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Developing standardized competencies to strengthen immunization systems and workforce ☆

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ABSTRACT

Despite global support for immunization as a core component of the human right to health and the maturity of immunization programs in low- and middle-income countries throughout the world, there is no comprehensive description of the standardized competencies needed for immunization programs at the national, multiple sub-national, and community levels. The lack of defined and standardized competencies means countries have few guidelines to help them address immunization workforce planning, program management, and performance monitoring. Potential consequences resulting from the lack of defined competencies include inadequate or inefficient distribution of resources to support the required functions and difficulties in adequately managing the health workforce. In 2015, an international multi-agency working group convened to define standardized competencies that national immunization programs could adapt for their own workforce planning needs. The working group used a stepwise approach to ensure that the competencies would align with immunization programs' objectives. The first step defined the attributes of a successful immunization program. The group then defined the work functions needed to achieve those attributes. Based on the work functions, the working group defined specific competencies. This process resulted in three products: (1) Attributes of an immunization program described within eight technical domains at four levels within a health system: National, Provincial, District/Local, and Community; (2) 229 distinct functions within those eight domains at each of the four levels; and (3) 242 competencies, representing eight technical domains and two foundational domains (Management and Leadership and Vaccine Preventable Diseases and Program). Currently available as a working draft and being tested with immunization projects in several countries, the final document will be published by WHO as normative guidelines. Vertical immunization programs as well as integrated systems can customize the framework to suit their needs. Standardized competencies can support immunization program improvements and help strengthen effective health systems.

1. Introduction

Global and regional immunization initiatives have supported low- and middle-income countries in strengthening immunization program capacity and introducing new vaccines [1]. The Global Vaccine Action Plan (GVAP), a framework to prevent millions of deaths by 2020, describes building the capacity of managers and frontline health workers as a recommended action to support strong immunization programs [1]. In response, immunization programs in ministries of health throughout the world have included workforce development activities as part of their program

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strategy, such as the Reaching Every District approach being used in 53 countries [2]. Countries such as Canada and the United Kingdom have identified required competencies for health workers at the service delivery level [3,4]. There also has been global support for developing standard training materials for immunization staff. The World Health Organization (WHO) has been a trusted source for providing standard training materials for countries to improve immunization program staff performance, particularly by mid-level managers [5]. Despite these and other activities that aim to develop a competent immunization workforce, there has not been a comprehensive description of all the competencies that are needed for an immunization program to address workforce planning, management, and performance at the national, multiple sub-national, and community levels.

Definitions of competency vary depending on the context [6]. We prefer the definition of competency from the University of Nebraska-Lincoln because it connects competencies to an organization's objectives: "the combination of observable and measurable knowledge, skills, abilities, and personal attributes that contribute to enhanced employee performance and ultimately result in organizational success" [7]. Using this approach, an organization, such as a country's immunization program, sets objectives and determines measures of achievement. It then defines the work functions that are needed to meet those objectives. These work functions, in turn, determine the competencies that are needed within the organization's workforce. These competencies inform the processes of finding and hiring new staff, developing employees' skills, and planning future human resources needs. Thus, competencies, when designed well, guide several aspects of managing human resources and directly support achievement of the organization's objectives. Public health programs are using competency-based approaches for human resources planning, including for pandemic preparedness [8]. Fig. 1 demonstrates how competencies are directly tied to an organization's objectives.

Potential consequences resulting from the lack of defined competencies include difficulties in adequately defining roles and responsibilities of the health workforce at all levels of the immunization program and inadequate distribution of resources to support the required work functions. The Strategic Advisory Group of Experts on Immunization (SAGE) commented in the 2016 GVAP mid-term review that countries with decentralized health systems have experienced prolonged confusion over roles and responsibilities within the immunization program [9]. For example, at a recent SAGE meeting Gilani reported that after immunization program implementation responsibilities devolved from national to provincial level in Pakistan, leadership encountered challenges harmonizing specific tasks between national and state levels [10]. A lack of standard competencies also has a great impact on workforce development—without standards to measure against, training objectives and needs cannot be properly identified, performance gaps cannot be measured, and training curricula might not adequately address actual performance needs.

In this paper, we describe the work of the Standard Immunization Competencies project. The project had two objectives: (1) to develop a description of the attributes of a successful national immunization program and (2) to define the competencies needed to successfully perform the key functions of an immunization program. The project aimed to produce a practical document describing standard immunization competencies that could be used to inform national immunization policy and practice, particularly in low- and middle-income countries.

The project was expected to provide three major benefits:

(1) A common language for describing workforce competency requirements within an immunization program.

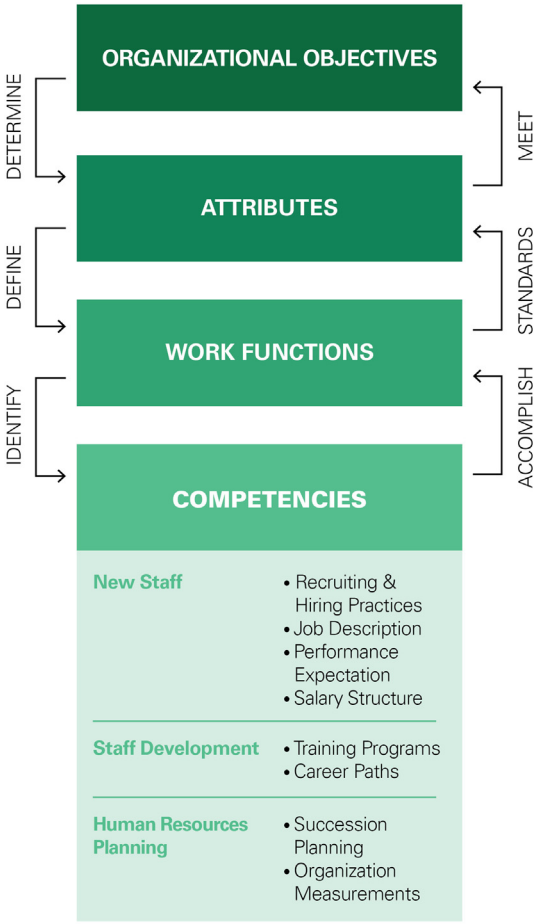

Fig. 1. Human resources needs are based on organizational objectives.

(2) Harmonization of all the elements of workforce planning and development, such as recruiting and hiring new staff, developing existing staff, and planning.
(3) Improved quality of training for the immunization program workforce by providing guidance to design, develop, and evaluate training that better supports the organization's objectives.

2. Material and methods

2.1. Working group formation and processes

In 2015 a working group of 32 global immunization partners launched the standard immunization competencies project. The working group included representatives from four leading agencies in global immunization, an Asian ministry of health immunization program, and representatives of country-specific nongovernmental organizations. Select group members with expertise in competency modeling, adult education, routine immunization, and immunization program policy and planning worked on literature reviews and content development. Using a worksheet and written instructions, additional working group members with general expertise in immunization programs or with expertise in a specific aspect of immunization (the "review team") reviewed drafts and provided additional project support. Key principles guiding the project included (1) using an inclusive process, (2) drawing upon diverse subject matter experts in the areas of immunization and workforce development, and (3) building on existing accepted content where possible.

The group worked under the assumption that the effectiveness and success of the immunization program depend on the following:

(1) The effectiveness of the broader health system.
(2) Factors such as decentralization (which can move immunization program functions between national, provincial, and district levels) and presence or absence of good coordination, communication, and feedback processes among health system levels.
(3) Presence of several conditions not specific to the program itself, including good governance, social and political stability, and basic national infrastructure (for example, information technology, laboratory systems, and effective fiscal and human resources management).

2.2. Competency modeling guidelines

The working group followed best practices for competency modeling described by Campion et al. as they were based on applied, academic, and professional experiences and lessons learned [11]. In addition, the working group adopted the level of rigor scale developed by Shippman et al. which considered ten variables, such as 'method of investigation' and 'detail of descriptor content' [6]. These variables use five levels (ranging from 'low rigor' to 'high rigor') in an effort to provide a measure of acceptability for job analysis and competency modeling. The working group ultimately used seven of the ten variables described by Shippman and aimed to achieve medium high to high rigor for each. The seven variables and their definitions are listed in Table 1.

Table 1
Variables used for level of rigor analysis in competency modeling and working group achievement.

Variable	Definition	Project working group achievement
(1). Method of investigation	The rigor of thinking behind the selection of data collection methods	High rigor
(2). Procedures for developing descriptor content	The degree to which subject matter experts are involved in developing competency descriptors compared with selecting pre-existing descriptors	High rigor
(3). Detail of descriptor content	The clarity, crispness, and lack of overlap of content descriptors and categories	High rigor
(4). Link to business goals and strategies	The extent to which there has been an effort to identify and link broader organizational goals to the research	High rigor
(5). Content review	The degree to which job content experts are involved in reviewing competency categories and descriptors	Medium/High rigor
(6). Assessment of reliability	The level of effort made to assess the consistency or reproducibility of the final set of competency descriptors	Medium rigor
(7). Documentation	The level of effort made to provide documentation of the research approach, methods used, experts involved, and results obtained	High rigor

2.3. Data collection methods

Because immunization tasks and processes were already widely documented, and some competency-based training had been in use for many years, the working group agreed to conduct a situational analysis rather than primary data collection. The group used PubMed and Google Scholar to search the literature using the Medical Subject Headings (MeSH) terms 'immunization program' or 'vaccination' and 'competencies' [12,13]. They conducted gray literature searches by exploring and reviewing their global immunization partners' websites, including those of the Bill & Melinda Gates Foundation (BMGF), Gavi, the Vaccine Alliance (Gavi), The US Centers for Disease Control and Prevention (CDC), John Snow Incorporated (JSI), PATH, UNICEF, United Kingdom Department for International Development (DFID), United States Agency for International Development (USAID), and WHO.

3. Defining attributes and assessing work functions

The working group used a stepwise approach to ensure that the standard competencies would connect to immunization program objectives (Fig. 1). The group first defined the attributes of an immunization program capable of meeting GVAP objectives, then identified the work functions that are required to achieve these attributes. The last step would define the competencies that are needed by the immunization program workforce to perform the work functions successfully.

To define the attributes of a successful immunization program, the working group completed a review of strategic immunization documents, guidelines, training materials, and reports, including the GVAP; draft Expanded Programme on Immunization (EPI) review guidelines from the WHO African and Eastern Mediterranean regional offices; the *Mid-Level Managers Immunization Training*; the *Reaching Every District* guidelines; the Polio Endgame strategy; the BMGF routine immunization system model; and the USAID Immunization Essentials Field Guide [1,5,14,15,16,17,18,19]. Attributes were identified by locating program performance indicators, conclusions from program reviews, and characteristics described in the literature as indicators of quality immunization services. We used the same sources to develop drafts of work functions by considering what work is required to achieve those attributes.

Drafts of immunization program attributes and work functions were distributed to the entire working group for review and comment. Reviewers' comments, as well as additional literature reviews and meetings with subject matter experts, informed subsequent versions of the attributes and work functions drafts.

3.1. Validating work functions and defining competencies

Now ready to develop the competencies, we returned to the three methods of data gathering that had been used thus far: literature review, subject matter expert input, and working group reviews. We also conducted key informant interviews with immunization program staff members from four countries and five WHO regional offices to help us understand the current staff responsibilities and competency requirements. Their responses provided an additional check on the attributes and work functions. We asked the key informants two major questions:

(1) *Thinking about your job at _____, what are your main responsibilities or duties when working with immunization activities or the Expanded Program on Immunization (EPI)*?
(2) *What knowledge and skills should a person have to successfully accomplish these responsibilities*?

If the person interviewed was a supervisor, they were asked the same questions for the staff positions they supervised.

We shared a draft version of the competencies with the working group and other subject matter experts for comment and asked

them to rank the relative importance of each competency statement using a scale of High, Medium, Low, or No. The rankings and other modifications informed subsequent drafts.

We then reconciled the variability among specific country responses. For example, some countries organize their health system into five levels. In such cases, we consolidated the additional levels into the level in our model that corresponded most closely to the work function that was being described.

4. Results

The working group found that the work functions and competencies for vaccine delivery at the community level were the most thoroughly documented within the published and gray literature, including those described for Canada and the United Kingdom [3,4]. Some competencies for mid-level managers have also been documented and are in widespread use [5]. Guidelines such as *Immunization in Practice: A Practical Guide for Health Staff* describes functions related to vaccine cold chain, vaccine safety, and planning and managing an immunization session at the community level [20]. Although these sources provided the most robust information in their respective areas, they did not cover all activities the working group found were needed to accurately represent a successful immunization program. These gaps were largely filled by information obtained from the key informant interviews. The key informant interviews were held with 21 staff members from four countries, including Bangladesh (one national partner staff member), India (one national partner staff member), Kenya (18 district and health facility government staff members), and Yemen (one retired national government staff member).

Following the best practices for competency modeling described previously, the working group was able to achieve at least medium high level of rigor for six of the seven Shippman variables that were pertinent to our project (Table 1).

The working group consolidated all the findings to create three products in stepwise fashion: attributes, work functions, and competencies. Because the literature review did not reveal a standardized rubric for organizing the components of an immunization program, we defined ten domains across which attributes, functions, and competencies could be categorized. Seven primary technical domains span all levels of the health system, with specific attributes, functions, and competencies varying depending on the level. Fig. 2 describes 59 attributes of a 'successful' immunization program across the seven primary domains and four levels of a health system (National, Province, District/Subdistrict, and Community).

Two of the ten domains ('management and leadership', and 'vaccine preventable diseases and programs') reflect competencies that cut across all domains of an immunization program and are required at some level of proficiency by all immunization staff members regardless of the health system level. We refer to these as 'foundational' domains. The tenth domain, 'service delivery,' describes work functions and competencies that are conducted solely at the community and district/subdistrict level.

The working group identified 229 distinct work functions across the eight domains and four levels that are required to support the defined attributes (there was a range of 2–15 work functions per domain and level). These work functions, in turn, were used to identify 242 distinct competencies, which were organized by health system level and domain. Categorization of competencies was achieved via consensus, for example functions and competencies related to supportive supervision are located in the Human Resources domain and not as a part of Management and Leadership.

Table 2 provides a high-level summary of the 10 foundational and technical competency domains. Table 3 provides a detailed example of competencies for one of the foundational domains, Management and Leadership; and Table 4 provides a detailed example of competencies for a technical domain, Safety of Vaccines and Immunization. Both tables describe the competencies that are needed to conduct work functions across the four levels of the health system.

The working group then consolidated the work into one document, organized by levels within the health system. Internationally recognized subject matter experts who had not been involved in the project reviewed the document and provided comments on content and format. The consolidated document was then circulated among the working group review team for final review, followed by field-testing with workforce-related projects. The group agreed that the consolidated document would be considered a 'draft' so that lessons learned through the field testing could be incorporated before publishing the final framework. WHO is developing a web page to host both English and French versions of the framework.[2] The working group will use the findings from the field experiences to improve and finalize the framework and to develop processes and tools that support activities related to new staff recruitment and orientation, staff development, and human resources planning.

5. Discussion

Based on the available published literature found via literature searches, this is the first time that a comprehensive set of competencies, including both technical and foundational, has been described for immunization programs across all levels of the health care system. We believe a standardized framework for immunization competencies is important for providing a common language, harmonizing elements of workforce planning and development, and supporting robust training programs. The immunization competencies framework is expected to be a particularly beneficial resource as country immunization programs become more complex, with introductions of new vaccines and implementation of service delivery across individuals' entire life course.

Although still in draft form, the immunization competencies framework has been used in several workforce-planning initiatives. In Ghana, the CDC staff used the competencies to assist the government with a review of the pre-service training curriculum for nurses. In the Middle East region, trainers have used the competencies for informing immunization program training needs assessments and training program design. CDC staff members used all three components of the framework in Ukraine when consulting with the national immunization staff about its organizational structure and job descriptions.

A simplified version of the competency framework serves as the basis for Gavi's Programme Capacity Assessments. Initial response has been positive: an assessment team member working in Chad believes that the framework should be used "*once the EPI reorganization is launched in order to write strong job descriptions, recruit new staff, onboard them, etc.*" Similarly, a member of a team working in Mali said that the framework "*efficiently details the key activities and competencies for an effective/efficient EPI program, and the mapping attributes structured by regional level is relevant*" (R Kumar 2018, personal communication, 7 August).

Standardization of competencies provides countries with a broad framework that can be adapted for the local situation to reduce inefficiency, increase consistency, and provide a baseline for monitoring and measuring performance. These benefits, in turn, could potentially lead to improvements in quality of service delivery and strengthening of the overall health system. As countries

[2] The competencies framework draft will be available on the WHO website in 2019.

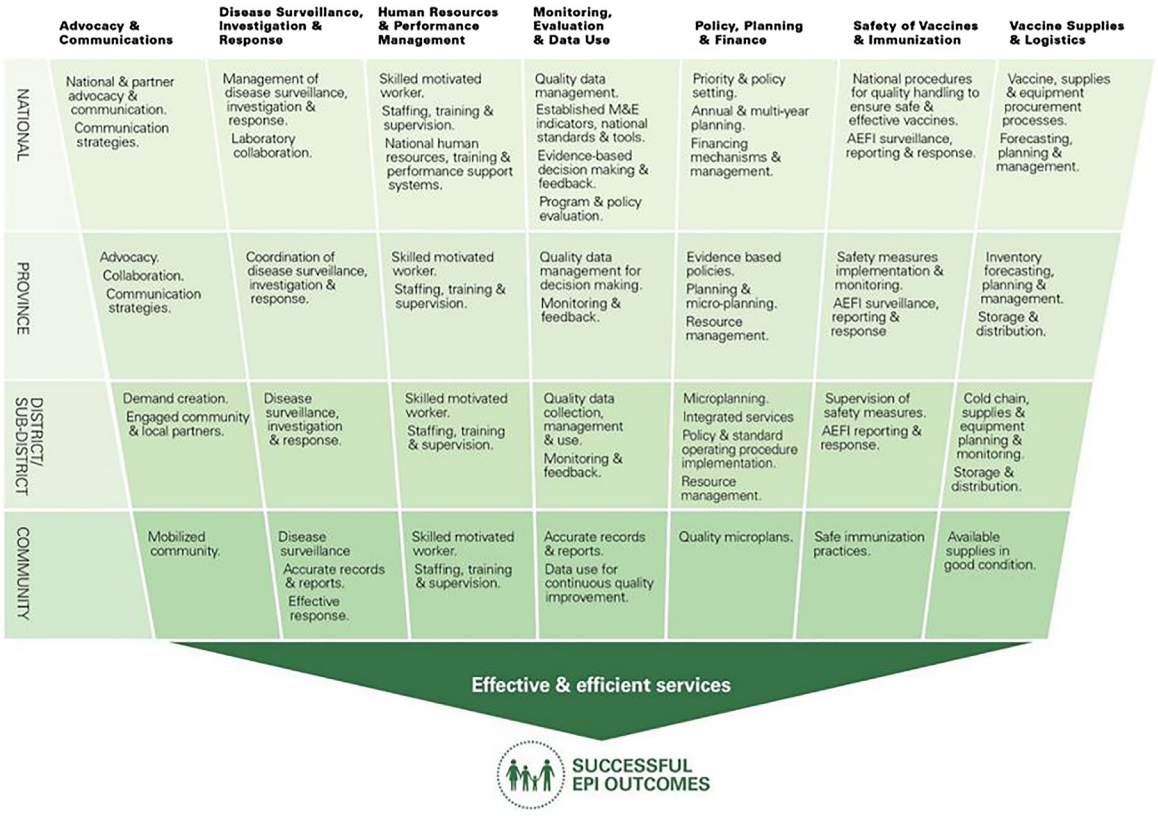

Fig. 2. Attributes of a successful EPI by domains and organizational level.

Table 2
Summary of immunization workforce competencies.

Foundational competencies	
Management and Leadership	Set a vision and direct people and resources to support universal access to all relevant vaccines for all at risk
Vaccine Preventable Diseases and Program	Explain how vaccines work and apply knowledge about immunizing agents per national guidelines
Technical competencies	
Advocacy and Communications	Effectively communicate verbally or in writing in a manner appropriate for the target audience in matters related to EPI
Disease Surveillance, Investigation, and Response	Operate systems that monitor immunization coverage, VPD incidence and prevalence, and respond to VPD outbreaks
Human Resources and Performance Management	Plan and manage staffing, performance management and workforce development for immunization staff and community volunteers, either as part of a human resources department or in a technical management position
Safety of Vaccines and Immunization	Develop & maintain processes to ensure safe storage, transport, administration, and disposal of vaccine
Monitoring, Evaluation, and Data Use	Develop and use M&E systems to monitor the effectiveness of EPI activities at all levels of the system
Policy, Planning, and Finance	Develop and implement policies and plans that address implementation, quality and coverage objectives
Vaccination Service Delivery	Safely deliver appropriate vaccines to the target population in a manner that optimizes coverage
Vaccine, Supplies and Logistics	Plan and manage systems and supplies to ensure consistent supply chain and safe transport and storage of vaccine

transition to integrated health systems, standardized competencies can inform how best to identify and meet the workforce requirements for the overall health care system.

We are hopeful that, by including technical as well as management and leadership competencies in the same framework, decision makers will address capacity building in an integrated fashion. For example, instead of designing and offering technical and management training separately, immunization programs can develop competency-based training that is holistic. Ghana Health Services' EPI program used this approach in 2017 and 2018 when it delivered workshops for health facility workers that integrated technical topics such as data analysis and defaulter tracing with management topics such as root cause analysis and process improvement.

Though packaged as a 3-part framework (attributes, functions, and competencies), each of the components can be used independently to support workforce management within an immunization program. Managers can use the attributes as part of their programmatic reviews to uncover performance challenges occurring in specific levels or domains. Work functions can inform multiple aspects of managing human resources, from writing job descriptions to recruiting applicants and setting performance expectations. Competencies can be used for designing or reviewing training curricula, assessing skills, setting salary structures, and identifying career paths. Competencies can also be used for devising country-specific accreditation standards and international benchmarks. All three components can be considered when developing immunization program monitoring and evaluation plans to ensure that workforce activities align with program objectives.

It is important to emphasize that the work functions and competencies are not intended to prescribe organizational structures or staffing recommendations. On the contrary, this tool can assist governments, health planners, and program managers by provid-

Table 3
Sample foundational competency: management and leadership.

Management and Leadership	
National	Define and communicate the organization's vision, mission and strategies Make effective, ethical, and timely decisions that match available resources Integrate core values, integrity, equity and accountability throughout all organizational practices Foster a culture of evidence-based decision making, use of scientific knowledge and continuous improvement Communicate verbally and in writing in a credible, effective way to various target audiences Use interpersonal communication skills to motivate, collaborate, and build alliances Use technology such as the internet, smart phones and informatics applications to complete immunization tasks Conduct situation analysis (e.g. stakeholder, landscape) Solve problems and deal effectively with uncertainty and complexity Manage time by prioritizing and delegating work Create a safe and trust-based work environment Plan and manage projects Conduct a meeting Supervise staff performance
Province	Set short term organizational goals and performance objectives Make effective, ethical, and timely decisions that match available resources Provide constructive and corrective feedback in a respectful and constructive manner Manage time by setting priorities and delegating tasks Create a safe and trust-based work environment Lead a quality improvement project Manage a provincial level project Develop a budget Conduct a meeting Supervise staff performance
District/ Sub-district	Set short term organizational goals and performance objectives Make effective, ethical, and timely decisions that match available resources Mentor staff in a respectful and constructive manner Take action based on evidence and stakeholder priorities Manage time by setting priorities Create a safe and trust-based work environment Manage a district level project Develop a budget Conduct a meeting Supervise staff performance
Community	Manage time by setting priorities Make effective, ethical, and timely decisions that match available resources Delegate tasks Work as part of a team to achieve organizational objectives Complete work tasks while under pressure Use interpersonal communication skills to collaborate with and motivate others Conduct a meeting Create a safe and trust-based work environment

Table 4
Sample Technical Competency: Safety of Vaccines and Immunization.

Safety of Vaccines and Immunization	
National	Develop and implement a vaccine and immunization safety-monitoring plan Design and implement an adverse event following immunization (AEFI) surveillance, response, and investigation system Use technology to collect, analyze, and interpret vaccine safety data Make programmatic decisions based on evidence, relevant national legislation, international standards, and regulations and safety databases Write standard operating procedures and technical reports for vaccine and immunization safety Conduct AEFI program quality assessments and make improvement recommendations
Province	Implement and monitor safety measures and policies Manage AEFI surveillance and reporting Collect, analyze, and interpret vaccine and immunization safety monitoring data Write technical reports for vaccine and immunization safety Lead an AEFI investigation
District/Sub-district	Collect, analyze, and interpret vaccine and immunization safety monitoring data Implement safety and waste disposal procedures Supervise safety measures (vaccine, injection, waste) Investigate and report AEFIs
Community	Handle vaccines and injection supplies safely Manage waste appropriately Monitor and report AEFIs Take infection prevention measures

ing guidance as they navigate change in the dynamic world of immunization. Fig. 3 illustrates the immunization program as a system of interconnected processes, using Rummler and Bache's adaptive systems model [21]. The model demonstrates how the work functions described in the competencies framework are interdependent. For example, planning is both informed by and informs disease surveillance and investigation. Immunization programs in resource-limited settings can use the competencies framework along with the adaptive systems diagram to set priorities and to collaborate with other health programs, such as maternal/child health or disease surveillance, and to design cross-departmental processes that ensure quality immunization services.

Fig. 3 also includes five key environmental influencers, such as government and socioeconomic. As described in our assumptions, the effectiveness and success of an immunization program relies not only on the dependencies within immunization but also on the effectiveness of the broader environment. It is possible that, in the course of conducting a competency assessment, an immunization program will uncover opportunities to improve processes in the broader health system.

WHO has proposed publishing the framework as normative guidance for countries' immunization programs. We presented the competencies framework at an April 2017 meeting of SAGE, at which SAGE agreed with WHO's proposal and emphasized the importance of looking at work functions and competencies from a health system perspective. We believe the adaptive systems diagram illustrates the systems perspective that SAGE values. SAGE further recommended piloting the framework within a variety of country contexts [22]. The working group is currently seeking country partners and developing a protocol for the pilot process. Additional future work includes developing workforce planning and management tools that are based on the competencies framework, such as sample job descriptions and workforce mapping tools.

5.1. Limitations

Because the working group did not have equal geographic representation, we may not have adequately captured the variability of country immunization program structures. A detailed review of existing literature mitigated this limitation, and we paid particular attention to literature which has had global reach, such as WHO's *Mid- Level Managers Immunization Training*.

Good practice in competency modeling advises against developing such statements in so much detail as to make the final product unusable [11]. In conformance with this best practice, the competency statements may not be sufficiently precise for all workforce planning activities. However, country staff members can use the

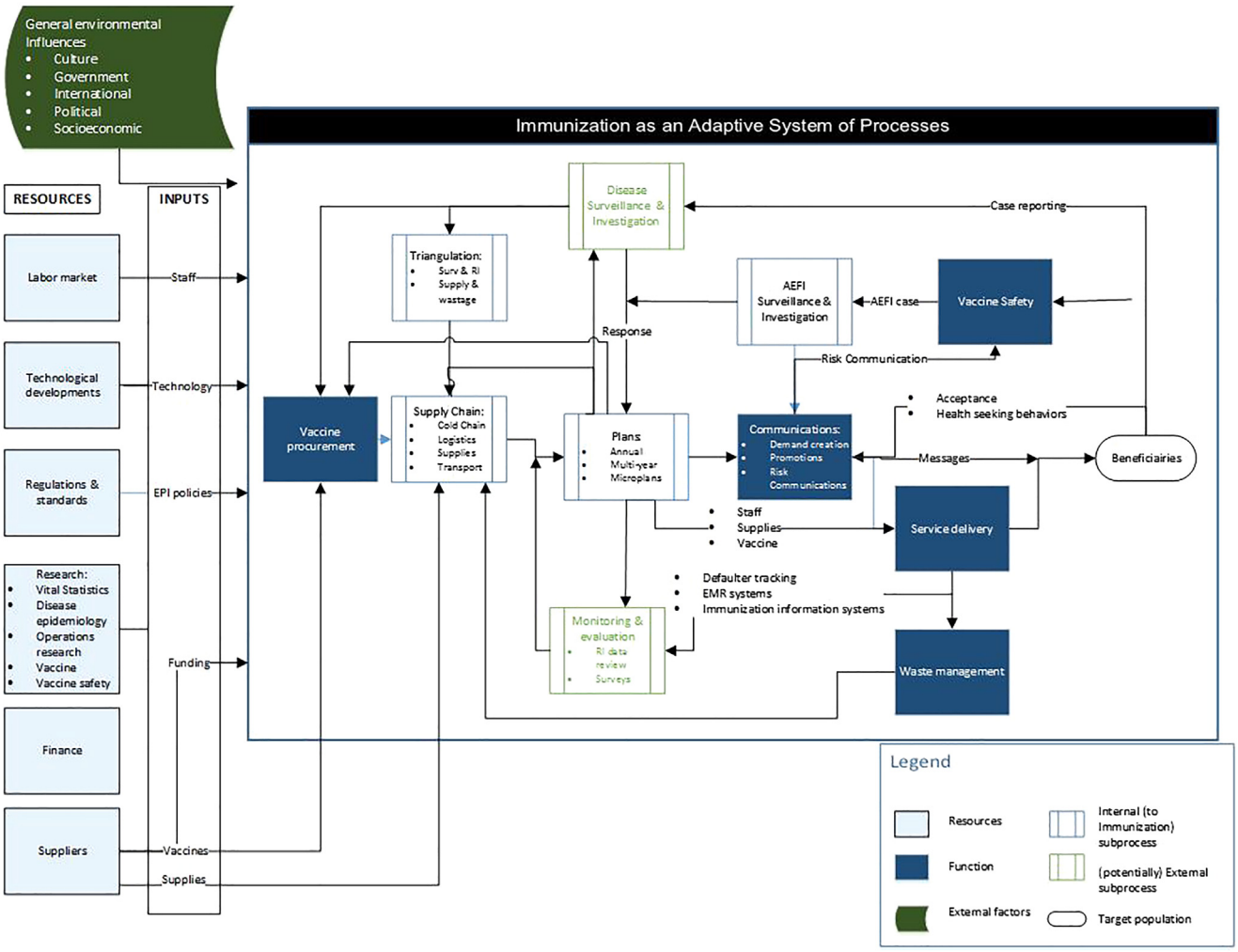

Fig. 3. Illustration of immunization program as an adaptive system.

framework to develop finer levels of detail according to their needs. A third limitation was the risk of not getting complete candor when interviewing key informants about sensitive personnel matters.

6. Conclusion

With the regular introduction of new vaccines, the integration of immunization activities into the broader health system, and the emergence of new technologies, immunization programs are increasing in complexity. At the same time, countries of every economic status are experiencing shortages in the workforce [23]. Whether managing decentralization, integrating various health systems, improving monitoring and evaluation methods, or transitioning away from disease eradication initiatives such as the global initiative to eradicate polio, the framework provides clarity about the work that must be done and the competencies needed to support that work. Standardized competencies can support immunization program improvements and contribute to effective health system strengthening, ensuring a workforce fit for purpose today and into the future.

Declaration of interest form

All authors declare that they have no competing interests and have approved the manuscript for submission.

Contributors

DT led the project, led the working group communications, recommended competency modeling decisions, conducted literature reviews, collected and interpreted data, developed drafts, reviewed comments, led the article development, and wrote substantial portions of the article. AP was secondary lead, conducted literature reviews, collected and interpreted data, developed drafts, reviewed comments, and wrote portions of the article. PB contributed to development of the initial concept of the work and provided substantive input into the implementation of the work and reviewing of the paper. DL made substantial contributions to the design of the framework; provided technical content and review for all framework components and wrote portions of the article. JB conducted advocacy for the project, reviewed all components of the framework, identified key subject matter experts, convened a subject matter expert workshop, and reviewed drafts of the article. SS arranged data collection in Kenya, reviewed all framework components and drafts of the article. TR assisted with literature review, made substantial contribution to interpretation of data, reviewed all framework components and wrote portions of the article. MA participated in the subject matter expert workshop, revised content revisions, and reviewed drafts of the article. CL reviewed draft versions of the framework, and assisted with writing the article, primarily in managing a graphic artist to develop figures. JA materially contributed to the design of the underlying work (e.g. to the

definition of required management capacities of EPI teams) and provided input on the implementation of the study on an ongoing basis (e.g. towards structuring the outputs), contributed to the preparation of the article, and regularly reviewed the content. LS contributed to conception and design of the framework, identified subject matter experts, reviewed drafts of all framework components. HS was the overall project leader, conducted project advocacy, advised the working group on project activities, provided technical content, advised the design of the article, reviewed all framework components, and reviewed multiple drafts of the article.

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Appendix A. Supplementary material

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