HHS Public Access

Author manuscript

Vaccine. Author manuscript; available in PMC 2025 October 24.

Published in final edited form as:

Vaccine. 2024 October 24; 42(Suppl 4): 125610. doi:10.1016/j.vaccine.2024.01.035.

Supporting National Immunization Technical Advisory Groups (NITAGs) in development of evidence-based vaccine recommendations and NITAG assessments – New tools and approaches

Stephen C. Hadler[a,*], **Abigail M. Shefer**[b], **Kathleen F. Cavallaro**[a], **Malembe Ebama**[a], **Catherine Tencza**[a], **Erin D. Kennedy**[b], **Sidy Ndiaye**[c], **Adeel Shah**[a], **Lisandro Torre**[a], **Joseph S. Bresee**[a]

[a]Partnership for International Vaccine Initiatives, Center for Vaccine Equity, Task Force for Global Health, 330 W. Ponce de Leon Ave, Decatur, GA 30030, United States

[b]Global Immunization Division, Centers for Disease Control and Prevention, 1600 Clifton Rd., Atlanta, GA 30033, United States

[c]Africa Regional Office, World Health Organization, Cite du Djoue, PO Box 06, Brazzaville, Republic of Congo

Abstract

[*]Corresponding author. shadler@taskforce.org (S.C. Hadler).

6. Author Contributions Credit Statement

Stephen Hadler, Abigail Shefer, Kathy Cavallaro, Malembe Ebama – Each contributed to the conception, design, data acquisition, analysis, interpretation, drafting, revision and final approval of the manuscript.

Erin Kennedy contributed to the conception, design, interpretation, revisions and final approval of the manuscript.

Catherine Tencza, Sidy Ndiaye, Adeel Shah – Each contributed to the design, data acquisition, interpretation, and revision and final approval of the manuscript.

Lisandro Torre and Joe Bresee contributed to the analysis, interpretation, revision and final approval of the manuscript.

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.

5. Disclaimer

The findings and conclusions of this manuscript are those of the authors and do not represent the official positions or policies of the organizations with which they are affiliated.

CRediT authorship contribution statement

Stephen C. Hadler: Conceptualization, Data curation, Formal analysis, Funding acquisition, Methodology, Project administration, Supervision, Validation, Writing – original draft, Writing – review & editing. **Abigail M. Shefer:** Conceptualization, Data curation, Formal analysis, Methodology, Project administration, Resources, Supervision, Validation, Writing – original draft, Writing – review & editing. **Kathleen F. Cavallaro:** Conceptualization, Data curation, Formal analysis, Methodology, Supervision, Validation, Writing – original draft, Writing – review & editing. **Malembe Ebama:** Conceptualization, Methodology, Project administration, Supervision, Writing – review & editing. **Catherine Tencza:** Conceptualization, Data curation, Methodology, Project administration, Software, Validation, Writing – review & editing. **Erin D. Kennedy:** Conceptualization, Methodology, Project administration, Resources, Validation, Writing – review & editing. **Sidy Ndiaye:** Conceptualization, Data curation, Methodology, Validation, Writing – review & editing. **Adeel Shah:** Conceptualization, Data curation, Methodology, Validation, Writing – review & editing. **Lisandro Torre:** Formal analysis, Methodology, Project administration, Validation, Writing – review & editing. **Joseph S. Bresee:** Formal analysis, Funding acquisition, Supervision, Validation, Writing – review & editing.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.vaccine.2024.01.035.

Increasing opportunities for prevention of infectious diseases by new, effective vaccines and the expansion of global immunization programs across the life course highlight the importance and value of evidence-informed decision-making (EIDM) by National Immunization Technical Advisory Groups (NITAGs). The U.S. Centers for Disease Control and Prevention (CDC) and Task Force for Global Health (TFGH) have developed and made available new tools to support NITAGs in EIDM. These include a toolkit for conducting facilitated training of NITAGs, Secretariats, or work groups on the use of the Evidence to Recommendations (EtR) approach to advise Ministries of Health (MoH) on specific vaccine policies, and an eLearning module on the EtR approach for NITAG members, Secretariat and others. The CDC and TFGH have also supported final development and implementation of the NITAG Maturity Assessment Tool (NMAT) for assessing maturity of NITAG capabilities in seven functional domains. The EtR toolkit and eLearning have been widely promoted in collaboration with the World Health Organization (WHO) Headquarters and Regional Offices through workshops engaging over 30 countries to date, and the NMAT assessment tool used in most countries in 3 WHO regions (Americas, Eastern Mediterranean, African). Important lessons have been learned regarding planning and conducting trainings for multiple countries and additional ways to support countries in applying the EtR approach to complete vaccine recommendations. Priorities for future work include the need to evaluate the impact of EtR training and NMAT assessments, working with partners to expand and adapt these tools for wider use, synergizing with other approaches for NITAG strengthening, and developing the best approaches to empower NITAGs to use the EtR approach.

Keywords

Evidence-based decision-making; National immunization technical advisory; group NITAG; Evidence-informed decision-making; Vaccine policy; Lessons learned

1. Introduction

Immunization continues to be one of the most effective and cost-effective global public health interventions [1]. During the past several decades, opportunities for disease prevention by vaccines have greatly expanded because of many newly available vaccines to prevent serious illness in all age groups (e.g., rotavirus, pneumococcal conjugate (PCV), human papillomavirus (HPV), malaria, COVID-19, respiratory syncytial virus (RSV) vaccines), and expanded immunization programs that use vaccines to prevent disease across the life course, from infants and children through adulthood, including vaccinating pregnant women and the elderly [2].

The emphasis of using evidence-informed decision-making (EIDM) in the development of each country's immunization policy has increased as vaccination programs have become more complex with an increasing number of vaccine antigens and updated strategies for delivering vaccines. The World Health Organization (WHO) and its Strategic Advisory Group of Experts on Immunization (SAGE) have recommended that all countries establish National Immunization Technical Advisory Groups (NITAGs) to develop evidence-based immunization policies [3]. The Global Vaccine Action Plan [4] reinforced this

recommendation defining the objective that all countries have a functional NITAG by 2020 [5], and Immunization Agenda 2030 (IA2030) highlighted the importance of NITAG accountability and monitoring of progress [1]. During the past decade, with support from WHO and partners, 160 countries have established NITAGs, and as of 2021, 120 countries met the six basic criteria for a fully functional NITAG [2,6,7].

A key objective for NITAG function is the ability to make vaccine recommendations using an evidence-informed decision-making (EIDM) process. Various expert guidance on the EIDM process is available [8,9]; however, practical training materials for developing skills in EIDM among NITAG members and the secretariats have been limited. In 2017, WHO published "Guidance for Development of Evidence-based Vaccination related Recommendations," which is used by the SAGE [10]. This document provides a detailed approach to develop evidence-based recommendations for vaccines, with an "Evidence to Recommendations" (EtR) table summarizing the information and recommendations. An early initiative focused on improving NITAG capacity was established by the Supporting Independent Immunization and Vaccine Advisory Committees (SIVAC) organization [11–13], which provided guidance and training materials for NITAGs, including the WHO evidence-based vaccination recommendations approach, and which served as the basis for multiple workshops in the EIDM process [14]. Subsequently, the WHO European Region (EURO), in collaboration with the Robert Koch Institute, developed and implemented trainings for NITAGs in the region, using an adapted evidence-to-recommendations approach [15,16]. Nevertheless, from a global perspective, NITAG trainings on the EIDM process have been limited by multiple factors which include the financial cost of facilitated trainings, the need to train new NITAG members and a limited number of available trainers, the lack of availability of NITAG members for multi-day training workshops, the inability of NITAGs to incorporate trainings due to competing pressures and lack of resources, and constraints for in-person trainings during the COVID-19 pandemic.

Assessment of the existence and functionality of NITAGs has been established through global monitoring of six basic process indicators[1] [6,17], with information self-reported by countries and collected through the WHO/UNICEF Joint Reporting Form (JRF). This was expanded in 2022 to include two additional output-related indicators[2] [18]. In addition, two tools to assess NITAG function are available (SIVAC Assessment Tool, 2016; Simplified Assessment Tool, 2018) and have been used in individual countries [6]. However, these tools do not establish criteria for assessment of the maturity of a NITAG in relation to its functions and capacities and are limited in their ability to provide clear recommendations on how to improve the NITAG. Recognizing the need for such a tool, a team of NITAG experts from the U.S. Centers for Disease Control and Prevention (CDC), WHO, Global NITAG Network (GNN), and Wellcome Trust has developed the new NITAG Maturity Assessment tool (NMAT) [19 - Dryer E et al, Development of a maturity assessment tool to evaluate

[1]Six NITAG process indicators - Existence of formal written terms of reference, a legislative or administrative basis, core membership covering at least five areas, meetings held at least once a year, agenda and meeting-related documents distributed in advance, and a policy on declaration of interests.

[2]Two additional NITAG indicators – Did the NITAG issue one or more recommendations? Are one or more of the NITAG recommendations adopted by the Ministry of Health?

and strengthen National Immunization Technical Advisory Groups (NITAGs), submitted for publication].

To address the need for EIDM materials for vaccine policy development and for training NITAGs, the Task Force for Global Health's (TFGH) Partnership for International Vaccine Initiatives (PIVI) and CDC Global Immunization Division (GID) have collaborated on multiple projects. These include the development of training materials for making vaccine recommendations based on the EtR approach, targeted at NITAGs and their secretariats; support for facilitated trainings of NITAGs on the EtR approach; and compilation of resource materials for the development of seasonal influenza vaccine recommendations. As an independent activity, the collaboration also supported completion of the development and implementation of the NMAT to assess the functional status of NITAGs and guide efforts to strengthen key NITAG functions. This paper summarizes the work of the TFGH-CDC collaboration in developing and implementing these materials from 2019 to 2023, building on and expanding previous work by the TFGH, CDC and others to strengthen the EIDM process in NITAGs and to enhance the ability to assess NITAGs and provide clear recommendations for NITAG strengthening [14,15].

2. Methods and approach

To support NITAG strengthening, PIVI and GID established a joint team of experts (TFGH-CDC team) in instructional design and NITAG functioning and vaccine policy development. This team worked in collaboration with GNN NITAG strengthening partners, including WHO Headquarters and Regional NITAG focal persons, to identify needs for NITAG strengthening. The team focused on developing training materials and tools to support the EIDM process for the development of vaccine policy, based on the EtR approach used by WHO SAGE and other NITAGs (e.g., US Advisory Committee on Immunization Practices (ACIP) [20]. This team also supported the final development of the NMAT for assessing the maturity of NITAGs. All draft materials developed by the TFGH-CDC joint team were shared with WHO Headquarters, WHO regional offices and other GNN experts. Materials were updated based on expert feedback, piloted in several countries through WHO regional offices, and further revised before wider dissemination.

2.1. NITAG training products developed

2.1.1. Evidence to recommendations (EtR) toolkit—The EtR toolkit is a collection of materials designed for facilitated training of the EtR approach. The EtR toolkit is targeted for new NITAGs and NITAGs with limited experience using a systematic approach such as the EtR framework to develop evidence informed vaccine recommendations. Development was initially informed by materials developed for the EIDM process by SIVAC and by WHO European Regional Office [15].

The EtR toolkit, freely available online [21], explains the how, what, why, when, and where to conduct facilitator-led EtR training. The toolkit contains all materials needed for training: slides with facilitator notes, videos, reference materials, participant handbook, group activity worksheets, and links to internet resources (Table 1).

The target audience for the toolkit includes NITAG members, secretariats, and NITAG workgroups working on a vaccine recommendation. Training using the EtR toolkit can be led by one or more facilitators who have been trained on use of the toolkit. The immersive and interactive training includes scenarios, discussions, problem solving and application to real-world policy questions. Interactive group exercises provide participants multiple opportunities to apply learned principles to sample scenarios and their own policy questions. Delivery of the training can be in person, remotely, or a hybrid of both. Although initially designed for a single NITAG, the toolkit has been used successfully to train multiple NITAGs at one time. The English toolkit was made available in October 2022 and French version in May 2023. Spanish and Portuguese translations are in progress [21].

2.1.2. How the training works—The training is composed of eight 1.5–2 h modules that present the EtR process (Tables 1 and 2). Module 1 introduces the EtR process. Module 2 enables participants to develop a focused vaccine policy question using the PICO approach. Module 3A introduces seven domains of evidence similar to those utilized by WHO SAGE (Table 3). In Modules 3B and 4, participants specify criteria of evidence for their PICO question and rank their priority towards making a recommendation. In Module 5, participants practice methods of finding and judging the quality of available evidence for vaccine benefits and harms, using WHO position papers as initial guidance, and review how GRADE (Grading of Recommendation, Assessment, Development and Evaluation) is used to assess the quality of vaccine benefits and harms. Module 6 focuses on the other domains (Table 3, e.g., problem, values and preferences) where sources of data will focus on local, national and regional data. Finally, Module 7 demonstrates how to assemble all information into an EtR framework, and to make judgements on the conclusions for each of the evidence domains upon which to formulate the vaccine recommendation.

NITAGs are required to work on a specific vaccine policy question, and to complete each of the modules for that policy question. To orient participants unfamiliar with the vaccine being considered, the training should include presentations by subject matter experts on the specific disease, vaccine, and vaccine policy considerations. The modules may be completed over the course of three days or intermittently over a longer period to accommodate participants' needs. By the end of the training, participants will have developed a PICO question, defined and prioritized criteria for evidence collection specific to their question, and developed a workplan for collection of evidence required to complete the recommendation. Moreover, they will understand how the process can be contextualized to their country. The final steps of completing the EtR framework and drafting a recommendation should follow the collection of relevant evidence and its appropriate synthesis.

2.1.3. Evidence to recommendations eLearning—At the recommendation of WHO and the GNN Secretariat, an eLearning module for the EtR process was developed. The EtR eLearning module follows the same steps as the EtR toolkit (Table 1), and uses various vaccine policy examples to illustrate each of these steps. This 2-hour module presents an overview of the EtR process, and includes work activities, examples, quizzes, videos and testimonials. The intended audience includes NITAG members, secretariat,

workgroup members, EtR training facilitators, and other stakeholders, including ex-officio members such as vaccine regulators. The eLearning module can be used as an introduction to EtR for new NITAG members and to the MoH and other partners to understand the EtR process and why it is important; as a refresher for current NITAG members, or as pre- or post-instructor-led EtR training reinforcement. English, French, Spanish and Portuguese versions of the module are available on the GNN website [22].

2.1.4. NITAG Maturity Assessment tool (NMAT)—The NMAT was developed by CDC and GNN partners, and is described in detail in a separate paper [19]. The NMAT is designed as a tool to assess the maturity of any NITAG, from new to most experienced. The NMAT was converted from a paper-based to an Excel-based tool with built-in logic to calculate maturity levels. After review and testing by several established NITAGs (e.g., Germany, China, Australia, United States, and Uganda), it was revised and made available to WHO regions and countries, and partners [6]. The tool assesses a NITAG across seven indicators (each including between 2 and 4 sub-indicators), which represent capacities, structures, functions, and procedures specific to the NITAG. Worksheets for each of the seven indicators define criteria for the five maturity levels assessed by the tool, from basic through leading edge. The NMAT also includes instructions and definitions, a data collection tool, and templates for a summary report for sharing results. To introduce the NMAT to WHO regions and countries, a tutorial and presentations were developed. The NMAT was finalized in January 2023 and is available in English, French, Spanish and Portuguese [23].

2.2. Accomplishments

2.2.1. NITAG EtR facilitated training—NITAG trainings using the EtR toolkit were conducted in collaboration with WHO Headquarters and Regional NITAG focal points; NITAG Support Hub (NISH, Capetown, South Africa); Global Health Development (GHD)/ EMPHNET); and countries. All were three to five-day instructor-led trainings on the EtR toolkit and also included sessions on NITAG organization and function and vaccinology (Supplementary Table 1). Post-training technical support and training were offered to guide the NITAG to complete evidence collection, compiling the EtR framework, and completing the recommendation. Delivery modalities varied from in-person to hybrid (in-person/remote) options, with most conducted in English or French with some translated into Russian or Portuguese where needed.

From 2019 through August 2023 we conducted 15 NITAG sessions (Supplementary Table 1) for more than 25 countries. Participants ranged from 1 to 3 NITAG members from multiple countries (Eastern Mediterranean Region (EMRO) 2022, 2023) to full NITAGs and Secretariat (5–15 participants per country; up to 52 persons in multi-country training). Based on these experiences, we developed an introductory module for new NITAGs (EMRO), and updated training materials in November 2023 to improve simultaneous training for multiple countries. The vaccine policies considered by countries during the sessions included influenza vaccination of pregnant women and health care workers, HPV for adolescent girls (initially 2 dose, subsequently 1 dose in 2023); and malaria (RTS,S/AS01 vaccine); inactivated polio vaccine (IPV) 2nd dose; and PCV for infants/young children.

Since its completion in October 2022, EtR eLearning has been used as pre-learning for new facilitators and participants in facilitated training and recommended as follow-up training for NITAG and Secretariat members unable to attend the training.

Implementation further evolved by training consultants (African Regional Office (AFRO), Nov 2022; EMRO (GHD/EMPHNET), June 2022; NITAG Support Hub (NISH), Feb 2023) to deliver training and follow up directly with countries. The TFGH-CDC team and consultants jointly conducted training in AFRO (Mali, Uganda, Benin, Namibia, Zambia) and EMRO (Amman 2022, 2023).

To date, EtR facilitated training sessions have led to 6 recommendations issued from 4 NITAGs in the AFRO; 4 of these have used the full EtR process as recommended in the trainings.

2.2.2. NMAT training and use—Beginning in June 2022, we have provided a 1-hour overview of the NMAT approach during 6 NITAG EtR trainings (Supplementary Tables 1 and 2). In February-March 2023, we conducted virtual NMAT training for all countries in EMRO. Almost all of these countries subsequently completed self-assessments and presented their findings and NITAG strengthening work plans in Spring and Summer 2023 to EMRO, WHO and TFGH-CDC NITAG teams. Similar virtual training for all Pan American Health Organization (PAHO) countries (April 2023) resulted in completed self-assessments and presentations by countries during a regional NITAG conference in December 2023. As of June 2023, AFRO had conducted 6 external and 2 self-assessments of low- and middle-income countries using the NMAT, and completed a virtual training for 22 additional countries (Oct 2023).

2.2.3. Materials for NITAG training for influenza—To support training for seasonal influenza vaccination policy, PIVI collaborators (including CDC Influenza Division) developed a comprehensive Influenza Resource Package (IRP) [14] and training materials, which supported NITAG trainings in Georgia and Kyrgyzstan in 2019 and 2022. The IRP is comprised of six parts, providing an overview of influenza virology and vaccines, disease burden, vaccine safety and efficacy for the risk groups as recommended by WHO, as well as economic and public health program considerations [14]. This also included literature reviews of burden and vaccine safety for five WHO subregions of interest, including East Asia, West Africa, Newly Independent States of the former Soviet Union, Southeast Europe, and the Middle East/EMRO. EtR trainings in two countries were centered around the seasonal influenza vaccine for which the IRP was used as the key resource material for information on influenza disease, vaccine safety and efficacy, and local disease data, with all materials translated into the relevant principal language of the country (i.e., Russian for Kyrgyzstan and Georgia). The updated WHO Influenza vaccine position paper [24] was used as the key resource in 2022.

2.3. Lessons Learned and Challenges – (Box 1)

During the development and implementation of the EtR training, several lessons have been learned (Box). First, the development of training materials benefits from having a diverse and multi-disciplinary team (e.g., instructional designers knowledgeable of best practices

for adult learning, experts in NITAGs and the EIDM process). The resulting interactive training focused on group work by NITAG participants has enabled NITAGs to gain a more practical understanding of the EtR process and has led to the development of new vaccine recommendations in at least four countries.

All facilitated NITAG EtR-trainings benefit from close coordination with WHO and Regional offices, country MoHs and NITAGs, and other partners (e.g., NISH) engaged in different components of NITAG training. The training participants have also benefited by being exposed to more comprehensive content, including basic NITAG functioning and vaccinology. The involvement of the chair and secretariat of experienced NITAGs in the planning and conducting of the trainings has enhanced the effectiveness of capacity-building. Each training has required some adaptation based on the vaccine being considered, such as orientation to WHO Vaccine Position papers and planning expert presentations on the disease and vaccine being considered. The training agendas remained flexible to accommodate time for unexpected needs (e.g., overcoming language barriers).

Although the initial training design was envisioned as virtually-facilitated training, in practice, country participants have been most interested in continuous 3–5 day in-person training. Remote presentation by experts (e.g., from WHO and CDC) has been very effective, when combined with on-site expert facilitators – ideally, at least one facilitator per country for multi-country training. In the experience of AFRO, facilitators are instrumental post-training in providing additional mentorship and guidance to the NITAG and its secretariat in completing the recommendation process.

The EtR eLearning has been a valuable tool to introduce facilitators and NITAG members to the EtR process, and to prepare participants for interactive group work. It is also useful as an introduction to EtR for persons unable to participate in facilitated training, as a refresher post-training, and for other NITAG members. While the general process for EtR is the same in all countries, the training recognizes and supports the fact that each country must adapt the model to fit their own context (e. g., adapting the EtR standard operating procedure (SOP) to fit the regulatory context).

The NMAT, which has generated wide interest in several WHO regions, has been introduced successfully using various formats. We have effectively introduced the Excel tool in short (one hour) introduction sessions during single or multi-country NITAG trainings, or as two to three hour NMAT-focused training for multiple countries (EMRO, PAHO and AFRO). In the latter context, the NMAT has served as an initial self-assessment tool to identify and prioritize steps for strengthening the NITAG including the need for additional training in the EtR process. After an initial self-assessment there may be interest in an externally led review to gain a more complete picture of NITAG functioning. Several NITAGs have been externally assessed using the NMAT by AFRO, resulting in detailed reports that have been shared with stakeholders, and which have provided an opportunity to identify needed resources and technical assistance for capacity building, including for EtR.

We have noted several challenges in efforts to build NITAG members' skills in the EtR approach (Box 1). First, bringing NITAG members for a three or more day training can

be difficult, because NITAG members are often not all available, or are distracted by their professional commitments. However, virtually conducted sessions risk distraction of participants and pose difficulty for facilitators to assess the engagement of participants. To date, the latter option has only been used when an in-person format was not feasible.

Resources for independent learning (such as eLearning) are helpful as pre-course work for training participants and as catch-up for those who are unable to attend in-person training; however, informal feedback suggests its use before trainings has been inconsistent. This may be due to lack of time and/or consistent internet connection among users. To incentivize completion of the eLearning, the issuing of a certificate for completing the module is being considered.

Another challenge is how to optimally focus the training to address NITAG members and training participants with different levels of skill and knowledge of EIDM and of the vaccines being considered. To help meet this challenge, participation of relevant global and local subject matter experts (SMEs) is critical for trainings, with adequate time planned for discussion and group interaction to encourage engagement of all participants.

Operational challenges include changes in the initial training schedule due to competing priorities for completing other parts of the NITAG training; internet or power outages impeding access to evidence sources; and whether single vs. multiple countries are being trained. Maintaining relevant content is challenging due to need to prepare specific reference materials for different vaccines being considered, and the different stages of readiness of countries to complete recommendations.

Process evaluations during and immediately after EtR facilitated training have been uniformly positive for content usefulness, quality of presentations and group activities. Evaluating the trainings' impact in terms of whether they result in evidence-based recommendations has been more difficult. Facilitated training guides NITAGs to the point of evidence collection and prepares them for continued work culminating in a recommendation. However, some countries need ongoing support to collect and synthesize evidence and draft a recommendation. In several AFRO countries, the regional advisor for NITAGs has assigned facilitators to support countries; their ongoing technical support has led four NITAGs to apply the EtR process to make 6 recommendations. A formal evaluation of the longer term (3–12 months) impact of the training is planned in close coordination with regional advisors.

Potential barriers to the development of a final recommendation include: time and resources needed for evidence collection, competing priorities, and countries not establishing a timeline to proceed with an actual NITAG recommendation. Moreover, most countries face challenges in the availability of relevant local data, such as disease burden, cost and potential cost effectiveness of vaccines, and acceptability of vaccine by target group and stakeholders. Follow-up for countries is recommended through WHO regional and country experts to encourage and facilitate completion of recommendations.

Challenges to conducting an assessment using the NMAT may result from lack of availability or willingness of NITAG members and Secretariat to participate. Support from the country (e.g., MoH or national program) is also necessary.

For influenza vaccine, primary challenges with developing policy using the EtR process are that the influenza program is often not linked with the EPI program or NITAG leadership, and influenza policy is often already completed (grandfathered) before NITAG deliberations, based on SAGE seasonal influenza vaccine recommendations. Additionally, the availability of local data on disease burden, vaccine costs, preferences of the target population and other issues is often limited.

3. Conclusions

The TFGH-CDC collaboration has been successful in developing and implementing EtR training materials and in supporting completion and initial implementation of the NMAT. We are regularly assessing the ongoing demand for these products in a variety of contexts, from support for new and developing NITAGs, reconstituted NITAGs, and for those who cannot participate in facilitator-led sessions. Critical factors for ongoing progress include flexibility in use of these materials, use of engaging and efficient methods, consideration for periodic training, and providing ongoing support to complete recommendations through timely follow-up by local, regional or international facilitators.

Evaluation of the impact of the EtR trainings should attempt to identify what is missing or could be improved to support countries' use of the EtR process. Opportunities to leverage the use of facilitators and partners to follow up with assigned countries, and to coordinate with Regional NITAG advisors and facilitators to monitor and document the impact of these trainings (i.e., leading to recommendations being made and accepted by MoH) could prove useful.

The EtR approach can also be supported through other approaches used to enhance NITAG functioning, such as twinning in which an experienced NITAG is paired with a new NITAG to provide training and support, or providing direct technical support through partnerships [2,6,15]. In addition, building capacity through vaccinology courses and guidance on approaches to accessing key data is critically needed, particularly local data needed for EIDM and advocacy for vaccine policy. Finally, because there are many newly available vaccines and options for vaccination policy, tools to help countries to determine vaccine program priorities are now becoming available (CAPACITI, CHOICE), and support may be needed for country MoHs to identify best options for vaccine policy development [25].

As the NMAT's use widens, efforts could identify how best it can strengthen NITAG capacity – e.g., the use of self-evaluation vs. external evaluation, support for countries in the development and implementation of NITAG strengthening plans, and as a pre- and post-evaluation of NITAG strengthening efforts such as twinning and training, including on use of EtR process. Efforts should also determine the frequency with which countries re-evaluate their program, and the best use of NITAG assessments to guide regional NITAG

support. Finally, evaluation of the impact of the NMAT use by countries should be timely to guide future use of this tool.

3.1. Recommendations

Efforts to strengthen the EIDM process among NITAGs should continue, with emphasis that this strategy is the current optimal approach to developing recommendations for vaccine use. Available tools such as EtR eLearning and toolkit and others (e.g., EURO EtR guidelines) [16] could be made widely available, including translation into multiple languages. Specific country needs, and best approaches to strengthen EIDM by NITAGs, could be determined by countries working with WHO and Regional offices.

Regular evaluation of NITAG maturity using NMAT or other tools for self- or external evaluation could guide efforts for strengthening and determine need and timing for follow-up evaluation. The impact of available trainings and tools should be evaluated within the next year, and tools should be refined based on the findings of this evaluation to optimally support building country NITAG capacity.

Moreover, work to support the generation of local information for vaccines and vaccine policies anticipated in the near future, and to make local data available through libraries or compilations of extant data, continues to be an urgent need. Countries may consider including identification of local evidence gaps in their research agenda in order to improve data gathering and to guide future decision making. In addition, providing resources and training to strengthen the ability of countries to collect and compile local data for making vaccine decisions is needed.

Finally, efforts to strengthen NITAGs globally should focus on building in-country, local, and regional capacity for this work. In addition, continued support of partners – such as WHO, GNN, non-governmental organizations, etc. - and increased interaction between NITAGs through global and regional networks and bilateral collaborations will be necessary to continue increasing NITAG capacity for evidence-informed decision-making.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgements

We appreciate the support of Ms. Louise Henaff, Dr. Christoph Steffen, and Dr. Shalini Desai (WHO Headquarters), WHO Regional NITAG focal points, and members of the GNN Secretariat who provided insightful reviews of the EtR toolkit and eLearning and of NMAT materials in final format. We also thank members of the Influenza Division, National Center for Immunization and Respiratory Diseases, (NCIRD), CDC, who provided expertise on development of the influenza materials, and of subject matter experts in Malaria, HPV, and poliomyelitis at WHO and CDC who provided technical support for development of materials and in facilitated EtR trainings. Thanks also to Dr. Ben Kagina and the NISH team and to Global Health Development/EMPHNET who provided technical and facilitator support for the NITAG workshops, and to Ms. Virginia Watson, who provided the initial expertise on instructional design for the EtR toolkit.

Funding

This work was supported by funding from the Centers for Disease Control and Prevention, through Cooperative Agreements NU2RGH001916 (Global Immunization Division, Global Health Center), and NU51IP000942 (Influenza Division, National Center for Immunization and Respiratory Diseases).

Data availability

No data was used for the research described in the article.

Abbreviations:

AFRO	Africa Regional Office, WHO
CDC	U.S. Centers for Disease Control and Prevention
EIDM	Evidence-informed Decision-Making
EMRO	Eastern Mediterranean Region, WHO
EURO	European Regional Office, WHO
EtR	Evidence to Recommendations
GHD	Global Health Development
GID	Global Immunization Division, CDC
GNN	Global NITAG Network
GRADE	Grading of Recommendation, Assessment, Development and Evaluation
HPV	Human Papillomavirus Vaccine
IA2030	Immunization Agenda 2030
IPV	inactivated polio vaccine
JRF	Joint Reporting Form
MoH	Ministry of Health
NITAG	National Immunization Technical Advisory Group
NISH	NITAG Support Hub
NMAT	NITAG Maturity Assessment Tool
PAHO	Pan American Health Organization
PIVI	Partnership for International Vaccine Initiatives
PCV	Pneumococcal Conjugate Vaccine
RSV	Respiratory Syncytial Virus

SAGE	Strategic Advisory Group of Experts on Immunization
SIVAC	Supporting Independent Immunization and Vaccine Advisory Committees
TFGH	Task Force for Global Health
WHO	World Health Organization

References

[1]. WHO 2020. Immunization Agenda 2030: A Global Strategy to Leave No One Behind. Immunization Agenda 2030: A Global Strategy To Leave No One Behind (who.int) [accessed August 29, 2023].

[2]. Steffen CA, Henaff L, Durupt A, El Omeiri N, Ndiaye S, Batmunck N, et al. et al. Evidence informed vaccination decision-making in countries: Progress, challenges and opportunities. Vaccine 2021 Apr 8;39(15):2146–2152. doi: 10.1016/j.vaccine.2021.02.055. Epub 2021 Mar 9. [PubMed: 33712350]

[3]. Duclos P National Immunization Technical Advisory Groups (NITAGs): guidance for their establishment and strengthening. Vaccine 2010 Apr;19(28 Suppl 1): A18–25. 10.1016/j.vaccine.2010.02.027.

[4]. WHO 2013. Global Vaccine Action Plan 2011–2020 (2013). Available from 9789241504980_eng (1).pdf. [accessed August 29, 2023].

[5]. SAGE April 2017 National Immunization Technical Advisory Groups Background paper. Apr2017_session8_NITAG.pdf (who.int) [accessed August 29, 2023].

[6]. Global NITAG Network. NITAG Resource Center website Home | NITAG RESOURCE CENTER (nitag-resource.org) [accessed August 29, 2023].

[7]. IA2030 Partnership Progress Reports 2022: Regaining Lost Ground (IA2030 Annual Reports (immunizationagenda2030.org) [accessed August 29, 2023].

[8]. Canadian Best Practices Portal – CBPP (phac-aspc.gc.ca) [accessed August 29, 2023].

[9]. Donadel M, Panero MS, Ametewee L, Shefer AM. National decision-making for the introduction of new vaccines: a systematic review, 2010–2020. Vaccine 2021;39:1897–909. 10.1016/j.vaccine.2021.02.059. [PubMed: 33750592]

[10]. World Health Organization, 2017. Guidance for the development of evidence-based vaccination related recommendations. Version 8, 31 January 2107. Guidance for the development of evidence-based vaccine-related recommendations (who.int) [accessed August 29, 2023].

[11]. Adjagba A, Senouci K, Biellik R, Batmunck N, Faye PC, Durupt A, et al. Supporting countries in establishing and strengthening NITAGs: lessons learned from 5 years of the SIVAC initiative. Vaccine 2015 Jan 29;33(5):588–95. 10.1016/j.vaccine.2014.12.026. Epub 2014 Dec 26. [PubMed: 25545597]

[12]. Adjagba A, McDonald NE, Ortega-Perez I, Duclos P. Global NITAG Network Meeting Participants. Strengthening and sustainability of national immunization technical advisory groups (NITAGs) globally: lessons and recommendations from the founding meeting of the global NITAG network. Vaccine 2017 May 25;35(23):3007–11. 10.1016/j.vaccine.2017.04.039. Epub 2017 Apr 26. [PubMed: 28456526]

[13]. van Zandvoort K, Howard N, Mounier-Jack S, Jit M. Strengthening national vaccine decision-making: Assessing the impact of SIVAC Initiative support on national immunisation technical advisory group (NITAG) functionality in 77 low and middle-income countries. Vaccine 2019 Jan 14;37(3):430–4. 10.1016/j.vaccine.2018.11.070. Epub 2018 Dec 10. [PubMed: 30545715]

[14]. Ba-Nguz A, Shah A, Bresee JS, Lafond KE, Cavallaro K, Shefer A, et al. Supporting national immunization technical advisory groups (NITAGs) in resource-constrained settings. New strategies and lessons learned from the Task Force for Global Health's Partnership for influenza vaccine introduction. Vaccine 2019 Jun 19;37 (28):3646–3653. doi: 10.1016/j.vaccine.2019.05.046. Epub 2019 May 23. [PubMed: 31130258]

[15]. Mosina L, Datta SS, Shefer A, Cavallaro K, Henaff L, Steffen CA, et al. Building immunization decision-making capacity within the World Health Organization European Region. Vaccine 2020 Jul 14;38(33):5109–13. 10.1016/j.vaccine.2020.05.077. Epub 2020 Jun 17. [PubMed: 32563604]

[16]. World Health Organization. Regional Office for Europe 2022. Guidance on an adapted evidence to recommendation process for National Immunization Technical Advisory Groups. Copenhagen: WHO Regional Office for Europe; 2022. License: CC BY-NC-SA 3.0 IGO 2023 https://apps.who.int/iris/handle/10665/356896 [accessed August 29, 2023].

[17]. Duclos P, Ortynsky S, Abeysinghe N, Cakmak N, Janusz CB, Jauregui B, et al. Monitoring of progress in the establishment and strengthening of national immunization technical advisory groups. Vaccine 2012;30:7147–52. 10.1016/j.vaccine.2012.04.015. Epub 2012 Apr 19. [PubMed: 22521845]

[18]. World Health Organization Immunization Data Portal 2022. National Immunization Advisory Mechanism. https://immunizationdata.who.int/pages/indicators-by-category/national_immunization_advisory_mechanism.html?ISO_3_CODE=CMR&YEAR= [accessed August 29, 2023].

[19]. Dryer E et al., Development of a maturity assessment tool to evaluate and strengthen National Immunization Technical Advisory Groups (NITAGs) submitted for publication.

[20]. Centers for Disease Control and Prevention. Advisory Committee on Immunization Practices, Evidence to Recommendations Framework | CDC [accessed August 29, 2023].

[21]. Task Force for Global Health and Centers for Disease Control and Prevention (2022) - link to Evidence to Recommendations (EtR) toolkit - Evidence to Recommendation Facilitator's Toolkit - Overview | Rise 360 (articulate.com) [accessed August 29, 2023].

[22]. Task Force for Global Health and Centers for Disease Control and Prevention (2022)- link to Evidence to Recommendations EtR eLearning on the Global NITAG Network (GNN) website - The Evidence to Recommendation (EtR) Process - introduction | NITAG RESOURCE CENTER (nitag-resource.org) [accessed August 29, 2023].

[23]. Global NITAG Network - link to NITAG Maturity Assessment Tool (NMAT) on GNN website - NITAG Maturity Assessment | NITAG RESOURCE CENTER (nitag-resource.org) [accessed August 29, 2023].

[24]. World Health Organization. Vaccines against influenza: WHO position paper – May 2022. Wkly Epidemiology Record 2022;97(19):195–208.

[25]. World Health Organization. Country-led Assessment for Prioritization in Immunization (CAPACITI). Decision-support framework Version 2.1 en_capaciti_decision-support_manual_v2.1.pdf (who.int).

Box 1

Summary of Lessons Learned and Challenges.

Lessons Learned

- Development of materials – value of instructional designer, experts in EIDM, NITAG on development team; review by outside experts.
- Design for group work – highly interactive; enables participants to complete actual work of NITAG to prepare for development of a vaccine recommendation. Emphasis on interactive skills among NITAG participants.
- Design - countries prefer continuous (3 day) training. Value of linking to other NITAG training, vaccinology, how to do literature search. Importance of SME presentations for vaccine being considered. Country groups should select a rapporteur, have at least one laptop computer, and access to projector to guide group work.
- Training facilitation – need on-site facilitators for interactive group work; some components, such as lectures can be remote; for multi-country workshops, minimum 1 on-site facilitator per country or per group, ideally a facilitator who will support the country post training.
- Value of eLearning as introduction and refresher to EtR for facilitators and participants.
- NMAT well adapted to short trainings and webinars, and as initial self-assessment for NITAGs.

Challenges

- Convening NITAG members for 3+ day training – members may be unable to attend, absent, and/or distracted. Need efficient, engaging training. Need resources such as eLearning to inform NITAG members, others who don’t attend training workshops.
- Different levels of skill, knowledge, interest of participants; assuring appropriate experts (SMEs) (local and international) at training; maintaining participant focus when discussing highly technical topics (e.g., GRADE)
- Need for flexibility – changes in schedule, internet/power outages, different vaccines being considered; workshops for single vs. multiple countries.
- Expectations to complete recommendations – requires collection and compilation of evidence, convening again to complete EtR Framework. Some have followed through with completion of NITAG recommendations with additional technical support and guidance. Many have not completed recommendations, due to limited availability of local evidence, and limited time and commitment. To optimize follow-through, need for support to compile local data, complete evidence gathering, and assembling EtR framework prior to NITAG voting.

- Need for evaluations of impact of EtR trainings and of NMAT evaluations.

Table 1

Summary of NITAG Training Materials, November 2023.

Type of training material	Purpose/Approach	Design	Type of Facilitation	Intended Target Population	Material included	Translations	Uses to date
EtR toolkit	Facilitated interactive group training on EtR process. Provides real-time practice, so that participants can address a real-life policy question and be ready to collect evidence by the end of the training.	8 modules of 90–120 min each. They are designed either to be facilitated over time, or to be completed all at once in a three-day period.	Facilitator-led (in person, remote or hybrid)	Full NITAG or NITAG work group on specific vaccine; NITAG Secretariat	The full toolkit is available on-line and includes: Facilitators slides and notes; participant handbook; worksheets, handouts, videos; templates (criteria tables, EtR framework, and internal procedures on EtR)	English (Eng) French (Fr) - completed; Spanish (Sp), Portuguese (Por) (in process)	Used for training in several formats: Training of a single country Training of several countries Training of trainers (as potential facilitators)
EtR eLearning	Self-paced overview of EtR process	2 h training with 5 sections (online)	None	NITAG members (new/refresher); Secretariat; NITAG workgroup; EtR Facilitators (prework for Toolkit); other interested stakeholders	Single module	Eng, Fr, Sp, Por	Pre-work for participants of multiple EtR trainings Training of Trainers (as potential facilitators), and as refresher for facilitators
NMAT	Assessment of NITAG maturity	Tool to assess 7 indicators of NITAG function. Defines criteria for meeting each indicator at each of 5 maturity levels. Available online as Excel- based electronic tool	Completed as self assessment or assessment by external experts	Country NITAGs – all levels	NMAT assessment tool including indicator worksheets, instructions, definitions, template for summary report. Related tools: tutorial; data collection tool.	Eng, Fr, Sp, Por Tutorials currently only available in English	Country assessments including external led reviews; Introduction of tool to PAHO, EMRO, AFRO countries followed by self-assessments

EtR – Evidence to Recommendations; NMAT – NITAG Maturity Assessment Tool; PAHO – Pan American Health Organization; EMRO – WHO Eastern Mediterranean Regional Office; AFRO – WHO Africa Regional Office.

Table 2

Contents of Modules in the Evidence to Recommendations (EtR) Toolkit.

Module		Module contents
1	Preparing for the EtR Process	Introduction to the EtR process. Provides a template for developing a standard operating procedure (SOP) for the EtR process
2	Formulating and Focusing the Policy Question	Participants develop a focused vaccine policy question using the PICO [1] approach
3A	Defining Generic Criteria for Decision Making	Introduction to seven domains of evidence as generic criteria for developing evidence based recommendations, similar to those utilized by WHO SAGE (*Table 3*).
3B	Defining PICO specific criteria for Decision Making	Participants specify criteria of evidence for their PICO question
4	Prioritizing Criteria for Decision making	Participants rank the priority (critical, important, of limited importance) of each PICO-specific criterion towards making a recommendation.
5	Gathering Evidence: Vaccine Efficacy, Safety and Global Policy	Participants learn and practice methods of finding and judging the quality of available evidence for vaccine benefits and harms, using WHO position papers as initial guidance, and review how GRADE [2] is used to assess the quality of vaccine benefits and harms.
6	Gathering Evidence: General and Local Data	Participants focus on how to find and assess quality of evidence for criteria in the other domains (Problem, Values and Preferences, Resources, etc...) where sources of data will focus most strongly on local, national and regional data.
7	Synthesizing Evidence for Decision Making	Participants learn how to assemble all information into an EtR framework, as utilized by WHO SAGE, and to make judgements and conclusions about evidence and quality of information for each of the evidence domains, upon which to formulate the vaccine recommendation.

PICO – Problem, Intervention, Comparator, Outcome approach to developing a vaccine policy question

GRADE – Grading of Recommendation, Assessment, Development and Evaluation

Table 3

Generic Evidence to Recommendations Evidence Tables - including columns for developing PICO specific criteria, Priority, and Sources of Evidence during the Workshops.

Policy Question:				
PICO Question:				
Domain 1: Problem				
Element	**Categories of Evidence**	**PICO-Specific Evidence to Collect**	**Priority**	**Sources of Evidence**
1.1 Burden of disease	☐ Incidence of morbidity & mortality			
	☐ Age-specific morbidity and mortality			
	☐ Risk groups			
	☐ Serotype distribution			
	☐ Disease occurrence over time			
	☐ Changes in epidemiology over time			
1.2 Clinical characteristics of the disease	☐ Signs and symptoms of disease			
	☐ Severe forms			
	☐ Long-term complications of disease			
	☐ Medical management of disease			
1.3 Use and Costs of Health Care	☐ Primary/secondary/tertiary care implications			
	☐ Short- and long-term use of healthcare (e.g., treatments, hospitalization)			
1.4 Alternative preventive and control measures	☐ Alternative preventive and control measures (e.g., health education, hygiene) and their effectiveness, costs, practicality			
1.5 Regional and international considerations	☐ Existence of regional and global recommendations			
	☐ Disease potential for international spread and pandemic risk			
Domain 2: Benefits and Harms of the Options				
Element	**Categories of Evidence**	**PICO-Specific Evidence to Collect**	**Priority**	**Sources of Evidence**
2.1 Vaccine characteristics	☐ Vaccine presentation, formulation, dosage, and route of administration			
	☐ Administration schedule and possibility of co-administration with other vaccines and drugs			
	☐ Flexibility of vaccination schedule			

	☐ Cold chain and logistic requirements			
2.2 Safety	☐ Type, consequences and frequency of short and long-term adverse events following vaccination			
	☐ Risk groups or risk factors for adverse events			
	☐ Contraindications or precautions			
2.3 Efficacy and effectiveness	☐ Vaccine efficacy/effectiveness and types of specific protection afforded			
	☐ Critical determinants of the immune response associated with protection			
	☐ Duration of protection and waning of immunity in general and risk groups			
	☐ Interference regarding protection or immunity with other vaccines			
2.4 Vaccine indirect effects	☐ Herd immunity/protection			
	☐ Potential negative population impact of emergence of non-vaccine serotypes			

Domain 3: Values & Preferences

Element	Categories of Evidence	PICO-Specific Evidence to Collect	Priority	Sources of Evidence
3.1 Benefits and harms	☐ Relative importance the target population attributes to the benefits and harms of the intervention as well as the comparison			
3.2 Differences by segments of target population	☐ Differences in values and preferences (ethical, religious, financial) for different segments of the target population (disadvantaged, religious)			
3.3 Demand	☐ Demand for vaccine of target population			

Domain 4: Resource Use

Element	Categories of Evidence	PICO-Specific Evidence to Collect	Priority	Sources of Evidence
4.1 Resource use and cost related to the vaccine	☐ Direct and indirect costs to administer the vaccine as they compare to other prevention or control measures			
	☐ Cost using different strategies			
4.2 Vaccine availability	☐ Availability of vaccine and long-term supply			
	☐ Available suppliers and competition dynamic in the market			
4.3 Vaccine affordability	☐ Availability of fiscal space to effectively implement and sustain the recommendation in the programme			
	☐ Prevailing prices for the vaccine in the market and price estimations for the local community			
4.4 Socio-economic	☐ School and work absenteeism			
	☐ Indirect cost to patients and families			

	☐ Productivity losses			
4.5 Economic impact of intervention on immunization program and health sector	☐ Reduction in healthcare costs ☐ Cost-effectiveness ratio of vaccination program			

Domain 5: Equity				
Element	**Categories of Evidence**	**PICO-Specific Evidence to Collect**	**Priority**	**Sources of Evidence**
5.1 Equal access	☐ Universality, accessibility, and affordability of services for all the inhabitants in the country, including vulnerable, hard to reach and immigrant populations			
5.2 Ethics, legality	☐ Non-health related effects of vaccination ☐ Ethical considerations ☐ Legal implications			
5.3 Stigma	☐ Stigma around the disease or around vaccination			

Domain 6: Acceptability				
Element	**Categories of Evidence**	**PICO-Specific Evidence to Collect**	**Priority**	**Sources of Evidence**
6.1 Related to disease and vaccine	☐ Perception of the public, stakeholders, and medical community about disease and vaccine (balances of benefits and harms)			
6.2 Related to other interventions	☐ Impacts of program on efficacy and safety of other vaccines and health care interventions			
6.3 Related to ethics, program, finances	☐ Ethical, programmatic, or financial issues that may affect acceptability of intervention by stakeholders			

Domain 7: Feasibility				
Element	**Categories of Evidence**	**PICO-Specific Evidence to Collect**	**Priority**	**Sources of Evidence**
7.1 Accessibility	☐ Accessibility of target population			
7.2 Resources for vaccine storage, distribution, and administration	☐ Availability of resources for vaccine storage, distribution, and administration —physical (cold chain storage), human, technical, and financial			
7.3 Licensing of vaccine	☐ National Regulatory Authority (NRA) requirements to register available vaccines for use in target population and/or use in a different schedule as originally recommended			
7.4 Information management	☐ Availability of information systems to manage the vaccine supply chain measure related performance metrics, i.e., coverage and vaccine utilization			
7.5 Disease and AEFI surveillance	☐ Existence and reliability of surveillance systems to monitor disease and AEFI			