2.

Data on incidence, prevalence, mortality, and case fatality rates were primarily extracted from the 2021 iteration of the Global Burden of Disease (GBD) study for Ethiopia [7]. Etiology-specific data on meningitis were obtained from the Meningitis Progress Tracker [17]. The burden of RSV and other pneumonia-causing pathogens, such as *Haemophilus influenzae* type B (Hib), was estimated using GBD data on the overall burden of pneumonia, combined with literature-based estimates of the proportions attributable to RSV and Hib [7,18,19]. Similarly, data on the burden of cholera were sourced from local studies and surveillance reports [20]. Due to the lack of reliable estimates on the incidence, prevalence, and mortality of rubella from the GBD and local sources, we used modeled data to estimate the burden of congenital rubella syndrome [21].

Data on vaccine effectiveness in preventing disease transmission, severe outcomes, and deaths; duration of protection; serogroup coverage; and adverse events following immunization (AEFIs) were primarily sourced from SAGE recommendations and the published literature [22–35]. Evidence on the existence and accessibility of

Table 2
Summary of type of the evidence and data sources for the vaccine prioritization and sequencing.

Type of Evidence	Key Stakeholders	Key Sources
Burden of disease, epidemiology	EPHI/MoH (surveillance, VPD)	DHIS2 or other national disease databases
	GBD	MoH annual disease reports including Surveillance reports
	WHO	GBD data, Global Meningitis Tracker
	Disease elimination or eradication initiatives	WHO Country profiles
		Literature reviews
		Modelling estimate
Finances & economics	Gavi	Gavi detailed product profile
	UNICEF	UNICEF NIS Costing tool
Market and supply	International partners (UNICEF, WHO, GAVI)	WHO MI4A
		UNICEF Market and Supply Updates
		GAVI Market shaping roadmaps
Vaccine specifications, safety profiles, etc.	WHO	WHO List of prequalified vaccines
	GAVI	GAVI Detailed Products
	(Peer-reviewed) Studies databases	NIH Studies Database
		Other data bases
Vaccine effectiveness, duration of protection, etc.	WHO SAGE	WHO SAGE position papers and annexes
	(Peer-reviewed) Studies databases	NIH Studies Database
		Other data bases
Service delivery	WHO	WHO recommendations for routine immunization
Logistics and cold chain	EPI Logistics section	National Stock Management Tool (SMT)
	UNICEF	eLMIS

EPHI: Ethiopian Public Health Institute; MoH: Ministry of Health; VPD: vaccine preventable disease; GBD: global burden of diseases; WHO: World Health Organization; DIHS: demographic health information system; Gavi: the Vaccine Alliance; UNICEF: United Nations Children's Fund; UNICEF NIS: United Nations Children's Fund national immunization strategy; WHO MI4A: World Health Organization market information for access to vaccines; NIH: National Institute of Health; SAGE: strategic advisory group of experts; EPI: expanded program on immunization; eLMIS: electronic logistic management information system.

alternative disease prevention measures was obtained from the literature and national surveys [20,30,36–38].

We obtained the wastage-adjusted price per fully immunized person from Gavi, the Vaccine Alliance's detailed product profiles for all vaccines except the RSV vaccine [39,40]. To estimate the vaccine-related programmatic costs for each candidate vaccine, we multiplied the price per fully immunized person by the population in need [41,42]. Similarly, we calculated the total number of vaccine doses and cold chain volume requirements for each candidate vaccine based on the vaccine schedule, target population, and vaccine package volume [39,41,42]. The EPI team provided data on total cold chain capacity and current utilization at the national level, regional hubs, and health care facilities, which informed our assessment of the additional volume requirements for each candidate vaccine. Information on Gavi eligibility, available grants and funding amounts, and country co-financing requirements was obtained from Gavi funding guidelines [43]. Data on market and supply availability for each vaccine—including the number of suppliers, countries supplied through UNICEF, and volumes secured via UNICEF procurement—were sourced from WHO and Gavi documents [39,44] and confirmed by partners from these organizations. The impact on human resources was assessed based on the additional patient contacts required and the personnel time needed to administer each vaccine dose [39,45].

3. Results

After presenting the evidence for the selected criteria and indicators for each candidate vaccine, the ENITAG and other stakeholders deliberated and ranked each vaccine accordingly for each criterion. Consensus emerged through individual rankings and were further discussed to ensure every NITAG member was comfortable with the ranking. Fig. 2 below presents the process by the ENITAG to prioritize and sequence the candidate vaccines.

3.1. Importance Criteria: Vaccine Ranking

The importance criteria assessed which vaccines are most critical to introduce. It considered several factors: the burden of vaccine-preventable diseases (including incidence, prevalence, mortality, and case-fatality rate); the vaccine's contribution to global, regional, and national health goals; its effectiveness in preventing transmission, reducing disease incidence, or lessening disease severity; duration of protection; serogroup coverage; and the availability of satisfactory alternatives. Serogroup coverage was not ranked, as it did not effectively differentiate among the candidate vaccines. Table 3 summarizes the rankings for each vaccine under the importance criterion, along with the weighted average rankings. Based on these criteria, NITAG members ranked the hexavalent vaccine as the highest priority, followed by rubella vaccine (MR vaccine), while the typhoid vaccine ranked the lowest.

3.2. Feasibility Criteria: Vaccine Ranking

The feasibility criteria evaluated how easily each vaccine could be introduced into Ethiopia's national immunization program. Factors considered included resource requirements and availability, market accessibility of the vaccine, cold chain volume needs, anticipated impact on human resources, and individual-level risk. As with the importance criteria, the hexavalent and rubella vaccine introduction were ranked highest in feasibility (Table 4). However, in contrast to the importance criterion, the RSV vaccine was ranked as the least feasible to introduce in Ethiopia.

The combined ranking for importance and feasibility criteria showed that hexavalent switch and rubella vaccine introduction were top on the ranking while cholera and typhoid vaccines were ranked the lowest (Fig. 3).

ENITAG members reached a consensus to prioritize the hexavalent and rubella vaccine introduction as high priorities, followed by the RSV vaccine and MMCV as medium priorities, and TCV and OCV as low priorities for introduction into the NIP in Ethiopia. Subsequently, ENITAG members consulted with the EPI manager to align these priorities with upcoming program plans, including NVIs and strategic EPI activities already in the pipeline.

Therefore, ENITAG recommendations take note of the following key immunization program activities which were identified as potential sources of programmatic and financial constraints:

- Measles 5-dose switch – planned in the first half of 2025
- Malaria vaccine introduction– planned in the second half of 2025
- Yellow fever vaccine introduction and preventive mass vaccination – planned for introduction in either 2025 or early 2026
- Hepatitis B birth dose vaccine introduction – planned for 2025
- The upcoming Integrated Measles SIA and periodic polio SIAs over the next five years.

Taking into account the programmatic and financial constraints highlighted by the EPI manager, ENITAG recommended the sequential introduction of the hexavalent, MR, MMCV, and RSV vaccines. NITAG identified the hexavalent and MR vaccines as high-priority candidates for earliest introduction during the 2026–2027 period, followed by MMCV and RSV as the next-level priorities (2028–2030).

NITAG also emphasized the importance of carefully timing the implementation, considering key activities already planned by the

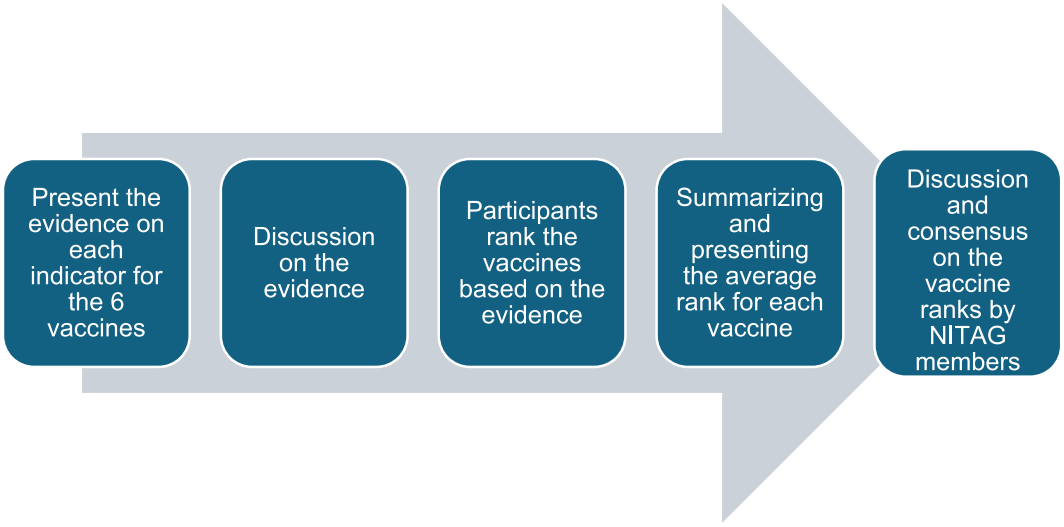

Fig. 2. Process of vaccine prioritization and sequencing.

Table 3
Ranking and aggregate ranking by importance criterion for each vaccine.

Vaccine	Incidence	Prevalence	Mortality & Lethality	Contribution to goals	Effectiveness of the vaccine	Duration of protection	Serogroup coverage	Availability of satisfactory alternatives	Average ranking with weighting
Hexavalent	1	1	2	1	2	2		2	1.9
Rubella (MR vaccine)	4	3	5	2	1	1		1	2.8
Meningitis Multivalent	2	4	1	3	3	3		3	2.8
RSV	2	2	3	5	4	5		4	3.7
Cholera	5	5	4	4	5	6		5	4.7
Typhoid	6	5	5	6	6	4		6	5.1

Hexavalent vaccine: Diphtheria, tetanus, pertussis, hepatitis B virus, hemophilus influenza type B and polio vaccines (DTwP-HepB-Hib plus IPV); MR: measles rubella; RSV: respiratory syncytial virus.

Table 4
Ranking and aggregate ranking by feasibility criteria for each vaccine.

Vaccine	Risk at individual level	Availability and sustainability of funding	Market availability of the vaccine	Availability of adequate cold chain equipment	Expected impact on human resources	Average ranking with weighting
Hexavalent	3	1	3	1	1	2.4
Rubella (MR vaccine)	5	2	2	2	2	2.9
Typhoid	2	3	1	3	5	2.9
Cholera	1	5	5	6	4	3.6
Meningitis Multivalent	6	4	4	5	3	4.3
RSV	4	6	6	4	6	4.9

Hexavalent vaccine: Diphtheria, tetanus, pertussis, hepatitis B virus, hemophilus influenza type B and polio vaccines (DTwP-HepB-Hib plus IPV); MR: measles rubella; RSV: respiratory syncytial virus.

Ministry of Health. These include the introduction of new vaccines in 2025 (yellow fever, malaria, and hepatitis B birth dose), upcoming campaigns such as the measles SIA, and the time lag between submitting a funding application to Gavi and the actual vaccine introduction.

In addition to prioritizing and sequencing NVIs, ENITAG made the following recommendations and suggestions:

- Conduct a programmatic analysis of health worker time required for vaccine administration and associated vaccine wastage rates.
- Strengthen the capacity of the ENITAG secretariat to support similar prioritization exercises in the future, particularly in the absence of external support.
- Improve access to centralized data repositories, in line with the new open data access law—particularly data from institutions such as EPHI and disease surveillance systems.
- Include evidence on community perceptions of different disease conditions and vaccine acceptability as criteria in future prioritization exercises.

Vaccine	Ranking importance	Ranking feasibility	Combined ranking
Hexavalent	1.9	2.4	2.1
Rubella (MR vaccine)	2.8	2.9	2.8
Meningitis Multivalent	2.8	4.3	3.3
RSV	3.7	4.9	4.1
Cholera	4.7	3.6	4.3
Typhoid	5.1	2.9	4.4

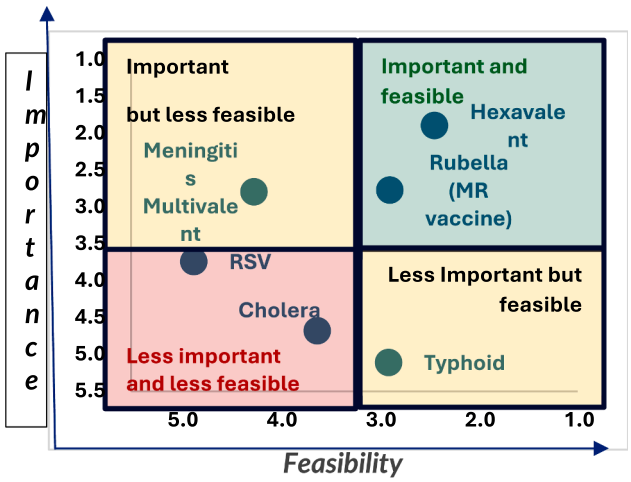

Fig. 3. aggregate scores based on combined criteria.

- Ensure periodic revision and updating of vaccine prioritization and sequencing, aligned with the NIS planning cycle and midterm reviews.

Following prioritization and sequencing, ENITAG finalized its recommendations in a comprehensive report—complete with justification and evidence—which is submitted to the Ministry of Health (MoH) and Inter-Agency Coordinating Committee (ICC). The recommendations are expected to be endorsed and operationalized by the Ministry of Health and linked to the NIS 2026–2030.

4. Discussion

With market availability of several new vaccines, national immunization programs face increasingly complex decisions. As countries develop and implement their NIS, they must consider which new vaccines to introduce and in what order (i.e., prioritization and sequencing). They must also optimize existing immunization programs by assessing potential changes to vaccine products, presentations, schedules and delivery strategies. This is particularly important in low-income settings, where programmatic challenges are substantial and resources are limited [3].

The ENITAG prioritized and sequenced new vaccines for introduction into the EPI over the next five years (2026–2030) using the NVI-PST tool kit [16]. This marks the first proactive engagement by ENITAG and its Secretariate to provide recommendations on NVI and sequencing through an evidence-informed decision-making process using MCDA. This represents a shift from the previous practice, in which ENITAG reviewed each new vaccine introduction individually upon request from the MoH. The process included an analysis of disease epidemiology, vaccine characteristics, the health system's capacity to absorb and sustain NVI, and the availability of human and financial resources.

ENITAG prioritized hexavalent and rubella (as Measles-Rubella) vaccines introduction. Although the hexavalent vaccine has a modestly higher procurement cost compared to the separate pentavalent and IPV, it requires less cold chain space, reduces the number of injections given and the time needed from health workers, thereby decreasing program complexity [39]. Similarly, the MR vaccine also does not require additional cold chain space and workforce time as compared to the existing measles vaccine.

MMCV and, to a lesser extent, the RSV vaccine were identified as important but less feasible for introduction in Ethiopia. The country has not yet incorporated the Meningococcal A vaccine into its routine immunization program (despite its use in outbreak response) which is a prerequisite for Gavi, the Vaccine Alliance, funding eligibility for transitioning to MMCV [43]. Currently, the RSV vaccine is not included under Gavi's co-financing arrangement, as it is still new to the market [43]. However, the manufacturer has made a global access commitment to supply RSV PreFusion vaccine at an affordable price to LIC and LMIC through public sector purchases, including through Gavi [46].

Typhoid and cholera vaccines ranked low on the current priority list. Ethiopia frequently experiences cholera outbreaks, during which OCV has been used in preventive campaigns alongside efforts to improve access to safe water, sanitation, and hygiene [20]. As the current ENITAG recommendation focuses on vaccines for routine use, it is expected that OCV will continue to be deployed in preventive campaigns during cholera outbreaks in Ethiopia.

Ethiopia has prior experience with vaccine optimization initiatives. The ENITAG previously approved a shift from a 10-dose measles vaccine vial to a 5-dose vial [14]. This change was intended to encourage health workers to open vials more frequently, thereby improving coverage. The move also aimed to reduce vaccine wastage, which could help offset cold chain requirements. In the current optimization exercise, the ENITAG considered transitioning from separate pentavalent and IPV vaccines to a combined hexavalent vaccine. This shift carries both programmatic and cost implications. While it is expected to slightly increase vaccine costs, it would reduce the number of injections, improve coverage, and enhance programmatic efficiency.

ENITAG successfully led Ethiopia's first NVI priority-setting exercise. However, from the immunization program perspective, strong linkages between technical recommendations from ENITAG and programmatic planning processes (such as the National Immunization Strategy, annual workplans, and budgeting cycles) are essential to ensure that evidence-based policy decisions are effectively translated into action. The ENITAG, EPI program, regulatory authorities such as the Ethiopian Food and Drug Authority, and partners should establish a coordination mechanism to ensure that policy decisions are communicated in a timely manner, jointly assessed for feasibility, and effectively integrated into broader program priorities.

The prioritization exercise for NVI enables a systematic comparison of vaccines and the development of clear introduction scenarios for which the budget impact can be realistically estimated. This approach moves beyond a simple antigen-versus-antigen comparison and instead focuses on understanding the overall implications of introducing specific vaccines or combinations within a defined fiscal and programmatic context. In settings such as Ethiopia, where health resources are limited and donor support is gradually declining, it is critical that any decision to introduce new vaccines be preceded by a thorough assessment of affordability and long-term budget impact. Such analyses ensure that new introductions do not compromise the financial and programmatic

sustainability of the EPI.

Our NVI prioritization and sequencing exercise is not without limitations. Data availability and quality at national, regional and global levels and ensuring the engagement of all the stakeholders has been a challenge. Because of insufficient resources to the secretariat, ENITAG was obliged to use a local partner for the data collection and analysis. Additionally, the process should be revisited regularly to account for the evolving landscape of vaccines, recommendations, funding, and other contextual factors.

The vaccine prioritization and optimization exercise conducted by the ENITAG provides a valuable model that can be replicated by other NITAGs in similar settings. However, successful implementation of such an initiative requires a strong and well-resourced secretariat, as it involves extensive data collection, compilation, and analysis across multiple sources. Strengthening the technical and analytical capacity of the secretariat is therefore essential to ensure the rigor, timeliness, and credibility of the process. Additionally, this type of exercise presents an important opportunity to foster collaboration and mutual learning among NITAGs, national immunization programs, and development partners. Experience sharing across countries can help refine the methodologies, adapt tools to local contexts, and promote harmonized approaches to evidence-based vaccine decision-making.

5. Conclusion

This prioritization and sequencing exercise marks a step forward in Ethiopia's approach to NVI, reflecting a more systematic, evidence-informed process led by ENITAG and its Secretariat. By proactively evaluating vaccine options using the NVI-PST toolkit, the country is better positioned to align its NIS with public health needs, resource availability, and programmatic feasibility. The prioritization of the hexavalent and MR vaccines demonstrates a pragmatic balance between cost, system efficiency, and disease burden. At the same time, the recommendations on vaccines like MMCV and RSV acknowledge current financial and operational constraints while maintaining flexibility for future introduction. Despite challenges in data quality and stakeholder engagement, this process offers a valuable framework for transparent, context-sensitive immunization planning that can be refined over time. Continued investment in technical capacity and coordination will be essential to ensure that Ethiopia's EPI remains responsive, sustainable, and equitable in the face of evolving public health needs.

CRediT authorship contribution statement

Solomon Tessema Memirie: Data curation, Formal analysis, Investigation, Validation, Visualization, Writing – original draft, Writing – review & editing. **Telahun Teka:** Data curation, Formal analysis, Investigation, Validation, Visualization, Writing – original draft, Writing – review & editing. **Amha Mekasha:** Data curation, Formal analysis, Investigation, Validation, Visualization, Writing – original draft, Writing – review & editing. **Tewodros Alemayehu:** Data curation, Formal analysis, Investigation, Validation, Visualization, Writing – original draft, Writing – review & editing. **Melkamu Ayalew Kokobie:** Data curation, Formal analysis, Investigation, Validation, Visualization, Writing – original draft, Writing – review & editing. **Yohannes Lakew Tefera:** Data curation, Formal analysis, Investigation, Validation, Visualization, Writing – original draft, Writing – review & editing. **Workeabeba Abebe:** Data curation, Formal analysis, Investigation, Validation, Visualization, Writing – original draft, Writing – review & editing. **Mirgissa Kaba:** Data curation, Formal analysis, Investigation, Validation, Visualization, Writing – original draft, Writing – review & editing. **Nassor Mohamed:** Data curation, Formal analysis, Investigation, Validation, Visualization, Writing – original draft, Writing – review & editing. **Florian Guiod:** Data curation, Formal analysis, Investigation, Validation, Visualization, Writing – original draft, Writing – review & editing. **Kamel Senouci:** Data curation, Formal analysis, Investigation, Validation, Visualization, Writing – original draft, Writing – review & editing.

Ethics approval

The study is based on publicly available secondary data, thus ethical approval was not applicable.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have influenced the work reported in this paper.

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Declaration of competing interest

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Data availability

The authors used publicly accessible data.

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