

An evaluation of a multifaceted training program to build National Immunization Technical Advisory Group (NITAG) capacity for making evidence-based immunization policy

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ARTICLE INFO

Keywords:

Training evaluation
Evidence-to-recommendation training
National Immunization Technical Advisory Groups

ABSTRACT

Background: Since January 2022, regional National Immunization Technical Advisory Group (NITAG) workshops have been held for more than 50 countries to strengthen participants' understanding of NITAG functions, basic vaccinology, and the ability to make evidence-based decisions on vaccines. A midterm evaluation was conducted in select countries to assess impact and guide future workshop enhancements, ensuring content is tailored to country-specific needs and practical application of NITAG functions.

Methods: An online questionnaire was conducted between December 2023 and February 2024, targeting NITAGs from 12 workshops held 6–24 months earlier in the African (AFR) and Eastern Mediterranean (EMR) Regions. Each country submitted one consolidated response covering five sections: general information, basic NITAG functions, the evidence-to-recommendation (EtR) process, vaccinology, and training agenda.

Results: Of 28 NITAGs trained between February 2022 and August 2023, 21 (75%; 13/15 AFR, 8/13 EMR) participated in the evaluation survey. Most NITAGs (76%) participated in multi-country workshops, with median 10 individuals (range 2–22) per country. Following the workshops, 67% of NITAGs developed or revised key documents (e.g., standard operating procedures) and 50% updated other policies (e.g., conflict of interest). Among 19 NITAGs that attended the full EtR training, 11 completed the vaccine-specific EtR process started during the workshop (6 also applied the EtR process to additional vaccines). Among 15 NITAGs that attended vaccinology sessions, all reported applying the knowledge in their work. Respondents requested more time for evidence analysis and synthesis during future trainings.

Conclusions: Post training evaluation of NITAG capacity-building workshops showed positive and sustained impact for operations, vaccinology, and the application of the EtR process for a vaccine policy question. Our findings suggest future workshops may be enhanced by requiring pre-training eLearning modules and strengthening indicators to monitor training quality and outcomes. Such improvements may help to reinforce NITAG capacity for evidence-informed immunization policy-making.

1. Background

The World Health Organization (WHO) and its Strategic Advisory Group of Experts on Immunization (SAGE) recommended in 2011 that all countries establish a National Immunization Technical Advisory Group (NITAG) to provide evidence-based recommendations to policymakers and immunization programme managers [1,2]. During the past

decade, with support from WHO and partners, 180 countries have established their own NITAG and by 2023, 132 countries met the six basic criteria for a fully functional NITAG [3,4]. As vaccination programs grow more complex, with an increasing number of vaccine antigens, broader target populations, financial constraints, and evolving delivery strategies, the ability of NITAGs to apply evidence-informed decision-making (EIDM) has become essential. This approach ensures

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<https://doi.org/10.1016/j.vaccine.2026.128600>

Received 26 November 2025; Received in revised form 13 March 2026; Accepted 14 April 2026

Available online 27 April 2026

0264-410X/Published by Elsevier Ltd.

that vaccine recommendations are appropriately prioritized and responsive to emerging health threats and reflective of the latest scientific evidence.

While various expert guidance on the EIDM process is available [3–5], practical training materials for developing skills in EIDM among NITAG members and secretariats have been limited and used mainly for regionally-focused workshops [6]. To address this gap, between 2019 and 2021 the Task Force for Global Health's (TFGH) Partnership for International Vaccine Initiatives (PIVI) and the Global Immunization Division (GID) at the U.S. Centers for Disease Control and Prevention (U.S. CDC) collaborated on the development of an 8-module training course for making vaccine recommendations based on the evidence-to-recommendation (EtR) framework used by WHO SAGE, a key component of EIDM. The training was informed by materials developed by the Supporting Independent Immunization and Vaccine Advisory Committees (SIVAC), the WHO European Regional Office, and experienced NITAGs [6–8]. Global partners (e.g. WHO Geneva, WHO African Regional Office (AFRO), WHO European Regional Office (EURO), and Global NITAG Network (GNN)) provided review and input. Freely available online, the EtR toolkit contains materials needed for training: slides with facilitator notes, videos, reference materials, participant handbook, group activity worksheets, and links to internet resources [9].

Between January 2022 and June 2025, 24 EtR workshops were conducted, involving 58 countries in WHO AFR, WHO Eastern Mediterranean Region (EMR), and Region of the Americas (AMR), primarily targeting new and less experienced NITAGs, and countries with renewed NITAG membership. Typically conducted over 3–5 days, in either English, Spanish, Portuguese, or French as appropriate, the training workshops focused on basic NITAG functioning, vaccinology concepts, and the EtR approach for developing vaccine recommendations. In initial workshops, each country worked on a vaccine policy to introduce Human Papillomavirus (HPV) vaccine. Beginning in December 2022, countries were able to select a vaccine policy question relevant to a current immunization policy being considered by the NITAG.

All workshops were led and facilitated in person, but most allowed remote participation and included virtual presentations on some topics, including disease specific updates, and in some workshops, vaccinology and EtR. The basic NITAG functioning component of the course and the vaccinology course were developed by WHO Geneva and NITAG Support Hub (NISH)/University of Cape Town, respectively. Partners who planned and facilitated the workshops included: WHO Headquarters and the African and Eastern Mediterranean Regional Offices, U.S. CDC, TFGH, NISH, and Global Health Development/The Eastern Mediterranean Public Health Network (GHD/EMPHNET). See Hadler et al. for additional details on how trainings were developed and conducted, and to learn more about the modules and the EtR toolkit [10].

To guide improvements in training materials and approaches for future NITAG trainings, an online survey was conducted to assess the midterm impact (6–24 months post training) of facilitated NITAG workshops on NITAG operations, vaccinology concepts, and use of the EtR process for developing evidence-based vaccine recommendations. To our knowledge, this is the first survey to evaluate the impact of a NITAG workshop, specifically regarding the impact of the training on the EtR approach for making a vaccine recommendation. This paper will summarize key survey findings on the strengths and weaknesses of the workshop, respondent feedback for improving the EtR modules, and areas for improvement for future workshop trainings and structures.

2. Methods

The evaluation was conducted using an online questionnaire between December 2023 and February 2024, approximately 6 to 24 months after the completion of the NITAG training workshops. The target population included all countries that had participated in 12 facilitated NITAG workshops held between January 2022 and August

2023. The questionnaire was developed by the training facilitators and piloted in two countries before its broader dissemination in December 2023.

The evaluation questionnaire consisted of 5 sections:

1. *General information*: Collected information on NITAG size and composition at the time of training, including the roles of participants (e.g., NITAG members, Secretariat, Ex-Officio members).
2. *Basic NITAG Functions*: Assessed whether key NITAG documents such as Terms of Reference (ToR), Standard Operating Procedures (SOPs), Declarations of Interest (DOI), and Conflict of Interest (COI) policies had been drafted, revised, or updated since the training.
3. *Evidence-to-Recommendation (EtR)*: Evaluated whether a specific vaccine policy question was selected for the EtR training, the rationale behind the choice, and whether the NITAG followed through with completing the EtR process using that question. Asked whether the approach has been applied to other vaccine recommendations, if an SOP for EtR has been developed, and whether there are plans for further EtR capacity-building.
4. *Vaccinology*: Explored how the vaccinology training informed NITAG activities and what additional vaccinology topics would be of interest for future training.
5. *Training Agenda*: Gathered feedback on the training structure, including if more or less time should be allocated to specific workshop topics.

The online questionnaire was completed by the NITAG Chair and Secretariat, in consultation with other NITAG members (e.g., ex-officio) and Ministry of Health (MoH) staff who participated in the training. Countries were asked to submit a single completed questionnaire representing the national response. Submitted questionnaires were reviewed by a member of the study team (S. Hadler), in consultation with WHO EMR and AFR NITAG focal points, to ensure accuracy and completeness. Multiple entries from the same country were consolidated into a single response in coordination with the respective NITAG and Secretariat. Countries that did not respond to the initial request were contacted two to three additional times to encourage participation. All submitted responses were compiled into a password-protected Excel database, accessible only to members of the study team to ensure data confidentiality and security.

2.1. Analysis

Descriptive results (frequencies) were compiled and summarized for questions within each section. Statistical tests were not conducted due to the small sample size. The results were stratified by several factors, including WHO region (AFR, EMR), year of training, whether the training was single- or multi-country, and NITAG functional indicators [11]. For certain responses, such as completion of the EtR process during training, characteristics of NITAGs that completed the activity were compared to those that did not. Data on the eight functional process indicators of NITAGs (2024) was obtained from the WHO and UNICEF Joint Reporting Form (JRF) [12]; these indicators are used to monitor functionality of NITAGs globally [12,13]. A JRF score was calculated for each country and categorized as either meeting six or more indicators or not.

3. Results

3.1. Respondent characteristics

Online questionnaires were sent to participants of the workshops in 28 countries (15 AFR, 13 EMR). After review, we received completed responses from 21 countries (75%); 13 in AFR and 8 in EMR (Fig. 1). Of the 13 countries in AFR that completed the evaluation, five attended single-country workshops, and eight participated in multi-country

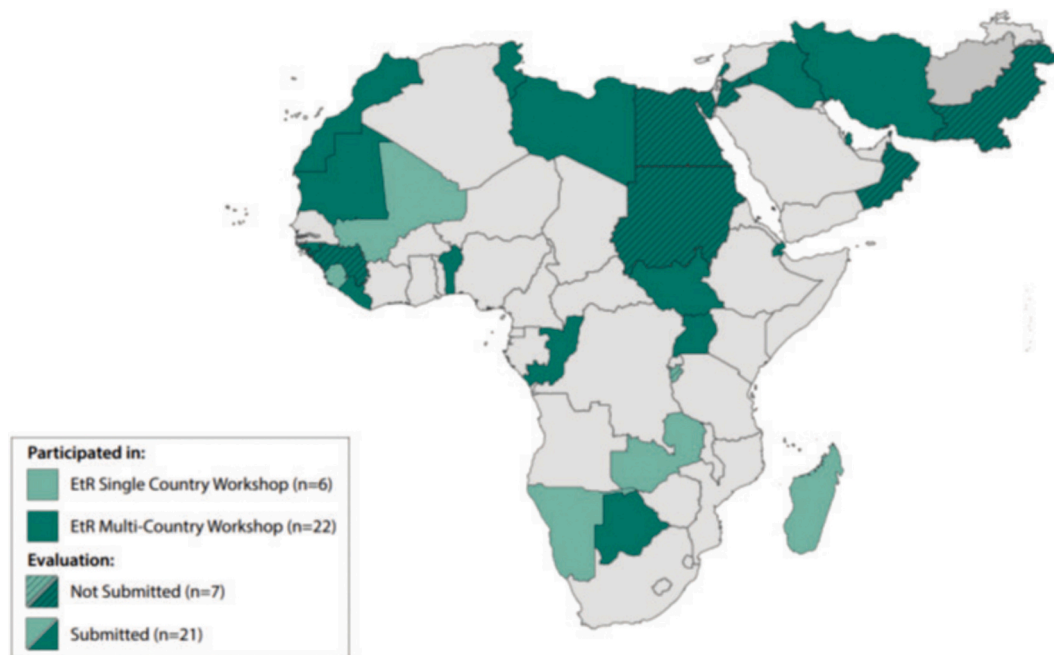


Fig. 1. Countries that participated in NITAG Evidence-to-Recommendation (EtR) Workshops between January 2022 – August 2023, and were invited to submit an evaluation between December 2023 – February 2024.

workshops (Fig. 1). All workshops in AFR covered sections on NITAG functions and EtR; whereas the vaccinology section was included in all trainings except for the Zambia single-country workshop. Of the eight countries in EMR that completed the evaluation, all participated in multi-country workshops, which included sections on NITAG functions and EtR training; however, only half of the EMR workshops included vaccinology. All EtR sections of the trainings lasted three days, except for the June 2023 beginner training, which provided only a brief 2-h introduction to EtR and was attended by 2 countries (Libya and Djibouti).

Two countries (1 EMR, 1 AFR) partially completed the evaluation. Despite repeated requests, one or more sections of their questionnaires remained incomplete; only completed sections were included in the analyses. Seven countries did not complete the evaluation, including 2 from AFR and 5 from EMR. Four of these countries had participated in workshops in 2022, but otherwise they did not differ substantially from those that completed the evaluations.

Among the countries that completed the evaluation ($n = 21$), five had participated in workshops in 2022; three in single-country workshops (all in AFR) and two in multi-country workshops (both in EMR). Sixteen countries completed workshops between February and August 2023, including two in single-country and 14 in multi-country workshops. Based on the 2022 WHO Joint Reporting Form (JRF) [12], 15 countries scored equal to or greater than 6, while 6 countries scored fewer than 6 on the NITAG functional indicators.

3.2. General information

Among respondents participating in the workshops, the size of NITAGs varied widely, ranging from 3 to 30 core members (median: 10). The number of core NITAG members who attended the workshops also varied (range: 1–13; median: 5). In addition to core members, a median of 2 Secretariat members and 1 Ex-officio member participated in the workshops. Overall, a median of 10 individuals per country, including core members, Secretariat, and Ex-officio members participated in the workshops (range: 2–22 participants) (Table 1).

Notably, the number of participants from AFR countries was higher overall (median: 11 trained), including core members (median: 8

Table 1

Composition of NITAG participants trained in workshops, by WHO Region (African Region [AFR] and Eastern Mediterranean Region [EMR]): January 2022 – August 2023.

Characteristics	All NITAGs		AFR		EMR	
	Range	Median	Range	Median	Range	Median
Countries (total)	21		13		8	
NITAG core members	3–30	10	6–30	16	3–20	5
Core members trained	1–13	5	4–13	8	1–5	2.5
Secretariat trained	0–5	2	0–4	2	0–5	1
Ex-officio trained	0–6	1	0–6	2	0–1	0
Total trained	2–22	10	6–22	11	2–10	4
Number of NITAGs						
Added core members after training*	6		3		3	
Added secretariat members after training*	7		4		3	

* Number of NITAGs that reported additional core or secretariate members added following training.

trained) and other categories, compared to EMR workshops (total median: 4 trained). Furthermore, a higher proportion of core members were trained in AFR (median: 65%) than in EMR (median: 43%).

3.3. Basic NITAG functions

In the period following the workshops, 14 (67%) of the 21 NITAGs developed or revised key documents, including ToR and general NITAG SOPs. Approximately half of the countries developed or updated their DOI forms, confidentiality policies, COI forms, and NITAG work plans (Fig. 2). Only minor differences were observed in the stratified analyses by region, most notably the development or update of a NITAG work plan, reported by 7 out of 13 countries in AFR compared to only 1 out of 8 in EMR.

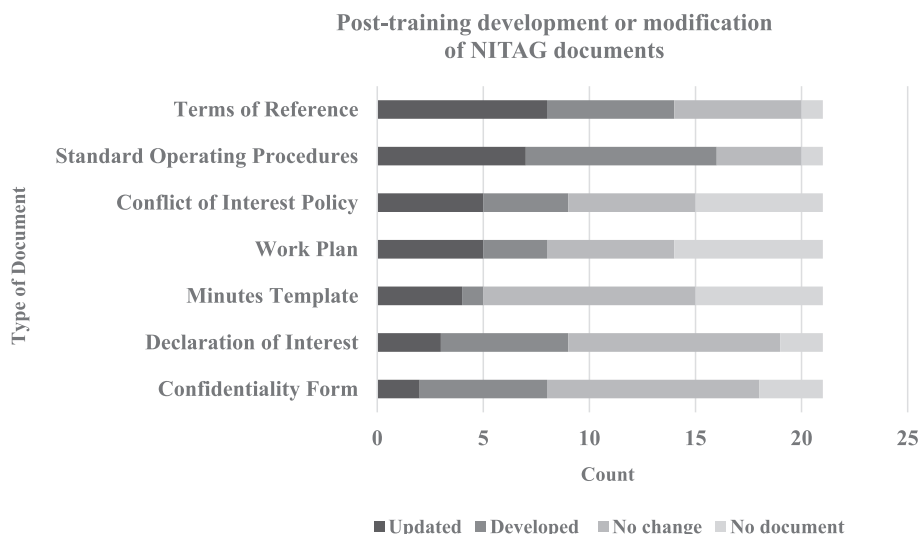


Fig. 2. Post-training development or modification of NITAG documents among participating countries (n = 21).

3.4. Evidence-to-recommendation

Nineteen countries completed the 3-day EtR part of the workshop, each working on either HPV or a different vaccine policy question identified by the country. The topics were as follows:

1. Human papillomavirus (HPV) vaccine (14 countries; Initially, trainings focused only on HPV vaccine in 9–14-year-olds (2 doses), but this was modified to single dose in 2023 after SAGE endorsed the change);
2. Malaria RTS,S/AS01 vaccine (2 countries);
3. Pneumococcal conjugate vaccine (PCV) for infants (2 countries); and
4. Second dose inactivated poliovirus vaccine for infants (1 country).

Eleven of the policy questions were used to address a current NITAG policy issue, while 8 were used strictly as an example for training purposes.

Among the 19 NITAGs that completed the full EtR training (13 AFR, 6 EMR), 12 (63%) countries continued the EtR process for the specific vaccine question initiated in the training after returning to country, and 11 (58%) NITAGs completed the EtR process, which is defined as completing the criteria tables, collecting evidence, summarizing evidence in the EtR framework, and drafting and voting on the recommendation (Table 2). Additionally, upon completion of the training, 11 (58%) of 19 countries had completed the EtR SOP for their NITAG, a document describing the concepts and steps used by the NITAG when developing vaccine recommendations according to the EtR process.

All five countries that received single country workshops completed the EtR process for the selected vaccine question addressed in the training, compared to 6 out of 14 countries participating in multi-country workshops. No substantive differences were seen by year of training or JRF score (i.e., functional indicators). Among 7 countries that had not continued the EtR process after training, 6 (85%) indicated that

Table 2
Post-workshop NITAG continuation of EtR process on vaccine policy question among participating countries (n = 19).

	Yes	No
NITAG used ETR to continue process	12	7
Completed PICO tables	11	1
Domain criteria evidence collected	12	0
ETR Framework summary completed	11	1
NITAG Vote on Recommendation	11	0

Note: Totals may not sum to 19 for all items due to missing responses.

they planned to use EtR approach for future recommendations.

Following the training, 6 of the 11 countries that had made a recommendation based on the vaccine question discussed during the training, also went on to use the EtR approach for making additional vaccine recommendations, which included the following: malaria (2), measles-rubella (MR) vaccine, Bacillus Calmette-Guérin (BCG), yellow fever (2), rabies (2), meningitis, hepatitis B birth dose, and COVID-19 (3). These included 5 AFR and 1 EMR countries. Among countries that received training in 2022 or February 2023, 55% (5 of 9) had used EtR for an additional vaccine policy, while among those trained after Feb 2023, 10% (1 of 10) had used EtR for additional vaccine policies by the time of the evaluation.

To support continued use of the EtR approach, 17 countries planned to provide EtR training for new NITAG members. The most commonly reported methods for doing so included reviewing key documents, conducting briefing sessions, and requiring completion of the online EtR eLearning course [15] (each cited by 65% of respondents). The EtR eLearning course was made available to participants starting in January 2023.

3.5. Vaccinology

Sessions on vaccinology were offered in 10 of the 12 workshops, focusing on basic epidemiology and immunology concepts, but also other topics such as case studies on developing vaccine policy and guidance on how to conduct a literature search (available in select workshops). Among the 15 countries which completed a vaccinology session (11 AFR, 4 EMR), all countries indicated they used vaccinology in their ongoing NITAG work.

NITAGs were asked to indicate 3 additional topics for which they would prefer additional vaccinology training. The most frequently named topics were the following: Vaccine hesitancy and health systems (n = 7 each), communications (n = 6), vaccine equity and systematic reviews (n = 5 each); all other topics (accessing quality, health economics, modeling, vaccine prioritization) had four or less countries each expressing interest. There were no substantive differences in vaccinology preferences by region, year of training or JRF score.

3.6. Training agenda

Respondents from 19 NITAGs evaluated whether times spent on each of the 15 listed topics was sufficient or if more or less time was needed on each topic (Fig. 3). Topics for which most respondents indicated more time was desired included the following EtR topics: finding evidence,

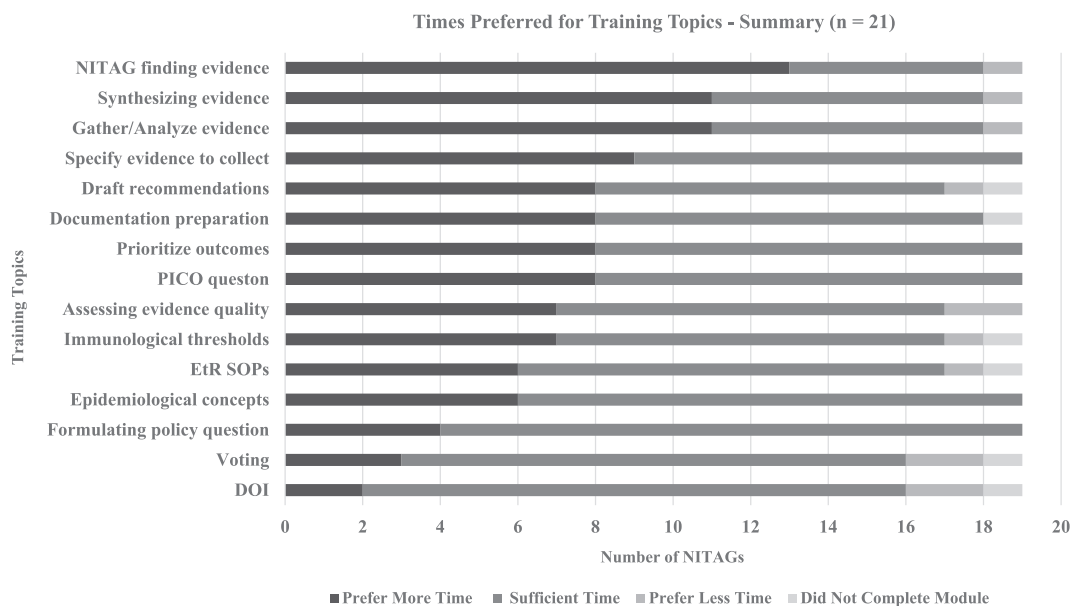


Fig. 3. Preferred allocation of time by training topics (n = 21).

synthesizing evidence into the EtR framework, and gathering and analyzing evidence. Topics for which approximately half of respondents suggested more time was needed included EtR topics specifying evidence to collect, formulating the Population, Intervention, Comparison, and Outcome (PICO) question, prioritizing evidence, document preparation, and preparing draft recommendations. The preferred allocation of training time across the 15 training topics for the AFR and EMR is presented in Figs. 4.a and 4.b.

4. Discussion

Our evaluation of comprehensive multifaceted NITAG training workshops conducted in the African and Eastern Mediterranean Regions during 2022–23 demonstrated positive and sustained impacts across all primary focus areas: NITAG operations, vaccinology, and the application of the EtR process for a vaccine policy question. Our findings of higher response rates of participants from more recently conducted workshops (84%, 2023; 56%, 2022) highlight the importance of timely follow-up after training and suggest that more intensive post-training engagement may be beneficial for maintaining impact and encouraging full participation in future evaluations.

We observed a positive impact of the training on NITAG operations. The majority of NITAGs either developed or updated two key governance documents (ToRs and SOPs). Many also revised additional materials essential for effective NITAG functioning, such as COI and DOI forms, confidentiality policies, and work plans. These findings are based on participant-reported updates made following participation in the training. As a result, most NITAGs that participated in the training updated their governance documents supporting all core functions. However, at the time of evaluation some NITAGs still lacked critical documents, including a work plan, meeting minutes template, and a formal COI policy. In some cases, this may reflect limited follow-up support after the training, challenges in sustaining momentum after initial workshop participation, or even a lack of awareness of the importance of these documents for ensuring transparency, consistency, and accountability in NITAG processes. Ensuring the development and consistent use of these materials across all NITAGs will require continued engagement, follow-up, and targeted support for NITAG leadership.

The vaccinology sessions emerged as a highly valued component of the training. Countries that received this training component expressed

strong interest in vaccinology and demonstrated use of its concepts in their post-training activities. In addition to the epidemiologic and immunologic content included in all workshops, participants showed particular enthusiasm for practical exercises, among especially those focused on conducting literature searches. In response, a two-hour practicum on literature review methods was added to the workshops beginning in early 2023. This session was delivered alongside EtR Module 6, which focuses on identifying and evaluating evidence related to key policy domains such as disease burden, feasibility, economic impact, and vaccine acceptability. Other high-interest vaccinology topics identified by NITAGs included vaccine hesitancy, communication strategies, and health systems strengthening. NISH, as the lead partner in developing and delivering the vaccinology training components, remains well positioned to continue advancing this work, particularly given the higher level of interest reported by NITAGs in the African Region.

The EtR component of the training had a clear and sustained impact on participating NITAGs. The evaluation found that many countries either continued or completed the EtR process for the vaccine policy question they had worked on during the training, and some applied the approach to additional vaccine questions after the workshop. Among countries that received the full EtR training, 11 (58%) completed the EtR process for the policy question addressed during the workshop, and slightly more than half completed the process for the initial policy question reported using the EtR framework for other vaccines post-training.

Importantly, 94% of countries indicated plans to use the EtR process in the future, and 80% planned to provide EtR training for new NITAG members, indicating strong uptake and integration of the approach into ongoing NITAG functions. A key factor contributing to this success was likely the use of real, country-prioritized policy questions during the workshops, which made the training directly applicable and allowed NITAGs to make meaningful progress on actual decision-making processes during the workshop sessions.

Several factors may have played a role in our finding that response rates were higher among countries that participated in workshops held in 2023 compared to those trained in 2022. First, a recency effect likely played a role, with more recent participants being able to recall training content in order to complete the evaluation. Second, the 2023 workshops had greater participation from NITAG core members, Secretariat, and Ex-officio staff, which may have increased collective ownership of

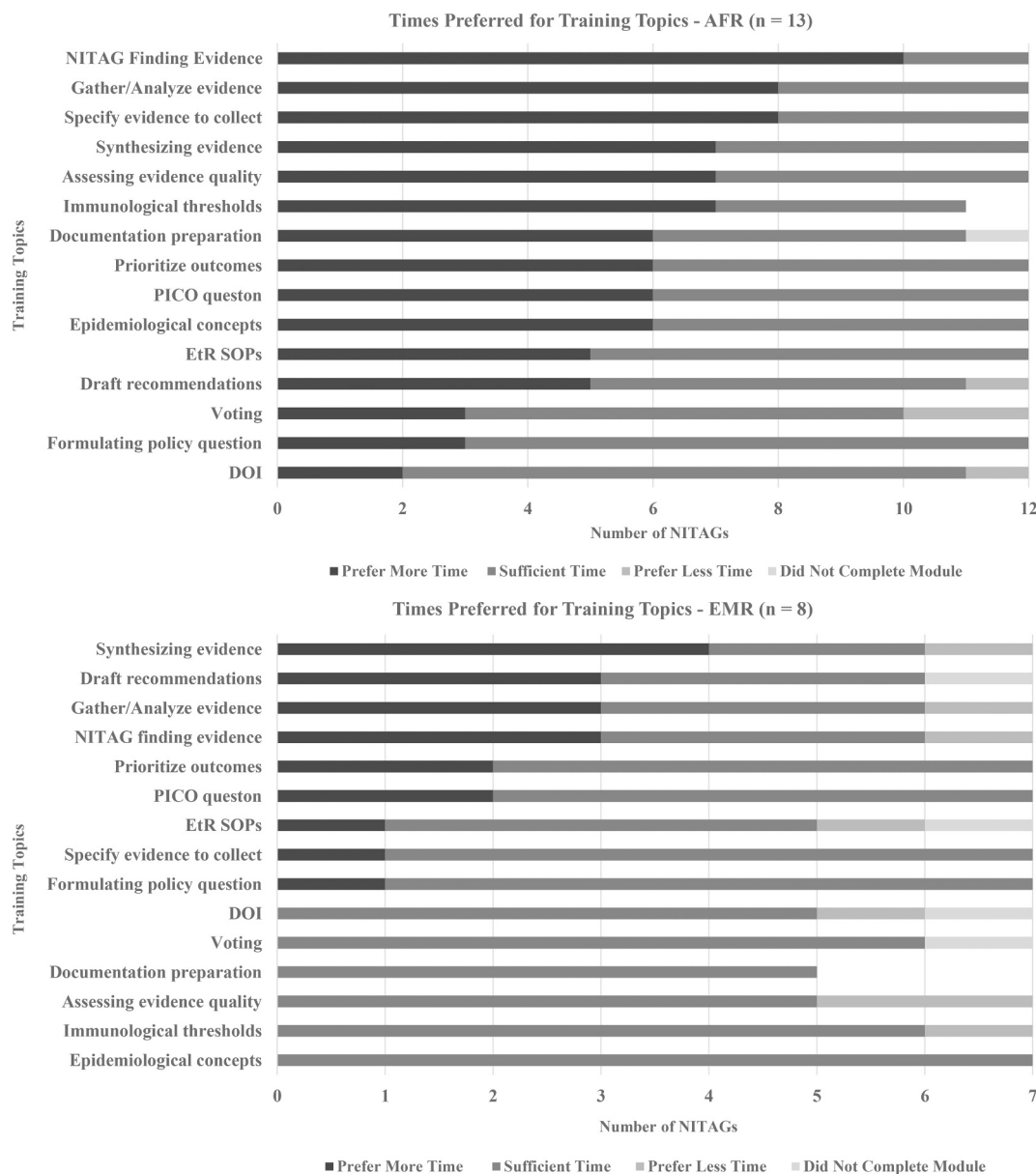


Fig. 4. a: Preferred allocation of time by training topics and by region: AFR (n = 13). b: Preferred allocation of time by training topics and by region: EMR (n = 8).

the training and contributed to higher completion rates. This was likely influenced by recommendations from the EtR training team and direct follow-up by WHO regional focal points, which encouraged full NITAG participation, promoted shared responsibility and emphasized the importance of long-term sustainability, thus contributing to higher completion rates. In contrast, lower response rates among 2022 workshop participants may suggest challenges in sustaining momentum over time, such as staff turnover, shifting national priorities, or limited follow-up support.

There are several possible reasons why some countries did not complete the EtR process that was initiated during the training. In many cases, countries did not begin the workshop with a specific plan or timeline for completing the vaccine recommendation, limiting their ability to follow through after the training. Additionally, two countries were newly established NITAGs and were participating in their first formal NITAG training, which may have impacted their capacity to implement the EtR process. The EtR process can be complicated and it may take several rounds of vaccine recommendations to implement completely. For these newer NITAGs the aim was to introduce the EtR

process and highlight the value of evidence-informed decision in the development of vaccine recommendations. Other contributing factors may have included limited funding for NITAG meetings or insufficient support from the NITAG Secretariat. Nevertheless, nearly all countries reported plans to use the EtR approach for future vaccine policy recommendations. Those NITAGs that had applied the EtR process to additional vaccine topics tended to have been trained earlier (February 2023 or before) and had considered a broader range of policy questions. NITAGs trained during this earlier period had also convened more meetings following the workshop (median of 3 meetings, range 2–18) compared to those trained after February 2023 (median of 1 meeting, range 0–4), providing them with more opportunities and possibly greater need to apply the EtR framework to additional policy decisions.

To address additional challenges to completing the EtR process such as limited preparation or familiarity with the approach, additional pre- and post-training resources and ongoing support mechanisms have been introduced. In January 2023, the online EtR eLearning became available and was recommended for participants to complete prior to the workshop, and later as a refresher. It was also intended to be used by those

NITAG members who were unable to attend the workshop with their NITAGs [14]. The EtR eLearning module follows the same steps as the EtR toolkit and uses various vaccine policy examples to illustrate each of these steps (in addition to English, all materials are also available in French, Spanish, and Portuguese). This 2-h module presents an overview of the EtR process and includes work activities, examples, quizzes, videos and testimonials. To support continued use of the EtR approach, most countries planned to provide EtR training for new NITAG members, using a variety of methods.

Some differences in outcomes were observed by WHO region, though no clear patterns emerged when results were stratified by year of training or by the 2022 NITAG JRF functional indicators. The absence of differences by JRF indicators may reflect limitations in these indicators' ability to capture readiness to implement new EtR processes, the relatively small sample size, or the equalizing effect of the training itself, which may have enabled both higher- and lower-functioning NITAGs to benefit similarly. However, regional differences were observed; notably, workshops in the AFR region were larger and included more members of the NITAG and Secretariat (AFR: median of 10 participants per training; EMR: median of 4 participants), and more frequently resulted in completed EtR recommendations (AFR: 9 out of 13 countries; EMR: 2 out of 6 countries). These findings suggest that training a greater number of NITAG members and Secretariat staff may enhance both the impact and efficiency of the training, as there is less reliance on post-training knowledge transfer to untrained members. However, decisions about the size and composition of workshop participants must also consider logistical and financial constraints, including travel, training, and accommodation costs, as well as the availability and scheduling needs of both NITAG members and training facilitators. Additionally, given the turnover that can occur among NITAG members and secretariat staff, sustaining capacity over time remains an important consideration. Institutionalizing training materials and approaches, alongside continued technical support and periodic training opportunities, may help maintain and reinforce the improvements observed following the workshops without requiring repeated multi-day in-person trainings.

Lastly, participating NITAGs expressed strong interest in dedicating more time to certain topics, particularly those covered in the EtR workshop, such as finding evidence, gathering and analyzing evidence, and synthesizing evidence within the EtR framework. While these topics are included in the EtR training (Modules 5, 6, and 7), the current three-day training schedule allows limited time for in-depth exploration. Consequently, some NITAGs likely found the time allocated to group work insufficient. This feedback will inform future refinements of the EtR training components, with adaptations aimed at tailoring workshops to the diverse needs of NITAGs, ranging from highly experienced groups to newly established ones.

4.1. Training improvements

Based on the evaluation results and feedback from participating countries, there are several improvements that could be made in order to better meet country needs both during and after the NITAG training (Table 3). These focus on three main areas: training structure, future training development, and monitoring and evaluation. Key suggestions include promoting preparatory eLearning, encouraging broad participation from NITAG and Secretariat members, and prioritizing multi-country workshops where feasible. Trainers have found preparatory eLearning [14] ensures participants arrive with a common foundation of knowledge, enabling more productive discussions; while broad participation strengthens group cohesion and supports institutional capacity; and multi-country workshops allow countries to learn from one another's experience, improve efficiency by streamlining support across countries and reduce costs through shared resources. Future efforts could expand the pool of regional facilitators and introduce additional training modules covering behavioral, communication, and economic topics. To ensure ongoing quality and impact, strengthening monitoring

Table 3

Areas for improvement for future NITAG trainings based on evaluation results and feedback from participating countries (n = 21).

Category	Areas for Improvement
Training Structure (EtR Focus)	<ul style="list-style-type: none"> • Encourage attendance of all or most NITAG and Secretariat members, as cost and time permit. • Promote EtR eLearning for new members before training; consider a prep call to review material and expectations. • Favor multi-country workshops when resources are limited, ensuring maximum participation. • Require countries to bring a specific vaccine policy question to EtR workshops; support and monitor progress post-training. • Include NITAG support as an essential, funded component of immunization program strengthening. • Expand regional facilitator pool through training-of-trainers workshops to increase capacity for workshops and ongoing technical support. • Develop new training modules as part of a broader learning journey, including: <ul style="list-style-type: none"> - Behavioral and social drivers of immunization, including vaccine hesitancy - Health communication - Community engagement and advocacy - Economic concepts and analysis (new module piloted) - Create online learning pathways for new NITAG members to learn - key concepts.
Future NITAG Trainings	<ul style="list-style-type: none"> • Develop evaluation indicators to monitor training quality and outcomes, ensuring multi-country workshops achieve parity with single-country workshops. • Use NMAT outputs to monitor impact of strengthening activities on selected NITAG functioning parameters.
Monitoring and Evaluation	

through specific evaluation indicators and the use of the NITAG Maturity Assessment Tool (NMAT) could also be used [15,16].

In addition to traditional NITAG participants (e.g., NITAG members, secretariats, working group members, and MoH representatives), future training efforts could consider engaging a broader range of stakeholders to promote greater understanding of how evidence-based immunization recommendations are developed and how these recommendations inform immunization policy and practice.

4.2. Limitations

There are several important limitations to consider when interpreting the survey findings. First, the relatively small number of evaluated NITAGs limited our statistical power to conduct group comparisons (e.g., by region). Findings should be interpreted with consideration of potential non-response bias, as individuals who completed the survey may systematically differ from those who did not respond despite multiple invitations. Second, the survey captured an overall country response, which may not reflect differing opinions among various attendees from the same country. Any conflicting responses were reconciled through discussions between the NITAG chair, secretariat, and members. Third, there was heterogeneity across workshops in both training topics covered and the maturity of the NITAGs being trained. As a result, the survey may not fully reflect uniform training experiences across all NITAGs. For instance, not all NITAG members were available for the full 4–5-day training sessions. Additionally, the limited duration of the workshops constrained the number of topics that could be addressed, despite strong interest in expanding vaccinology and EtR content.

5. Conclusion

This post-training evaluation of NITAG workshops conducted in 2022–2023 demonstrates sustained positive impact across the primary areas of focus: basic NITAG functioning and documentation,

vaccinology, and the application of the EtR approach to vaccine recommendations. The evaluation also highlighted opportunities to further strengthen these workshops, expand training on specific topics, and provide continued support to country NITAGs and Secretariats following the training. Notably, countries continue to add new core members, Secretariat staff, and Ex-officio members after the training, underscoring the need for ongoing orientation and training of new participants. The partners, stakeholders, and local consultants who are leading these trainings will continue to work to enhance the impact of the NITAG trainings per guidance from this evaluation.

CRedit authorship contribution statement

Rena Fukunaga: Writing – review & editing, Writing – original draft, Visualization, Formal analysis. **Lisandro Torre:** Writing – review & editing, Data curation, Conceptualization. **Abigail M. Shefer:** Writing – review & editing, Methodology, Formal analysis, Conceptualization. **Kathleen F. Cavallaro:** Writing – review & editing, Methodology, Formal analysis, Conceptualization. **Catherine Tencza:** Writing – review & editing, Methodology. **Benjamin M. Kagina:** Writing – review & editing, Methodology, Formal analysis. **Stephen C. Hadler:** Writing – review & editing, Methodology, Formal analysis, Conceptualization.

Disclaimer

The findings and conclusions in this paper are those of the authors and do not necessarily represent the official position of the U.S. Department of Health and Human Services, the U.S. Centers for Disease Control and Prevention, or Task Force for Global Health.

Funding

The funding for this work was received through a Cooperative Agreement.

(5 NU2RGH001916–04-00) from the U.S. Centers for Disease Control and Prevention to Task Force for Global Health. The authors received no financial support for the research, authorship, and/or publication of this article.

Declaration of competing interest

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

Acknowledgements

We thank all NITAG members who participated in completing the evaluation. We also acknowledge our colleagues Louise Henaff, Dr. Sidy Ndiaye, and Dr. Gerald Sume from WHO headquarters, the Regional Office for Africa (AFRO), and the Regional Office for the Eastern Mediterranean (EMRO), respectively. They contributed to the Evidence-to-

Recommendation (EtR) framework training for NITAGs, facilitated workshops, and supported the evaluation. Their efforts were instrumental in making this survey possible.

Data availability

Data will be made available on request.

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