

## Development of a maturity assessment tool to evaluate and strengthen National Immunization Technical Advisory Groups (NITAGs)

Eliza Dryer<sup>a</sup>, Abigail Shefer<sup>a,\*</sup>, Shalini Desai<sup>b</sup>, Lance Rodewald<sup>c</sup>, Magdalena Bastías<sup>d</sup>, Nathalie El Omeiri<sup>e</sup>, Sidy Ndiaye<sup>f</sup>, Kori Cook<sup>g</sup>, Louise Henaff<sup>b</sup>, Erin Kennedy<sup>a</sup>

<sup>a</sup> Centers for Disease Control and Prevention, 1600 Clifton Rd, Atlanta, GA 30333, United States

<sup>b</sup> World Health Organization, Avenue Appia 20, 1211 Geneva, Switzerland

<sup>c</sup> National Immunization Program, Chinese Center for Disease Control and Prevention No. 27 Nanwei Road, Beijing 100050, China

<sup>d</sup> Independent Consultant, Santiago, Chile

<sup>e</sup> Pan American Health Organization, 525 23<sup>rd</sup> St NW, Washington, D.C. 20037, United States

<sup>f</sup> Regional Office for Africa, World Health Organization, Cité du Djoué, P.O.Box 06, Brazzaville, Republic of Congo

<sup>g</sup> Department of Health and Social Care, Victoria St, London SW1H 0EU, United Kingdom

### ARTICLE INFO

#### Keywords:

NITAG  
Immunization policy  
Evidence-based recommendations  
Health system strengthening  
Evaluation

### ABSTRACT

As dozens of new National Immunization Technical Advisory Groups (NITAGs) were established worldwide in the past decade, and as existing NITAGs continued to play an important role in vaccine policy, global NITAG partners recognized a need for a standardized assessment tool to evaluate and strengthen their functions. This article describes the development of the NITAG Maturity Assessment Tool (NMAT), a stepwise evaluation tool that assesses NITAGs on seven key indicators of structure and process. A draft tool was developed through an iterative, consensus-based process with an expert working group before it was piloted with an economically and geographically diverse convenience sample of NITAGs. The final NMAT is a flexible tool that can be used by in-country or external evaluators to understand NITAG maturity, identify priorities for optimization, and measure the impact of strengthening efforts.

### 1. Introduction

National Immunization Technical Advisory Groups (NITAGs) are expert bodies that advise national governments on immunization policy. While specific NITAG mandates vary by country, their core function is to make evidence-based recommendations on vaccine products, schedules, and programs that are appropriate for the local, social, and epidemiologic context. [1] The number of declared NITAGs increased from 111 to 173 by 2022, following the World Health Assembly's 2012 approval of the Global Vaccine Action Plan for 2020, which recommended that all countries "create, or strengthen existing, independent bodies that formulate national immunization policies." [2,3].

Some NITAG evaluation metrics and tools are available, such as the 8 indicators from the World Health Organization (WHO)/UNICEF Joint Reporting Form (JRF) that determine whether a NITAG is "functional," meaning it has met the minimum requirements necessary to make immunization policy recommendations (e.g., meeting at least annually).

[4] The Supporting Independent Immunization and Vaccine Advisory Committee (SIVAC) initiative introduced a comprehensive evaluation tool in 2017, [5] and WHO and the U.S. Centers for Disease Control and Prevention (CDC) introduced a simplified assessment tool in 2018. [6] Although each of these tools collect information that can assess NITAG capabilities, none of them provide clear steps that NITAGs can take to improve their structure and function.

As new NITAGs were established and began developing, and as existing NITAGs continued to play an important role in immunization policy, global NITAG partners recognized the need for a standardized assessment tool that could recommend clear next steps for NITAG strengthening. A request to develop an evaluation tool that categorizes the stages of NITAG growth and provides steps toward strengthening was proposed by participants at the Third Global NITAG Network (GNN) meeting in Ottawa in 2018. [7] In their role to support core Secretariat functions to the GNN, WHO was given the mandate to create a working group to develop such a tool.

\* Corresponding author.

E-mail addresses: [ams7@cdc.gov](mailto:ams7@cdc.gov) (A. Shefer), [sdesai@who.int](mailto:sdesai@who.int) (S. Desai), [rodewaldl@chinacdc.cn](mailto:rodewaldl@chinacdc.cn) (L. Rodewald), [elomeirin@paho.org](mailto:elomeirin@paho.org) (N. El Omeiri), [ndiayes@who.int](mailto:ndiayes@who.int) (S. Ndiaye), [henaffl@who.int](mailto:henaffl@who.int) (L. Henaff), [ftw3@cdc.gov](mailto:ftw3@cdc.gov) (E. Kennedy).

<https://doi.org/10.1016/j.vaccine.2024.05.053>

Received 27 January 2024; Received in revised form 20 May 2024; Accepted 21 May 2024

Available online 27 May 2024

0264-410X/© 2024 Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND IGO license (<http://creativecommons.org/licenses/by-nc-nd/3.0/igo/>).

Maturity models comprise a class of evaluation frameworks adapted from the Capability Maturity Model (CMM). [8] The CMM was originally designed to assess government contractors on their software development processes and identify the steps they could take to improve. Ad hoc processes are considered the least mature; levels of maturity increase as processes are formalized and optimized. The CMM has been adapted to evaluate a variety of public health processes, including health profession regulation, [9] infectious disease preparedness and response, [10] and governmental and organizational policymaking. [11] A maturity model for NITAGs may help promote best practices for transparent, evidence-based immunization policymaking, as well as offer NITAG stakeholders a way to identify priorities for strengthening their structures and processes. The purpose of this manuscript is to describe the process undertaken to develop the NITAG maturity model and the NITAG Maturity Assessment Tool (NMAT).

## 2. Maturity model development

### 2.1. Literature search

A two-phased literature search was conducted through PubMed in October and November of 2019. The literature search was not intended to be systematic, but rather to provide background information for a working group of subject matter experts who would develop the new model. In light of this modest objective and a short time frame, the reviewer searched only one database. In the first phase, we reviewed articles that included the term “maturity model” in the title or abstract and were indexed with the MeSH term “public health” or any of its sub-terms. We reviewed articles detailing the development of maturity models in public health settings, with the goal of identifying elements to include in a NITAG maturity model. Previous maturity models developed for public health settings include between four and six levels of

maturity. [9,12] Most public health maturity models are structured like academic scoring rubrics, describing increasingly advanced standards for specific features and functions. Alternatively, some models are structured like checklists, identifying binary indicators that are expected at increasing levels of maturity. A variety of scoring schemas are used in existing models. Some models generate a maturity score for each indicator or function. Other models produce only an overall score that summarizes maturity across all indicators or functions.

The second phase of the literature search included results of a PubMed search for articles whose abstracts included the terms “NITAG” and at least one of the following: establish/establishment, strengthen/strengthening, evaluate/evaluation, and sustainability. This phase also included reports from the Global NITAG Network (GNN) annual meetings and existing evaluation tools including the NITAG functionality indicators, the SIVAC Evaluating NITAG Performance Practical Tool, and the WHO/CDC NITAG Simplified Assessment Tool. A total of 21 publications were reviewed in phase 2 (Table 1).

Published guidance for strengthening and evaluating NITAGs was compiled and grouped by thematic areas, e.g., conflict of interest policy, meeting frequency, and secured funding. These thematic areas were then further grouped into one of seven broader categories called indicators: establishment (regarding the NITAG’s legislative or administrative basis, terms of reference (ToR), and membership); independence/bias (regarding the conflict of interest process, transparency, and independence from government, industry, and interest groups); resources (regarding access to material, informational, and administrative support), standard operating procedures (SOP) (regarding meeting logistics, communication and reports, and the annual work plan); developing recommendations (regarding the quality of the process for collecting and evaluating evidence); integration into the policy-making process (regarding governmental solicitation, consideration, and implementation of recommendations); and

**Table 1**

Publications on NITAG Strengthening and Evaluation.

1. Adjagba A, MacDonald NE, Ortega-Perez I, Duclos P, Global NNMP. 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;35(23):3007–3011.
2. Advisory Committee on Immunization Practices. Policies and Procedures. 2022. (cdc.gov) <https://www.cdc.gov/vaccines/acip/committee/downloads/Policies-Procedures-508.pdf>
3. Andrus JK, Jauregui B, De Oliveira LH, Ruiz Matus C. Challenges to building capacity for evidence-based new vaccine policy in developing countries. *Health Aff (Millwood)*. 2011;30(6):1104–1112.
4. Bell S, Blanchard L, Walls H, Mounier-Jack S, Howard N. Value and effectiveness of National Immunization Technical Advisory Groups in low- and middle-income countries: a qualitative study of global and national perspectives. *Health Policy Plan*. 2019;34(4):271–281.
5. Blau J, Faye PC, Senouci K, et al. Establishment of a National Immunization Technical Advisory Group in Cote d’Ivoire: process and lessons learned. *Vaccine*. 2012;30(15):2588–2593.
6. Blau J, Sadr-Azodi N, Clementz M, et al. Indicators to assess National Immunization Technical Advisory Groups (NITAGs). *Vaccine*. 2013;31(23):2653–2657.
7. Dabanch J, González C, Cerda J, et al. Chile’s National Advisory Committee on Immunization (CAVEI): Evidence-based recommendations for public policy decision-making on vaccines and immunization. *Vaccine*. 2019;37(32):4646–4650.
8. Duclos P. National Immunization Technical Advisory Groups (NITAGs): Guidance for their establishment and strengthening. *Vaccine*. 2010;28:A18-A25.
9. Duclos P, Dumolard L, Abeyasinghe N, et al. Progress in the establishment and strengthening of national immunization technical advisory groups: analysis from the 2013 WHO/UNICEF joint reporting form, data for 2012. *Vaccine*. 2013;31(46):5314–5320.
10. Evans-Gilbert T, Lewis-Bell KN, Figueroa JP. The Caribbean Immunization Technical Advisory Group (CITAG); A unique NITAG. *Vaccine*. 2019;37(44):6584–6587.
11. Harmon SHE, Faour D, MacDonald NE, et al. Strengthening vaccination frameworks: Findings of a study on the legal foundations of National Immunization Technical Advisory Groups (NITAGs). *Vaccine*. 2020;38(4):840–846.
12. Joint Committee on Vaccination and Immunisation. Code of Practice. 2013.
13. MacDonald NE, Duclos P, Wichmann O, et al. Moving forward on strengthening and sustaining National Immunization Technical Advisory Groups (NITAGs) globally: Recommendations from the 2nd global NITAG network meeting. *Vaccine*. 2017;35(50):6925–6930.
14. Ricciardi GW, Toumi M, Poland G. Recommendations for strengthening NITAG policies in developed countries. *Vaccine*. 2015;33(1):1–2.
15. Ricciardi GW, Toumi M, Weil-Olivier C, et al. Comparison of NITAG policies and working processes in selected developed countries. *Vaccine*. 2015;33(1):3–11.
16. Supporting Independent Immunization and Vaccine Advisory Committees. Evaluating National Immunisation Technical Advisory Groups’ (NITAGs) performance: Practical tool. 2016.
17. Top KA, Esteghamati A, Kervin M, Henaff L, Graham JE, MacDonald NE. Governing off-label vaccine use: An environmental scan of the Global National Immunization Technical Advisory Group Network. *Vaccine*. 2020;38(5):1089–1095.
18. 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;37(3):430–434.
19. Wiyeh AB, Sambala EZ, Ngcobo N, Wiysonge CS. Existence and functionality of national immunisation technical advisory groups in Africa from 2010 to 2016. *Hum Vaccin Immunother*. 2018;14(10):2447–2451.
20. World Health Organization. WHO/UNICEF Joint Reporting Process. <https://www.who.int/teams/immunization-vaccines-and-biologicals/immunization-analysis-and-insight/global-monitoring/who-unicef-joint-reporting-process>.
21. World Health Organization, Centers for Disease Control and Prevention. Assessment tool for National Immunization Technical Advisory Groups. 2018. NITAG simplified assessment tool\_EN.pdf (nitag-resource.org)

stakeholder recognition (regarding the NITAG's relationship with scientific and professional organizations, the Global NITAG Network, and the public).

Conflicting guidance was highlighted for focused discussion by the working group. For example, Duclos (2010) recommended public dissemination of meeting minutes, while Blau et al. (2013) argued against including this practice in NITAG evaluations because of limited understandability, ease of collection, and/or perceived usefulness. [1,13].

## 2.2. Subject matter expert working group

The U.S. Centers for Disease Control and Prevention (CDC) convened a working group (WG) with representatives from several organizations supporting immunization policymaking and programs. The group included members from CDC, the Chinese Center for Disease Control and Prevention (China CDC), WHO (including the Headquarters, the Regional Office for Africa, and the Pan American Health Organization), the Global NITAG Network, and the Wellcome Trust. Each member had worked with national and/or international NITAGs, and their collective experience covered a geographically and economically diverse range of NITAG settings. The WG therefore understood the standards and practices for a wide variety of NITAGs to fulfill their mandates.

The WG met monthly via teleconference between November 2019 and June 2021. The WG's first priority was to choose a structure and scoring scheme for the model. After reviewing key differences among the example models identified through the literature search, the WG agreed to depict five levels of maturity through a rubric, i.e., by detailing increasingly advanced approaches to key functions rather than through a cumulative sum of binary indicators. WG members endorsed this approach as most reflective of the process by which NITAGs develop. Finally, the WG decided that scoring for each indicator should be based on the highest level of maturity at which all criteria for that indicator are met. For example, if a NITAG meets all of the criteria for Developing and three of the four criteria for Intermediate, it should receive a score of "Developing" for the given indicator. This would provide a conservative estimate of the maturity status of the NITAG. The rubric structure and scoring process are described in depth in the "Tool Development" section.

After determining the structure and scoring scheme, the WG populated the model with criteria for each indicator. Two members who performed the literature review (ED and EK) proposed rubrics for the first three indicators—Establishment, Independence/Bias, and Resources—for review and input from the other members. The WG collectively reviewed the compiled written feedback and arrived at consensus about rubric contents and phrasing through discussion. For the remaining indicators, the WG made suggestions about how to populate the rubric and through an iterative discussion process, reached consensus on the draft model. The criteria for each indicator were developed to align as closely as possible with best practices based on the literature and WG members' expert opinion. While populating the rubric, WG members also recorded definitions of key terms and articulated distinctions between potentially subjective indicators (such as the difference between basic and robust funding). Throughout the process of developing the rubric, WG members kept GNN members apprised of their objectives and progress, offering opportunities for input at conferences and partner meetings. Following WG member completion of the initial draft of the maturity model, the model was reviewed for completeness and consistency.

## 3. Tool development

Working with the CDC, the Task Force for Global Health (TFGH) developed an Excel-based tool called the NITAG Maturity Assessment Tool (NMAT) that enables assessors to apply the maturity model rubric to the NITAG under assessment. The tool is described in detail in "Description of the NMAT." The model and tool include seven

indicators: (1) establishment and composition; (2) independence and non-bias; (3) resources and secretariat support; (4) operations; (5) making recommendations; (6) integration into policy making process and (7) stakeholder recognition. Each of these indicators include further sub-indicators and criteria (please see tool in Annex 1).

### 3.1. Pilot testing with select NITAGs

Between January and February 2022, we received input on a beta version of the NMAT from the GNN Steering Committee, WHO colleagues, the Strategic Advisory Group of Experts on Immunization (SAGE), and other NITAG partners. Most of this input related to overall clarity of the tool and the suitability of criteria for each level of maturity.

The NMAT was subsequently pilot tested with a convenience sample of five NITAGs from low, middle-, and high-income countries; this was done to ensure its usability and acceptability among countries representative of the intended audience. The first pilot, an in-country assessment of Uganda's National Immunization Technical Advisory Group (UNITAG), was conducted by a joint team from WHO AFRO and U.S. CDC in February 2022. [14] For the remaining pilot tests (July 2022 to January 2023), country NITAGs and their Secretariats used the NMAT to conduct their own assessments. For Germany's Standing Committee on Vaccination (STIKO) and China's National Immunization Advisory Committee (NIAC), the NITAG used the tool and gave feedback on its usability and areas for improvement. For the Australian Technical Advisory Group on Immunization (ATAGI) and the U.S. Advisory Committee on Immunization Practices (ACIP), the NITAGs were provided the tool but the assessments were completed by several NITAG members and/or the Secretariat during virtual or face-to-face sessions where CDC and WHO provided support as needed; these sessions were an opportunity to collect feedback on the tool through observation as well as discussion.

The feedback collected from pilot testing led to refinements and improvements to almost all aspects of the NMAT. Key changes included: adding steps to instructions, clarifying terms and definitions in the glossary, and providing additional language for interpreting outputs based on country context. In response to questions and comments received from the pilot testers, we developed an online tutorial including an overview of the assessment process, a step-by-step video walkthrough of entering data into the Excel-based tool, and a list of frequently asked questions and answers.

### 3.2. Description of the NMAT

Each of the seven indicators is assessed on its own Excel sheet. Moving one sub-indicator (row) at a time, assessors are instructed to mark with an "x" the maturity levels (columns) for which the NITAG meets all criteria (Fig. 1). The tool is coded with an algorithm that auto-populates results from the inputted information. Results are displayed in a column for each sub-indicator, and an overall maturity level for the indicator is assigned based on the highest level at which the criteria for all sub-indicators are met. The tool's code also calculates the percentage of criteria met for each indicator and auto-populates a summary worksheet with these percentages.

Key terms developed by the WG, which appear in bold within the rubric, are further elaborated in a separate definition section of the tool. This structure allows the tool to contain comprehensive explanations and examples of maturity criteria while keeping wording in the tables concise. An instructions section includes suggested activities to do before, during, and after using the tool. For example, assessment team members are instructed to read through the tool in its entirety and make notes before meeting as a group.

The beta version introduced an optional data collection tool and a summary worksheet. The optional data collection tool is a fillable Microsoft Word document embedded within the Excel-based NMAT; it provides prompting questions, following the layout of the indicator

INDICATOR 3: RESOURCES AND SECRETARIAT SUPPORT						RESULTS	
	Basic	Developing	Intermediate	Advanced	Leading Edge		
1	Secured Funding N/A	There is no funding to cover <b>basic operational costs</b> .	x There is funding to cover basic operational costs.	x A <b>guarantee of funding</b> from the government covers basic operational costs.	x Guaranteed funding is robust.	x There is access to funding that can cover travel expenses for national and international NITAG strengthening activities (regional or global NITAG meetings, collaborations, training).	Leading Edge
2	Access to Relevant Data and Other Necessary Tools N/A	NITAG has inconsistent access to regional and global information; no access to local information.	x NITAG has adequate access to regional and global information.	x NITAG has consistent and comprehensive access to global and regional information, as well as adequate access to local information.	x NITAG has consistent and comprehensive access to reliable local, regional, and global information.	NITAG has access to <b>raw data</b> or can request specific analyses of the data presented.	Advanced
3	Access to External Technical Expertise and Capacity-building Tools N/A	NITAG does not solicit or accept input from external experts.	x NITAG solicits or accepts input from <b>external experts</b> .	x NITAG routinely gets input from external experts.	As appropriate, NITAG formalizes relationships with external experts through non-core membership.	<i>Leading Edge will automatically fill if you select Advanced.</i>	Intermediate
4	Secretariat Support N/A	There is no officially appointed <b>Secretariat</b> to support the NITAG.	x Secretariat provides active administrative support.	x Secretariat provides basic technical support.	Secretariat or designated support services are able to conduct and/or outsource advanced analyses.	Secretariat has multiple full-time staff members with a mix of skill sets.	Intermediate
<b>OVERALL MATURITY LEVEL FOR THIS INDICATOR</b>						<b>Intermediate</b>	

**Fig. 1.** Indicator 3 scoring rubric for a hypothetical NITAG which has met the Leading Edge criteria for the secured funding sub-indicator, the Advanced criteria for the data access sub-indicator, and the Intermediate criteria for the technical expertise and secretariat support sub-indicators. The overall maturity level for Indicator 3 is Intermediate, reflecting the highest level of maturity met for all sub-indicators.

tables, to help assess the maturity levels of the seven indicators and provide results in a way that is easy to review and enter into the Excel tool. The summary worksheet contains auto-populated results from the assessment and blank fields for assessors to identify planned actions for each indicator based on the lowest unmet maturity levels. Assessors are instructed to select the party responsible for leading on priority actions and set a deadline for their implementation. The summary worksheet was created so that it could be shared as a separate report (printed or electronic) in user-friendly format to participants.

### 3.3. Using the tool

The tool is flexible and can be used to conduct either an external or self assessment. Self assessments are wholly conducted by members of the NITAG and its Secretariat; members from the country’s MoH may also be involved. External evaluations are conducted by outside assessors in close collaboration with the NITAG Chair and Secretariat. Outside assessors often include people experienced with the NMAT (e.g., NITAG stakeholders from neighboring countries, regional representatives of global health partners, or assessors trained to implement the tool). Outside assessors can also include experts within the country who are not involved in NITAG operations. There are benefits for each option and the decision whether to conduct an external or self assessment depends on such things as availability of resources, convenience in scheduling, interest of NITAG members to become familiar with the tool, and if the type of assessment will impact its use for advocacy purposes.

Once the assessment team is established, key NITAG-related documents should be collected and reviewed (e.g., legal or administrative documents establishing the NITAG, Standard Operating Procedures, Terms of Reference, Conflict of Interest policy, meeting minutes, etc.). While not required, in-depth individual interviews of key stakeholders (e.g. select NITAG members, professional association, scientific societies) can help assessors gain an understanding of different perspectives and identify topics for further discussion; the optional data collection tool can assist with this. The last phase of conducting an assessment using the tool is a group session where at a minimum all NITAG members and the Secretariat meet to complete the tool; if an external assessment is being conducted, this session would be led by the external review group. During this session, the group should come to consensus on whether and to what extent the NITAG meets criteria for the different indicators assessed by the tool, with findings from the desk review and interviews (if conducted) contributing to the discussion.

The tool and a tutorial guide to using the NMAT are posted to the GNN NITAG Resource Center site, where it is available for download. [15].

## 4. Discussion

The purpose of the NMAT is to complement the indicators collected in the JRF and to assist NITAGs and stakeholders—such as MoH, immunization programs, and partner organizations—in understanding how well a NITAG is functioning and identifying priorities for NITAG strengthening. After assessors identify which stage of maturity a NITAG has achieved for a given sub-indicator, the criteria described at the subsequent stage can be added to the NITAG’s strengthening plan (Fig. 2). The scoring scheme was designed to support NITAGs in prioritizing steps to increase their maturity in a stepwise manner, one level of maturity at a time. For example, a NITAG that meets the criteria for Developing first needs to meet the Intermediate criteria before improving its maturity score to Advanced.

The tool’s secondary output—percentages of the criteria met for each indicator—provides an additional result for the NITAG to review. This output allows NITAGs to record progress on a more granular scale than maturity level alone would enable. For example, a NITAG may not improve its maturity level on a given indicator between one assessment and the next, but could still demonstrate successful strengthening if it meets a greater percentage of the criteria for that indicator.

A NITAG can use the NMAT at any point in its life-cycle. An assessment conducted soon after a NITAG’s establishment (e.g., after 2–3 years) can help in identifying and planning that will improve the capacity of the NITAG. A NITAG’s maturity can be assessed prior to a training session or as part of a larger immunization program review, such as Expanded Program on Immunization (EPI) review or Joint External Evaluation (JEE). NITAGs may also benefit from an assessment when the secretariat’s hosting institution changes, or when a new executive secretary is appointed. Even long-established NITAGs that have been functioning for many years can benefit from a standardized assessment. For these NITAGs, gaps and weaknesses may be due to ways that the NITAG has operated historically; in this context there may be room to improve the NITAG by supplementing and refining its practices and procedures. Even NITAGs that achieve the highest level of maturity across multiple indicators may find room for improvement in other indicators. Finally, there may be situations where the level of maturity of a NITAG can decrease in one or more areas, between assessments; this

INDICATOR 3: RESOURCES AND SECRETARIAT SUPPORT						
	Basic	Developing	Intermediate	Advanced	Leading Edge	RESULTS
1 Secured Funding	N/A There is no funding to cover <b>basic operational costs</b> .	x There is funding to cover basic operational costs.	x A <b>guarantee of funding</b> from the government covers basic operational costs.	x Guaranteed funding is robust.	x There is access to funding that can cover travel expenses for national and international NITAG strengthening activities (regional or global NITAG meetings, collaborations, training).	Leading Edge
2 Access to Relevant Data and Other Necessary Tools	N/A NITAG has inconsistent access to regional and global <b>information</b> ; no access to local information.	x NITAG has adequate access to regional and global information.	x NITAG has consistent and comprehensive access to global and regional information, as well as adequate access to local information.	x NITAG has consistent and comprehensive access to reliable local, regional, and global information.	x NITAG has access to <b>raw data</b> or can request specific analyses of the data presented.	Advanced
3 Access to External Technical Expertise and Capacity-building Tools	N/A NITAG does not solicit or accept input from external experts.	x NITAG solicits or accepts input from <b>external experts</b> .	x NITAG routinely gets input from external experts.	x As appropriate, NITAG formalizes relationships with external experts through non-core membership.	x <i>Leading Edge will automatically fill if you select Advanced.</i>	Intermediate
4 Secretariat Support	N/A There is no officially appointed <b>Secretariat</b> to support the NITAG.	x Secretariat provides active administrative support.	x Secretariat provides basic technical support.	x Secretariat or designated support services are able to conduct and/or outsource advanced analyses.	x Secretariat has multiple full-time staff members with a mix of skill sets.	Intermediate
<b>OVERALL MATURITY LEVEL FOR THIS INDICATOR</b>						<b>Intermediate</b>

Fig. 2. Indicator 3 scoring rubric for a hypothetical NITAG, showing Intermediate maturity. The prioritized actions are those that would allow the NITAG to meet all criteria for each sub-indicator at Advanced, the next level of maturity.

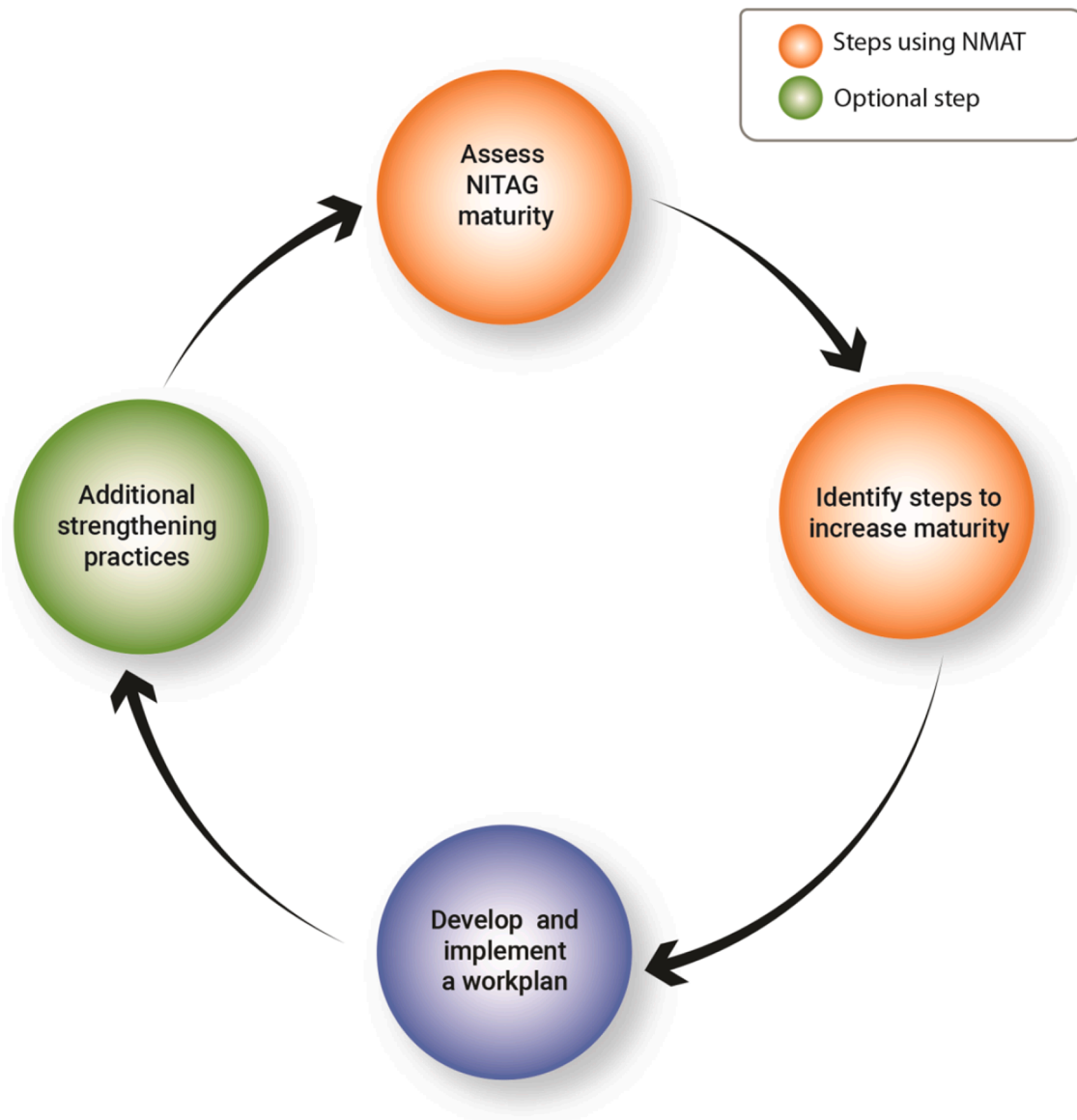


Fig. 3. Iterative Evaluation and Strengthening Process Using NMAT.

could be due to a number of factors, such as decreased funding for NITAG operations or large turnover in NITAG members/secretariat leading to loss of procedural or technical expertise.

NITAGs and their stakeholders can also repeat use of the NMAT as part of an iterative improvement process, or to document the impact of NITAG strengthening efforts (Fig. 3). For example, twinning partnerships—in which an experienced NITAG is paired with a new NITAG to provide training and support data collection and analysis—have been endorsed as a capacity-building strategy by the GNN. [16] The NMAT could be administered to establish a baseline maturity level and measure progress under twinning arrangements.

#### 4.1. Strengths & limitations

The key strength of the NMAT is that it delivers on the objective of evaluating NITAGs and providing clear recommendations for their strengthening. A major additional strength of the tool is the iterative, collaborative approach used to develop it. At each stage of the tool's development, perspectives from immunization policymakers operating in low, middle, and high-income settings in a variety of global regions were considered and incorporated. Another of the NMAT's strengths is its flexibility to be implemented through either self or external evaluation. There are advantages of each option. If sufficient resources are available, outside evaluators can lend objectivity, transparency and ensure balanced discussions. Potential benefits of self-assessment include that it can be conducted with limited resources, can be done at a pace convenient to the NITAG (e.g., in one session or through several weeks), and allows the Secretariat and NITAG to become familiar with the tool and maturity levels.

There were limitations to the process of developing the tool, and some challenges remain in using the tool. We sought to make the tool relevant to a variety of country contexts; however, fundamental differences among countries that do not actually reflect NITAG maturity could make rating according to standardized criteria challenging. For example, indicator 6, which assesses a NITAG's integration into the policymaking process, will look very different in a centralized government than a federated state government structure. Additionally, there are ways NITAGs can be successful that are not captured in the tool; for example, certain NITAGs may perform auxiliary functions such as advising governments on national immunization laws or off-label vaccine use. While these functions certainly add value, they are not universal enough to include in the tool and therefore do not factor into a NITAG's maturity. The tool is currently available only in English, French, Spanish and Portuguese. As the need arises, further translations will be considered.

#### 4.2. Lessons learned

Past assessments have identified that the likelihood of conducting a successful assessment is impacted by NITAG members' availability and willingness to participate, as well as by support from the country (e.g., MoH or national program) to conduct the assessment. [17,18] During the preparatory phase, it is important to clarify the objectives of the assessment to participants and make clear that it is not an audit. NITAG-related documentation must be accessible and available during the desk review phase. If stakeholder interviews are conducted, evaluators should be able to adapt their interview style (e.g., face to face or virtual) and type (e.g., use of open-ended questions may be preferable for heads of professional societies). For the group session, it is helpful to send the tool before meeting with participants, set rules for visiting participants, and focus the discussion on unclear aspects of whether the NITAG meets certain criteria.

Early usage of the NMAT has suggested that the tool can be used to provide insights and strategic direction for not only individual countries, but also regionally. During the first half of 2023, all of the WHO's Eastern Mediterranean Region countries conducted NMAT self-

assessments [19]. The results were used by individual NITAGs but also to generate an aggregate description of NITAG capabilities and to identify cross-cutting regional needs. A summary of these needs can be helpful to regional and global partners interested in strengthening NITAGs.

In developing the tool, the WG confronted the challenges of formulating a tool that was clear and specific, while not overly prescriptive. We also observed this challenge during the piloting of the tool. It was necessary to communicate to evaluation teams that reaching the leading edge level is not necessary or even desired for every NITAG. Rather, assessors should adapt the assessment findings to fit their country context. Also, some areas that the NMAT identifies for possible improvement will not be entirely under control of the NITAG to address (e.g., resources, integration into policy process).

## 5. Conclusion

The development of norms and standards for NITAG strengthening which form the basis of this tool, has created a solid foundation on which to move forward to improve immunization-related evidence-based decision making not only for individual countries but also globally. For countries, a main benefit in using the tool is to foster communication between the NITAG and MoH and enable prioritization of activities and resources (i.e., in-country and for external donors) to improve the NITAG. The benefits of fostering strong and transparent relationships between NITAGs and MOHs—as well as between NITAGs and the publics they serve—are numerous, including smoother policymaking and improved public buy-in to evidence-based immunization schedules. These outcomes can improve a country's resilience against vaccine-preventable diseases, as well as contribute to maintaining overall public confidence in the immunization program.

Looking forward, and as reflected in the global immunization strategy for 2021–2030 (Immunization Agenda 2030), [20] NITAGs wield substantial influence in ensuring strong leadership and actively contribute to monitoring, evaluation, and decisive action in reaching global objectives. Furthermore, assessment tools such as the NMAT could offer a chance to gauge advancements in enhancing NITAGs capabilities – an important component of IA2030 in improving country accountability and evidence-based decision-making.

#### Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

**CDC Disclaimer:** The opinions expressed in this article are the author's own and do not reflect the view of the Centers for Disease Control and Prevention, the Department of Health and Human Services, or the United States government.

#### CRediT authorship contribution statement

**Eliza Dryer:** Writing – review & editing, Writing – original draft, Project administration, Formal analysis, Conceptualization. **Abigail Shefer:** Writing – review & editing, Writing – original draft, Project administration, Formal analysis, Conceptualization. **Shalini Desai:** Writing – review & editing, Writing – original draft, Formal analysis, Conceptualization. **Lance Rodewald:** Writing – review & editing, Writing – original draft, Formal analysis. **Magdalena Bastias:** Writing – review & editing, Writing – original draft, Formal analysis. **Nathalie El Omeiri:** Writing – review & editing, Writing – original draft, Formal analysis. **Sidy Ndiaye:** Writing – review & editing, Formal analysis. **Kori Cook:** Writing – review & editing, Formal analysis. **Louise Henaff:** Writing – review & editing. **Erin Kennedy:** Writing – review & editing, Writing – original draft, Supervision, Project administration, Methodology, Conceptualization.

## 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.

## Data availability

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

## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.vaccine.2024.05.053>.

## References

- [1] Duclos P. National Immunization Technical Advisory Groups (NITAGs): Guidance for their establishment and strengthening. *Vaccine* 2010;28:A18–25. <https://doi.org/10.1016/j.vaccine.2010.02.027>.
- [2] World Health Organization. *Global Vaccine Action Plan 2011-2020*. 2013. <https://www.who.int/publications/i/item/global-vaccine-action-plan-2011-2020>.
- [3] Global NITAG Network. NITAG Network Map. Updated 2022. <https://www.nitag-resource.org/network/map>.
- [4] World Health Organization. WHO/UNICEF Joint Reporting Process. Updated March 2021. <https://www.who.int/teams/immunization-vaccines-and-biologicals/immunization-analysis-and-insights/global-monitoring/who-unicef-joint-reporting-process>.
- [5] Supporting Independent Immunization and Vaccine Advisory Committees. Evaluating National Immunisation Technical Advisory Groups' (NITAGs) performance: Practical tool. 2016.
- [6] World Health Organization, Centers for Disease Control and Prevention. Assessment tool for National Immunization Technical Advisory Groups. 2018.
- [7] Global NITAG Network. *Third Global NITAG Network Meeting: Record of Discussion*. 2018. <https://www.nitag-resource.org/resources/3rd-gnn-meeting-record-discussion>.
- [8] Paulk MC, Curtis B, Chrissis MB, Weber CV. Capability maturity model for software. Citeseer; 1991.
- [9] McCarthy CF, Kelley MA, Verani AR, St. Louis ME, Riley PL. Development of a framework to measure health profession regulation strengthening. *Eval Program Plann* 2014;46:17–24. <https://doi.org/10.1016/j.evalprogplan.2014.04.008>.
- [10] Centers for Disease Control and Prevention. *National Inventory of Core Capabilities for Pandemic Influenza Preparedness and Response*. 2010. [https://www.cdc.gov/flu/pdf/professionals/national\\_inventory\\_of\\_core\\_capabilities.pdf](https://www.cdc.gov/flu/pdf/professionals/national_inventory_of_core_capabilities.pdf).
- [11] Storm I, Harting J, Stronks K, Schuit AJ. Measuring stages of health in all policies on a local level: The applicability of a maturity model. *Health Policy* 2014;114(2):183–91. <https://doi.org/10.1016/j.healthpol.2013.05.006>.
- [12] USAID. One Health APP: Assessment for Planning & Performance. Accessed October 2019. <https://www.onehealthapp.org/about>.
- [13] Blau J, Sadr-Azodi N, Clementz M, et al. Indicators to assess National Immunization Technical Advisory Groups (NITAGs). *Vaccine* 2013;31(23):2653–7. <https://doi.org/10.1016/j.vaccine.2013.01.047>.
- [14] Ndiaye S, Wibabara Y, Kennedy E. *Report of the Joint WHO US/CDC External Evaluation Mission: Uganda National Immunization Technical Advisory Group (UNITAG)*. 2022. [https://www.nitag-resource.org/sites/default/files/2022-09/UNITAG%20ASSESSMENT\\_REPORT\\_FINAL-14042022.pdf](https://www.nitag-resource.org/sites/default/files/2022-09/UNITAG%20ASSESSMENT_REPORT_FINAL-14042022.pdf).
- [15] NITAG Maturity Assessment Tool (NMAT). Global NITAG Network. <https://www.nitag-resource.org/external/nmat/#/>.
- [16] Global NITAG Network. *Fourth Global NITAG Network Meeting: Record of Discussion*. 2020. April 2020. [https://www.nitag-resource.org/sites/default/files/2020-05/20GNN%20\\_04\\_27\\_2020\\_final.pdf](https://www.nitag-resource.org/sites/default/files/2020-05/20GNN%20_04_27_2020_final.pdf).
- [17] Dabanch J, González C, Cerda J, et al. Chile's National Advisory Committee on Immunization (CAVEI): Evidence-based recommendations for public policy decision-making on vaccines and immunization. *Vaccine* 2019;37(32):4646–50. <https://doi.org/10.1016/j.vaccine.2019.06.069>.
- [18] Jroundi I, Benazzou M, Yahyane AH, Alaoui MT, El Omeiri N. Moroccan National Immunization Technical Advisory Group: a valuable asset for the national immunization program and the immunization agenda in the EMRO region. *Hum Vaccin Immunother* 2021;17(8):2788–92. <https://doi.org/10.1080/21645515.2021.1888622>.
- [19] Sume GE, Hasan Q, Shefer A, et al. Region-wide assessment of National Immunization Technical Advisory Groups (NITAGs) using the NITAG Maturity Assessment Tool (NMAT) - Experience from the Eastern Mediterranean Region of the World Health Organization, 2023. *Vaccine* 2024;42(9):2239–45. <https://doi.org/10.1016/j.vaccine.2024.02.058>.
- [20] World Health Organization. *Immunization Agenda 2030: A Global Strategy to Leave No One Behind*. 2020. <https://www.who.int/teams/immunization-vaccines-and-biologicals/strategies/ia2030>.