Vaccine 40 (2022) 3581–3587

Contents lists available at ScienceDirect

Vaccine

journal homepage: www.elsevier.com/locate/vaccine

Building leadership and management competencies of national immunization teams in 16 Gavi-eligible countries through the EPI leadership and management programme

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ARTICLE INFO

Article history:
Received 21 January 2022
Received in revised form 22 April 2022
Accepted 23 April 2022
Available online 14 May 2022

Keywords:
Vaccination
Immunization programs
Health systems strengthening
Leadership and management
Health management education

ABSTRACT

Background: Strengthening leadership and management competencies among national Expanded Programme on Immunization (EPI) teams will be critical to achieving global immunization targets and other sustainable developmental goals. However, there is little empirical evidence of the effectiveness of investments in leadership and management capacity in the context of national EPI programs. Therefore, we sought to evaluate the EPI Leadership and Management Programme (EPI LAMP), a nine-month certificate program for EPI teams in national Ministries of Health from Gavi priority countries in Anglophone and Francophone Africa and Asia.

Methods: We used a mixed-methods longitudinal evaluation to describe EPI LAMP at four levels: (1) participant response to the training experience based on program administration records and satisfaction surveys; (2) change in management and leadership skill based on competency surveys and exit interviews; (3) change in behavior in the workplace based on exit interviews; and (4) impact of the training on EPI program performance based on the results of each delegate's leadership project.

Results: In the first three cohorts, the programme engaged 16 countries (63 participants) and achieved an 86% graduation rate (54 alumni). Participants demonstrated significant improvement in management and leadership competencies across eight domains with the largest improvement observed in the domain of governance and leadership. Women showed greater increases than men, especially in the domains of Operations Management and Political Advocacy and Dialogue. We observed no difference in the gains made by French-speaking delegates compared to English-speaking participants. Breakthrough projects developed by each team improved EPI program performance, as measured by metrics specific to each project.

Discussion: Our results show that team-based leadership programs can foster improvements in management practice, collaboration, and problem-solving, and that engagement the broader policy and organizational context is needed to foster the systems thinking capacity required to address complex challenges and improve system performance.

1. Introduction

Immunization is one of the most cost-effective investments in global health [1], and reaching every child with immunization is the major strategic goal of Gavi, the Vaccine Alliance. Despite significant increase in vaccination coverage in low- and middle-income countries (LMICs), 14 million children were not reached by routine immunization in 2019 [2]. EPI programs must adapt and evolve to address complexities such as reaching zero- dose children, reaching children in conflict settings and other humanitarian crises, managing an increasingly complex portfolio of routine immunizations, overcoming weaknesses in primary health care systems, and, more recently, ensuring continuity of services in light of COVID-19. Strengthening leadership and management competencies [3,4] among national EPI teams will be critical to achieving global immunization targets and other sustainable development goals [5,6,7].

In response, Gavi has developed a small but strategic portfolio of investments in leadership and management to support EPI

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https://doi.org/10.1016/j.vaccine.2022.04.070
0264-410X/

program performance. Drawing on literature from primary health systems strengthening more broadly, leadership and management is associated with better health systems performance in LMIC settings [8], and can be improved through practical approaches to education and mentorship for healthcare professionals at all levels of the health system [8–19]. Leadership and management trainings conducted at the facility level have been linked with the reduction of wait times and patient crowdedness in hospitals in Egypt [13] and the increase in the number of women receiving counseling during antenatal care in Cameroon [14]. At the district level, a number of studies [8,15,16,17,18,19] reported the impact of management and leadership training on primary care system performance. However, there is little empirical evidence of the effectiveness of investments in leadership and management capacity in the context of national EPI programs.

Therefore, in order to influence strategic and evidence-based advancements of leadership and management for national EPI programmes, we sought to evaluate changes in leadership and management capacity associated with a single Gavi investment in leadership and management, the EPI Leadership and Management Programme (EPI LAMP). EPI LAMP represents a flagship investment in Gavi's leadership and management portfolio, engaging teams from national Ministries of Health from Gavi-eligible countries in Anglophone and Francophone Africa and Asia in a nine-month certificate program. We used a mixed-methods design to describe the impact and identify lessons learned from delivery of EPI LAMP to the first three cohorts of participants. The results of this study may be useful to educators, practitioners, and government officials seeking to strengthen EPI programme performance, as well as policymakers and global partners seeking to invest in evidence-based management and leadership development models.

2. Methods

2.1. Partners

Yale's Global Health Leadership Initiative (Yale) led the EPI LAMP consortium, which included PATH, the University of Global Health Equity in Kigali, Rwanda (UGHE, for English-speaking teams), and the University of Yaoundé I (UYI) and the Department of Disease Control, Epidemics and Pandemics in Yaoundé (DLMEP) of the Cameroon Ministry of Public Health (for French-speaking teams). Yale convened the consortium and managed design, delivery, and evaluation of the programme. PATH contributed to the design and delivery of the program with its global technical expertise in immunisation, making sure that the programme was tailored to the specific context of the national immunisation teams and providing technical mentorship to breakthrough project teams. UGHE, UYI, and DLMEP contributed to the design, led in-country implementation and face to face delivery by providing faculty and coaches who adapted core content for regional contexts while coordinating logistics for the in-person components of the programme. Gavi, the Vaccine Alliance, funded the program through a grant to Yale.

2.2. Participants

For each cohort, Yale worked with Gavi to engage between five and six countries. In the country selection process, Yale provided briefing documents and nomination packages that Gavi used to engage their Senior Regional and Country Managers (officers responsible for the portfolio of Gavi investments in each country), with the goal of seeking nominations for country participation in EPI LAMP. Yale recommended that Gavi officers prioritize countries that were at a critical turning point in EPI program development (i.e., introducing new vaccines, preparing for transition from the Gavi portfolio, emerging from leadership changes) and likely to be receptive to organizational change efforts. Once a set of countries were nominated, Yale worked with the Ministry of Health in each country to build delegations of between four and six Ministry of Health officials tasked with oversight and management of their country's EPI programme. Participants, called delegates, served in roles that conferred first-hand experience with the most pressing EPI leadership and management challenges, authority to drive meaningful change, and the potential to grow through the programme experience. With sign-off by their immediate supervisor, delegates committed to full participation in the program (including protected time for coursework and support for the applied breakthrough project), and made a good-faith commitment to remain in public service for two years following graduation.

2.3. Curriculum

We designed the EPI LAMP curriculum to be interactive, practical, and feasible in the context of delegates' full-time work demands. EPI LAMP's team-based, blended learning model combined (1) 60 hours of asynchronous online learning to build essential skills, delivered through Yale's Canvas™ platform, (2) three one-week classroom-based forums (in Rwanda for English-speaking teams; in Cameroon for French-speaking tems) to refine skills and leverage professional networks for peer learning, and (3) a team-based breakthrough project to apply new skills for measurable impact on EPI programme performance. A three-part coaching model included management coaching from Yale, UGHE, and UY1, technical guidance from PATH coaches with deep expertise in targeted areas of immunization systems strengthening, and support from a Yale learning coach who reviewed progress on e-learning assigments and breakthrough project milestones for accountability and additional support. At each program launch, delegates completed a virtual orientation, were introduced to the coaches, and completed a web-based self evaluation of leadership and management compentencies. The main curriculum included six modules: strategic problem solving, leading effective teams, political engagement, human resource management, financial management, and supply chain management (***Supplemental File 1***). Delegates that successfully completed all program components were awarded a certificate from Yale, PATH, and UGHE (Cohorts I and III) or UYI (Cohort II).

2.4. Evaluation design and measures

We conducted a mixed-method evaluation of the first three cohorts. Consistent with the Kirkpatrick model [20] to assess the effectiveness of training programs, we sought to describe EPI LAMP at four levels: (1) delegate response to the training experience (including participation, completion, and satisfaction); (2) delegate change in management and leadership competencies; (3) delegate change in behavior in the workplace; and (4) impact of the training on EPI program performance.

2.5. Data collection and analysis

Administrative records: We monitored delegate completion of all course requirements and graduation rates, disagregated by cohort and gender, using participation records tracked in MSExcel®.

Delegate feedback survey: At the end of each in-person forum, delegates completed a voluntary, anonymous, paper-based survey soliciting feedback on programme logistics, scheduling, individual sessions, and facilitation (***Supplemental File 2***). The results of the survey were entered into MSExcel® for subsequent analysis.

Self-assessment of management competencies: At the beginning and end of the programme, delegates completed a web-based self-assessment using Qualitrics® based on a set of management competencies for global health [4,21,22] that were adapted for national EPI programs (***Supplemental File 3***). Each competency was measured using a five-point likert type scale: no knowledge; some knowledge, unable to perform; able to perform with assistance; able to perform independently; and able to mentor others. Using a 95% confidence interval, we tested for a significant change in management competencies by domain using the one sample *t* test. In addition, we tested for a significant change in management competencies using a two sample *t* test by gender across the three cohorts and by language comparing the French-speaking cohort (Cohort II) to the two English-speaking cohorts (Cohort I and III). Competency survey data was managed and analysed in MSExcel®.

Summary of breakthrough project progress and impact: At the end of each in-person forum, country teams presented their final breakthrough project. Each team was assessed by programme faculty on the satisfactory presentation of the breakthrough project showing clear and realistically defined project goals, substantial progress toward objectives, and measurable impact on a targeted aspect of EPI system performance.

Exit interviews: At the end of the programme, we invited delegates to participate in confidential exit interviews, conducted by GHLI team members. We conducted the interviews using an open-ended interview guide (***Supplemental File 4***) to elicit delegates' experience with the programme, application of the management and leadership competencies in their workplaces, and changes in team-based ways of working. Following informed consent, each interview was conducted in the primary language of the course (English or French), lasted approximately 45 min, and was audiotaped. Recordings were transcribed by a professional transcription service and a member of the study team checked each transcript against the audiorecording to ensure quality. We entered the transcripts into Atlas.tiV8 for coding and thematic analysis. To analyze the in-depth interviews, two members of the research team with expertise in qualitative analysis worked independently to code each transcript for each cohort and a total of three coders worked across the three cohorts. Researchers used the constant comparative method [23] to conduct line-by-line review of transcripts, coding of blocks of text using a code sheet that included apriori codes based on evaluation goals. Coders met regularly to discuss their observations, reconscile discrepancies in coding through negotiated consensus, update the code sheet include emergent constructs. The research team reviewed the resulting code reports to identify emergent themes, with attention to seeking out negative feedback and disconfirming evidence.

Integration: The results from the analysis of each type of data were integrated to generate a final set of observations following the levels of the Kirkpatrick model. This allowed for more robust descriptions of the program impact at each of 4 levels (enagement, skill development, application, and performance).

Ethical considerations: This evaluation was determined to be exempt from continuing review by the Yale University Instutional Review Board.

3. Results

3.1. Engagement (retention and satisfaction)

In the first three cohorts, the programme engaged 16 countries and achieved an 86% graduation rate (54 alumni, Table 1). Cohort I (April – December 2018) engaged delegations from the Gambia, India, Liberia, Rwanda, and Zambia. Cohort II (April – December 2019) engaged delegations from Burkina Faso, Burundi, Cameroon, Congo Republic, Democratic Republic of Congo, and Guinea. Cohort III (May 2019 – January 2020) engaged delegations from Ethiopia, Myanmar, Tanzania, and the Pacific Islands (Solomon Islands and Kiribati). Alumni of the program were 54% male and 46% female.

Feedback surveys administered at graduation indicated that 100% would *definitely* recommend EPI LAMP to their peers, and all delegates strongly agreed or agreed that the course met the learning objectives (Table 2).

Delegates provided positive feedback of on programme elements (Table 3) and expressed their satisfaction with the factilitation and coaching received during the in-person forums. For example, a Cohort II delegate described "*Good organization, relevant modules, well-experienced faculty who master the module, good accommodation and organization at the in-person forum.*" Delegates noted room for improvements for logistics communication prior to

Table 2
Delegate feedback on progress toward program objectives (n = 51).

	Strongly Agree	Agree
The members of our EPI LAMP team have built skills and relationships that will allow us to work effectively together	83%	17%
I have developed leadership skills that will allow me to create and utilize effective, inclusive teams	76%	24%
I feel prepared to conduct the entirety of the strategic problem-solving process with my team	89%	11%

* Response options were: strongly agree, agree, disagree and strongly disagree.

Table 3
Delegate satisfaction with programme components (n = 51).

	Very Satisfied	Somewhat Satisfied
Pre-Forum Logistics Communication	63%	37%
Forum Facilitation	94%	6%
Forum Schedule	75%	25%
Site Visit	79%	19%
Mentoring and Coaching	80%	18%

*Response options were: very satisfied,somewhat satisfied and not at all satisfied.

Table 1
Description of the sample for EPI LAMP Cohorts.

	Cohort I	Cohort II	Cohort III	Total
Enrollment and completion				
Enrolled	22	22	19	63
Graduated	20	16	18	54
Gender of alumni				
Female	9	2	14	25
Male	11	14	4	29
Participation in evaluation				
Feedback form at graduation	20	16	17	53
Competency assessment	18	16	17	51
Exit interview	20	16	12	48

the forums, and suggested more time for reflection and informal connection during the busy forum days.

3.2. Change in management and leadership competencies

Delegates demonstrated a statistically significant increase in competency across all domains. The largest improvement was observed in governance and leadership, followed by strategic problem solving, political analysis and dialogue, and community and customer assessment and engagement (Fig. 1).

Strategic problem solving: This competency increased from 3.3 to 4.5 ($p < .05$) and was the area of greatest strength by the end of the program. This is consistent with the design of the program, in which strategic problem solving served as the foundation for the breakthough projects (additional detail below). Across cohorts, delegates provided rich descriptions of how they used specific tools to identify and unpack compex challenges faced within their EPI programmes.

> *For you to implement the strategic intervention, you have to know exactly what you are dealing with. Now we are able to come up with solutions specifically for the problem. We used to just guess the cause of our problems. When we did strategic problem solving, we were able to know exactly. We looked at the data we had and we knew exactly what we were supposed to target to increase coverage. (Zambia, Cohort I)*

Governance, leadership, and political engagement: Delegates reported significant increase in capacity to engage with political and coordinating structures with the largest improvement in Governance and Leadership (2.8 to 4.1, $p < .05$) and Political Analysis and Dialogue (2.7 to 3.9, $p < .05$). This is consistent with the team-based design, which foster engagement and collaboration between EPI teams and more senior Ministry of Health officials. Delegates described applying learnings from the Political Advocacy module to develop and implement engagement strategies; and felt more prepared to engage decision-makers at all levels with targeted communication.

> *The EPI LAMP course helped us to conduct political advocacy all the way to the highest levels. After we verified our strategy, we started to establish contacts on the level of the vice-president of the Republic. So that the vice-president, the second vice-president of the republic could sponsor a high-level workshop to mobilize internal resources which would enable us to mobilize financing of the vaccination. And thanks to the skills acquired in EPI LAMP, we've started to implement these strategies. (Burundi, Cohort II)*

Resource Management: Delegates reported significant improvements in self-assessed competency in managing human resources (3.1 to 4.1, $p < .05$) and financial resources (2.8 to 4.1, $p < .05$). They described that the Human Resource Managament module was directly applicable to their professional practice, describing how they valued and applied specific tools they had learned.

> *EPI LAMP enabled us to reorganize and improve the directorate. First, through the approach of job descriptions. This enables each agent to be more comfortable, not to accumulate many tasks, and in that way to be more efficient. (Burkina Faso, Cohort II)*

Delegates reported that the financial management module strengthened their confidence, and fostered an appetite for increased visibility of budgets and other financial management information as inputs to EPI programme performance.

> *We are going to try to make financial management a little more legible in the sense of making the document more accessible and to make all the collaborators understand. The notions of financial management is no longer a matter for a manager alone. (Cameroon, Cohort II)*

Performance management and accountability: Delegates reported significant improvements in self assessed competency in performance management and accountability (3.3 to 4.0, $p < .05$). They described how EPI LAMP inspired them to pay more attention to team dynamics, including use of tools that helped with promoting role clarity and improved communication and collaboration towards a shared vision for the EPI programme.

> *Because of poor communication, the work is not done on time or is incomplete and they blamed each other. After our leadership module, I let them manage their duty and I give them authority to let them manage. Now they communicate with each other and reduce the social conflicts between them and they work together. (Myanmar, Cohort III)*

Delegates also reported feeling more accountable for EPI program performance, articulating how their unique roles contributed to programme success. For professionals beyond the EPI programme team, EPI LAMP provided an understanding of the operational challenges and objectives of the programme.

> *When I was first invited to the programme, I thought, "Okay. Where do I come from, how did I come into this?" Because I am a pharmacist. My role in the pharmacy is to look after the procurement unit. I don't know what I'm supposed to do for vaccines. I think I've learned so much about the EPI programme in our*

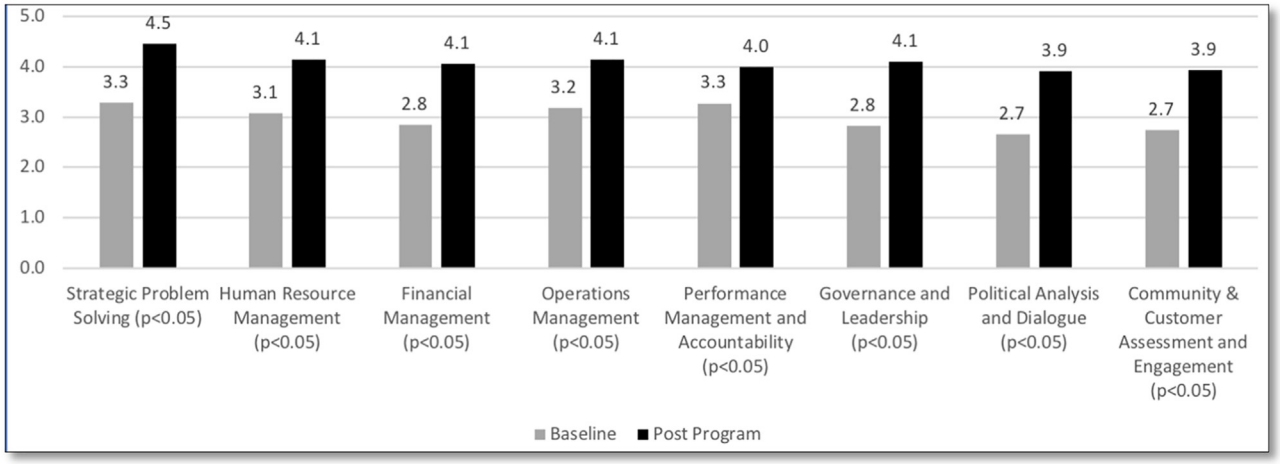

Fig. 1. Longitudinal change in competencies by domain across three cohorts (n = 51).

country, and I've come to learn the importance of this programme, and how it means a lot to our country. (Kiribati, Cohort III)

Women demonstrated a significantly greater increase than men in Operations Management (1.3 vs 0.07 point gain, $p < .01$) and Political Analysis and Dialogue (1.5 vs 1.0 point gain, $p < .05$). We observed no difference in the magnitude of improvement in management competencies among delegates in the French-speaking cohort compared to delegates in the English-speaking cohorts.

3.3. Change in ways of working

Beyond the application of new managerial tools and skills, delegates provided robust descriptions of new insights into their own capacity for leadership, and expressed an urgency to ensure that subnational and district-level immunization professionals had access to similar management and leadership development opportunities.

Delegates described gaining new insights into their own capacity for leadership. They described leadership concepts such as psychological safety and followership as being highly relevant to their roles. Many delegates reported that following EPI LAMP, they have been placed into more senior decision-making roles and are entrusted with more and expanded EPI responsibilities.

I have to admit that because of the EPI LAMP training, my manager has more confidence in me. Our relationship has evolved. He asks for my opinion more often, without putting others on the side. He consults me, given that him and I are both participating in this program, so we are exchanging opinions on a regular basis and discuss measures to be taken in order to make progress. It is true that even before EPI LAMP, I've been participating in strategic meetings with partners, but now I'm much more involved. My role is more decisive. (Republic of Congo, Cohort II)

Delegates described ways they learned through experience sharing with other EPI LAMP country teams, and shared a sense of urgency to disseminate key learnings from EPI LAMP to subnational teams and other programmes within the Ministry of Health.

We have created a group where there is a lot of exchange and sharing of experiences that allow us to enrich our knowledge in the field of leadership. We share the success that the others had in their country and that serves as examples to try to address our own problems here. (Cameroon, Cohort II)

I have to share this knowledge to our team, and we have to work together because it is not enough to change by myself, we have to change the whole team to [have] good performance. (Myanmar, Cohort III)

Overall delegates demonstrated increased confiednce in management and leadership, and described concrete ways in which they applied their new competencies within their home organizations.

3.4. Impact on EPI program performance

During the final forum, delegations presented their breakthrough projects to address a complex performance challenge within the EPI programme. They had defined a problem and set a corresponding objective, completed a thorough root cause analysis that synthesized multiple sources and types of data, and developed a strategy to address the focal root cause. By the end of the program, most delegations were in the process of implementing their selected strategy and monitoring process toward their objective. Delegations focused on diverse performance challenges including poor immunization coverage (i.e., increasing MR2 coverage from 50% to 80% in Zambia's Lusaka district by clarifying health worker guidelines and tools; doubling MR2 coverage in the 4 regions of Burkina Faso experiencing political insecurity by engaging local technical staff), resource management issues (i.e., developing a new service delivery model to achieve a projected $6.1 m in savings in Myanmar; establishing a monitoring system for vaccine wastage in Kiribati), and operational issues (i.e., achieving acceptable levels for data quality based on WHO Data Quality Standards in Ethiopia by developing a digital supportive supervision model; increasing reliability of plans for outreach services in the Ilala district of Tanzania through better planning and budgeting). ***Supplemental File 5*** provides the achievements associated with each breakthrough project.

4. Discussion

We describe changes in leadership and management capacity associated with EPI LAMP, a flagship investment in Gavi's leadership and management portfolio, which engaged teams from national Ministries of Health from 16 Gavi-eligible countries in Anglophone and Francophone Africa and Asia. The program achieved high levels of engagement and completion (86% graduation rate) despite the length and rigor of the program, supported by consistently positive feedback from delegates on the quality and relevance of the program. Taken together, these findings demonstrate a strong appetite for leadership development support from national immunization professionals.

Integrated results from the competency self-assessment and exit interviews demonstrate that delegates achieved significant and meaningful improvements in their leadership and management capacity, and were able to apply their skills to shift ways of working in their national programs. Gains were greatest in the areas of strategic problem solving, leadership and governance, political engagement, and client engagement. This is consistent with the areas of emphasis for the curricular models, as well as with the design of the delegations, which were curated to foster delegates ability to take a systems perspective on immunization programme challenges by working across levels of hierarchy and other organizational boundaries. Women demonstrated greater gains in management, highlighting the importance of continuing to ensure gender equity in access to leadership development opportunities among senior officials. The lack of difference in results between the French-speaking and English-speaking delegates was encouraging given our commitment to ensuring that all participants had access to an equally high-quality learning experience despite the historical lack of access to this type of programming in Francophone Africa [24].

The results of the breakthrough projects demonstrated that delegates were able to identify and systematically unpack diverse and complex challenges within their national programmes. Most teams gained new insights ("aha moments") on the nature of the problem through coaching on the use of multiple sources and types of data, and engagement with diverse stakeholders in the root cause analysis process. Teams that moved into implementation of new strategies during the programme period demonstrated their abilities to engage in the political landscape and marshall both existing and new resources, overcoming common barriers to implementation among technical programs in LMIC settings.

Our results are the first of their kind derived from work with national immunization programs in LMIC settings, but are consistent with the literature on leadership and management development in other areas of public health. Evidence from other studies has shown that team-based leadership programs can foster improvements in management practice, collaboration, and problem-solving [17,25], and that engagement the broader policy

and organizational context is needed to foster the systems thinking capacity required to address complex challenges [26,27,28] and improve system performance [28,29]. Therefore, programs that foster development of a cross-country learning community, engage multiple levels of hierarchy, and equip teams to address complex adaptive challenges are likely to be superior to brief training programs grounded in technical quality improvement skills or focused on individual participants.

Our results should be interpreted in light of several limitations. First, changes in management and leadership competency is based on self-assessments and exit interviews, both subject to social desirability bias and not corroborated by assessment of the participant by others in their organization. However, the gains improved were consistent across countries and cohorts, and were substantiated by thick descriptions [29,30,31] of how participants had applied their new skills in the workplace [8]. Second, although delegations demonstrated significant improvements in individual competencies and made meaningful progress on their breakthrough projects during the project period, a longer period of observation would be required to determine whether implementation was associated with improvements in their outcomes of interest, or whether the changes made have been sustained. However, most teams achieved novel insights into their problem and engaged with common sources of friction associated with complex adaptive challenges, strengthening likelihood of success as compared to traditional quality improvement interventions. Investment in systematic, longitudinal impact evaluation of programs within Gavi's LMC portfolio would help further clarify the relative return on investment for EPI LAMP and similar programs. Third, we are not able to determine whether participation in a program like EPI LAMP (or other investments in Gavi's LMC portfolio) is associated with broader improvements in management and leadership systems capacity. Although individual competencies for immunization managers have been developed [3], systems measures such as those used to measure management capacity in LMIC hospitals or primary healthcare systems are lacking [32,33], highlighting an opportunity for future research.

5. Conclusion

Strengthening leadership and management competencies among national EPI teams will be critical to achieving global immunization targets and other sustainable developmental goals, and can be significantly improved through participation in a team-based program customized to meet the needs of immunization professionals across Gavi-eligible countries. Programs that foster development of a cross-country learning community, engage multiple levels of hierarchy, and equip teams to address complex adaptive challenges are likely to be superior to brief training programs focused on individual participants. The results of this study may be useful to educators, practitioners, and government officials seeking to strengthen EPI programme performance, as well as policymakers and global partners seeking to invest in evidence-based management and leadership development models.

Declaration of Competing Interest

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

Acknowledgements

We are grateful to all of the EPI LAMP delegates for sharing their insights, and for their continued dedication to reaching every child with lifesaving immunizations. We are also grateful to the full EPI LAMP team of faculty, facilitators, coaches, and staff for bringing the program to life. Specific to this evaluation, we thank Adeola Ayedun, Emily Cherlin, and Margaret Anderson for support of the qualitative data collection and analysis, and Nukte Goc for management and analysis of the survey data.

Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.vaccine.2022.04.070.

References

[1] Ozawa S, Clark S, Portnoy A, Grewal S, Brenzel L, Walker DG. Return on investment from childhood immunization in low- and middle-income countries, 2011–20. Health Affairs (Project Hope) 2016;35(2):199–207.
[2] "Vaccination And Immunization Statistics - UNICEF DATA". *UNICEF DATA*, 2020, https://data.unicef.org/topic/child-health/immunization/.
[3] Traicoff D, Pope A, Bloland P, Lal D, Bahl J, Stewart S, et al. Developing standardized competencies to strengthen immunization systems and workforce. Vaccine. 2019;37(11):1428–35.
[4] Bradley EH, Taylor LA, Cuellar CJ. Management Matters: a Leverage Point for Health Systems Strengthening in Global Health. Int J Health Policy Manag 2015;4(7):411–5.
[5] Egger D, Travis P, Dovlo D, Hawken L. Strengthening management in low-income countries. Making health systems work. Working paper, No. 1. Geneva: World Health Organization; 2005.
[6] Travis P, Bennett S, Haines A, Pang T, Bhutta Z, Hyder AA, et al. Overcoming health-systems constraints to achieve the Millennium Development Goals. Lancet 2004;364(9437):900–6. https://doi.org/10.1016/S0140-6736(04)16987-0.
[7] Reich MR, Javadi D, Ghaffar A. Introduction to the Special Issue on "Effective Leadership for Health Systems". Health Systems & Reform 2016;2(3):171–5.
[8] Fetene, N., Canavan, M., Megentta, A., Linnander, E., Tan, A., Nadew, K., & Bradley, E. (2020). District-level health management and health system performance.
[9] Linnander EL, Mantopoulos JM, Allen N, Nembhard IM, Bradley EH. Professionalizing Healthcare Management: a Descriptive Case Study. Int J Health Policy Manag 2017;6(x):1–6.
[10] Wong R, Bradley EH, Mantopoulos J, Linnander E, Jagwiza J, Adomako E. Health management education and professional development in low-income settings, 24. On the Horizon; 2016.
[11] Kebede S, Abebe Y, Wolde M, Bekele B, Mantopoulos J, Bradley EH. Educating leaders in hospital management: a new model in Sub-Saharan Africa. Int J Qual Health Care 2010;22(1):39–43.
[12] Rowe LA, Brillant SB, Cleveland E, Dahn BT, Ramanadhan S, Podesta M, et al. Building capacity in health facility management: guiding principles for skills transfer in Liberia. Hum Resour Health 2010;8(1). https://doi.org/10.1186/1478-4491-8-5.
[13] Wong R, Hathi S, Linnander EL, El Banna A, El Maraghi M, El Din RZ, et al. Building Hospital Management Capacity to Improve Patient Flow for Cardiac Catheterization at a Cardiovascular Hospital in Egypt. Jt Commission J Qual Patient Safety 2012;38(4):147–53.
[14] Baba Djara and Conlin, "Cameroon PPFP Endline Study Report: The Added Value of Combining a Leadership Development Program with Clinical Training on Postpartum Family Planning Service Delivery."
[15] Seims LRK, Alegre JC, Murei L, Bragar J, Thatte N, Kibunga P, et al. Strengthening management and leadership practices to increase health-service delivery in Kenya: an evidence-based approach. Human Resources for Health 2012;10(1). https://doi.org/10.1186/1478-4491-10-25.
[16] Mansour M, Mansour JB, Swesy AHE. Scaling Up Proven Public Health Interventions Through a Locally Owned and Sustained Leadership Development Programme in Rural Upper Egypt. Human Resources for Health 2010;8(1). https://doi.org/10.1186/1478-4491-8-1.
[17] Mutale W, Vardoy-Mutale A-T, Kachemba A, Mukendi R, Clarke K, Mulenga D, et al. Leadership and management training as a catalyst to health system strengthening in low-income settings: evidence from implementation of the Zambia Management and Leadership course for district health managers in Zambia. PLoS One. 2017;12(7):e0174536.
[18] Kwamie et al. Health Research Policy and Systems 2014:12:29. , http://www.health-policy-systems.com/content/12/1/29.
[19] Peterson EA, Dwyer J, Howze-Shiplett M, Davsion CY, Wilson K, Noykhovich E. Presence of Leadership and Management in Global Health Programs: Compendium of Case Studies. Washington DC: The Center for Global Health, The George Washington University; 2011.
[20] Kirkpatrick D, Kirkpatrick J. Evaluating Training Programs. San Francisco: Berrett-Koehler Publishers; 2005.
[21] Robbins CJ, Bradley EH, Spicer M. Developing Leadership in Healthcare Administration: a Competency Assessment Tool. J Healthc Manag 2001;46(3):188–202.

[22] Cherlin E, Helfand B, Elbel B, Busch SH, Bradley EH. Cultivating next generation leadership: preceptors' rating of competencies in post-graduate administrative residents and fellows. Journal Health Administration Education 2006;23(4):351–65.
[23] Bradley EH, Curry LA, Devers KJ. Qualitative data analysis for health services research: developing taxonomy, themes, and theory. Health Serv Res. 2007;42 (4):1758–72. https://doi.org/10.1111/j.1475-6773.2006.00684.x.
[24] Linnander E, Nolna SK, Mwinsongo A, Bechtold K, Boum Y. Reaching across the linguistic divide in management and leadership education. The Lancet Global Health 2019;7(9):e1177. https://doi.org/10.1016/S2214-109X(19)30256-6.
[25] Cleary S, Toit Ad, Scott V, Gilson L. Enabling relational leadership in primary healthcare settings: lessons from the DIALHS collaboration. Health Policy and Planning 2018;33(suppl_2):ii65–74.
[26] Kwamie A, Dijk HV, Agyepong IA. Advancing the application of systems thinking in health: realist evaluation of the Leadership Development Programme for district manager decision-making in Ghana. Health Research Policy and Systems 2014;12(1). https://doi.org/10.1186/1478-4505-12-29.
[27] Kwamie A, Agyepong IA, van Dijk H. What Governs District Manager Decision Making? A Case Study of Complex Leadership in Dangme West District. Ghana. *Health Systems & Reform* 2015;1(2):167–77.
[28] Swanson RC, Cattaneo A, Bradley E, Chunharas S, Atun R, Abbas KM, et al. Rethinking health systems strengthening: key systems thinking tools and strategies for transformational change. Health Policy and Planning 2012;27 (suppl 4):iv54–61.
[29] Ponterotto J. Brief Note on the Origins, Evolution, and Meaning of the Qualitative Research Concept Thick Description. *The Qualitative*. Report. 2015.
[30] Denham MA, Onwuegbuzie AJ. Beyond Words: Using Nonverbal Communication Data in Research to Enhance Thick Description and Interpretation. Int J Qual Methods 2013;12(1):670–96.
[31] Patton MQ. Strategic themes in qualitative inquiry. In: Patton MQ, editor. Qualitative Research and Evaluation Methods. Thousand Oaks, Calif: Sage Publications; 2002. p. 40.
[32] Liu L, Desai MM, Fetene N, Ayehu T, Nadew K, Linnander E. District-Level Health Management and Health System Performance: the Ethiopia Primary Healthcare Transformation Initiative. Int J Health Policy Manag 2020. https://doi.org/10.34172/ijhpm.2020.236.
[33] Liu, L., Desai, M., Fetene, N., Ayehu, T., Nadew, K. and Linnander, E., Under review. Strengthening Health Management and Health System Performance at Sub-national Levels: The Ethiopia Primary Healthcare Transformation Initiative. *International Journal of Health Policy and Management*.

Supplemental File 1. The EPI LAMP Curriculum

The **Strategic Problem Solving** module begun with the definition of a shared problem and measurable objective, followed by a systematic and data-driven analysis of root causes; generation, comparison, and selection of strategic options for improvement; development and implementation of concrete action plans; and evaluation of progress toward the objective. This method served as the foundation for each team's breakthrough project.

The **Leading Effective Teams** module prepared delegates to engage others to set and achieve a common goal. Delegates learned to understand leadership as a relational concept, promote effective team formation (role clarity and representation, work across boundaries, decision making), diagnose and address common challenges within teams, and develop effective organanzational culture (accountability, psychological safety, and productive conflict.

The **Political Engagement** module prepared delegates to influence beyond the formal scope of authority for any one manager or programme, including establishing and leading governing board and stakeholder forums to promote coordinated decision-making, understanding and influencing political and regulatory environments, positioning EPI programme priorities within broader health sector strategies, and promoting interest-based negotiation for optimal results.

The **Human Resource Management** module prepared delegates to describe essential human resource management and development functions, develop and use basic tools of human resource management, apply theories of human motivation and engagement, promote more effective meetings with your supervisor and staff, and create effective feedback sessions and performance review mechanisms.

The **Financial Management** module prepared delegates to develop and manage an operating budget for a project or work plan, use financial ratios and financial reports for performance monitoring and decision-making, ensure appropriate financial controls are in place, and effectively communicate financial information to mobilize resources.

The **Supply Chain Management** module introduced the basic principles of supply chain management for EPI programmes including current challenges and limitations and the role of innovative approaches for improving vaccine management in LMICs. Delegates learned to understand the basic principles and systems for supply chain management in relation to vaccines, evaluate the global supply architecture and its influence on vaccines supply, and learn best practices for forecasting immunization demand and vaccine storage.

Note: Cohort I included a Performance Management module and did not include the Supply Chain Management module. For Cohorts II and III, principles of performance management were integrated into the other modules, and the Supply Chain module was added.

Supplemental File 2: Delegate Feedback Survey

Thank you for your participation in EPI LAMP.
Please take a moment to provide some feedback on your experience. This will help us ensure that the next forum is even better. Your responses are entirely confidential.

To what extent do you agree with the following statements?				
	Strongly Agree	Agree	Disagree	Strongly disagree
The members of our EPI LAMP team have built skills and relationships that will allow us to work effectively together				
I have developed leadership skills that will allow me to create and utilize effective, inclusive teams				
I feel prepared to begin to assess the root causes of our teams' defined problem				
Our team can begin using the steps in Strategic Problem Solving in working on our breakthrough project				

How satisfied were you with each of the following program elements?			
	Very Satisfied	Somewhat Satisfied	Not at all Satisfied
Orientation to EPI LAMP			
Pre-Forum Logistics Communication			
Forum Facilitation			
Forum Schedule			

Based on your experience thus far, would you recommend EPI LAMP to your peers from another country?				
☐ Yes, definitely	☐ Maybe	☐ Not likely	☐ No, definitely not	☐ No opinion

Think about your experience in EPI LAMP so far (including orientation, e-learning modules and the in-person forum). So far, what has worked well?
Think about your experience in EPI LAMP so far (including orientation, e-learning modules and the in-person forum). So far, what has not worked well? What would you change?
Please use this space to provide any additional feedback or suggestions.
If there is anything you would like us to follow-up with you on, please give us your name and your specific request?

Supplemental File 3. Management and Leadership Competencies

Domain	Competencies
Strategic thinking & problem solving	• Set objectives and align resources for problem solving to achieve organizational goals, especially within changing/uncertain contexts
Human resource management	• Provide feedback, coaching, and professional development opportunities • Conduct individual performance reviews • Develop recruitment, employment, and retention processes
Financial planning and budgeting	• Develop operational budgets for EPI and budget variance analysis • Translate needs into an approved budget proposal in line with domestic budget processes • Manage grant application and implementation • Track and influence disbursement of funds • Track and report on use of financial resources • Negotiate for needed financial resources
Operations management	• Develop and use strategic and operational plans to guide EPI programme activities • Plan for the introduction of new vaccines and supplementary immunization activities • Establish and improve management systems, including registration and patient flow, immunization records, environmental services and immunization waste, infection prevention, vaccine supply/cold chain, pharmacy and laboratory/diagnostics management, Immunization follow-up and pharmacovigilance (AEFI) management
Performance management and accountability	• Foster a sense of ownership and accountability across the team • Prioritize and delegate work effectively • Establish appropriate indicators, targets and milestones for measuring EPI programme performance in the context of GAVI Performance Frameworks (i.e. logic models) and country indicators • Monitor performance using available data and tools (i.e., balanced scorecards) • Hold effective routine performance reviews (dialogues and reports) • Develop and maintain a culture of data use for decision making
Governance and leadership	• Develop effective organizational culture • Ensure integration of EPI strategic plans into broader health sector strategies • Conduct governing board activities (e.g. Interagency Coordinating Committee (ICC), National Immunization Technical Advisory Groups (NITAGs), Health System Coordinating Committee (HSCC) • Ensure proactive succession planning
Political analysis and dialogue	• Communicate in an effective way; build trusting relationships across MoH departments, relevant national authorities, development partners, and other stakeholders • Foster coordinated decision-making within and outside of coordinating mechanisms (e.g. ICC and HSCC) • Proactively identify and analyse policy gaps and solutions • Understand political and regulatory environments, including policy trade-offs and stakeholder interests

Community and customer assessment and engagement	• Incorporate epidemiological methods, survey techniques, and community-based participatory research into EPI programme plans • Leverage health education and social marketing to generate demand and achieve programme goals • Promote a client/community-centered organizational culture

Supplemental File 4. EPI LAMP Exit Interview

1. Please describe your current role in relation to the immunization program.
    a. How long have you been in your role? Has your role changed since you started EPILAMP?

2. Can you give an example of how your experience in EPILAMP helped you improve your immunization program performance?

    i. What aspect of the immunization program's performance did you improve?
    ii. What skills learned from the program did you use? How did you use them?
    iii. What was different about how you approached this problem/scenario/aspect of the immunization program from how you might have tackled it before EPI LAMP?
    iv. Did you face any challenges? How did you address them?
    v. Was this a new way of working within your organization? What helped you share this new approach within your organization?

3. Now, can you give me an example of a time you tried to make a change in your work based on EPILAMP that didn't work so well or help improve your immunization performance?

    i. What was the problem you were trying to address?
    ii. What EPI LAMP skills were you trying to use?
    iii. Why do you think the strategy was unsuccessful?
    iv. Did you face any barriers in trying to use this skill/tool/strategy/concept? If yes, what were they? How did you try to address them?
    v. What could have helped you translate your skill back to the workplace in this example?
    vi. Will you try to use this skill/tool/strategy/concept again? Why or why not?

4. In what ways will continue to use EPI LAMP learnings in your work after this program ends? (probe for specific examples)
    a. Describe scenarios where you find learnings might be most relevant.
    b. Do you anticipate any challenges or barriers in using learnings in those instances? Why or why not?

Supplemental File 5. Cohort I, II and III Breakthrough Projects

Cohort I

Gambia

The Gambia team joined EPI LAMP with an issue of high dropout rate of 23% between MR1 and MR2 vaccination coverage in Gambia and set an objective of reducing the dropout rate between MR1 and MR2 from 23% to 13% by the end of 2019. By conducting interviews and observations in the health facilities in two regions with the highest dropout rates of North Bank East (28%) and Lower River (27%), the team identified that 80% of mothers were not aware due to inadequate Information, Education and Communication (IEC) materials while 83% were not aware because caregivers were not recalling. The team concluded that **low awareness of caregivers on the importance of vaccination after the first year of life is the root cause of high dropout rate in these regions.** To address this identified root cause, the team chose as best strategy to have community groups such as Community Health Workers and organized groups provide health education to caregivers in their communities.

India

Upon joining EPI LAMP, the India team with its diverse team of state representative decided to focus on the low full immunization coverage. The full Immunization coverage was 65% in India, which was lower than the recommended 90%. The team then set an objective of improving full immunization coverage from 65% to 90% by December 2018 in 3 participating states of India: Telangana, Bihar, and Madhya Pradesh. By combining the data and findings of the previous studies and surveys, the team found there was a large awareness gap in terms of adverse events following immunization (AEFI) and routine immunization among Auxiliary Nurse Midwife with only 50% and 56% of ANM aware of AEFI in Telangana and Bihar respectively, while only 51% were aware of routine immunization in Madhya Pradesh. In addition, the team found only 13% of ANM were well trained in Interpersonal Communication (IPC) in Telengana. The team concluded that the **awareness gap and low IPC skills of the frontline workers in these 3 states in India** were the root cause. To address this identified root cause, the team chose as best strategy training to improve knowledge and communication skills for frontline workers.

Liberia

The Liberia team joined EPI LAMP with an issue of a low MCV1 coverage in Grand Cape Mount County in Liberia with a coverage of 62% in 2017 as opposed to the national average of 86.4%. To address this issue, the team set an objective of increasing the MCV1 administrative coverage in Grand Cape Mount County from 62% to 85% by December 2019. Through the review of administrative coverage data for all antigens, the 2018 cold chain equipment assessment report, equity assessments data and in-depth interviews, the team found **inadequate logistics to bridge geographic access** was the root cause. To address this identified root cause, the team chose as strategy the expansion of outreach services because data revealed the outreach coverage was low compared to fixed MCV1 coverage.

Rwanda

The Rwanda team joined EPI LAMP with an issue of high drop-out rate between MCV1 and MCV2 in Rwanda with a dropout rate ranging between 2% and 25% across different districts in Rwanda and set an objetive of reducing the proportion of dropout from 9.2% to 2% by 2019. Employing qualitative study design and immunization registry, the team conducted operational research focusing on parents/caretakers of children who missed MR second dose, and revealed that the root cause as **caretakers who forgot about the MCV2 schedule** with 37% of parents/caretakers who forgot about the second dose schedule.To address this identified root cause, the team proposed as strategy Performance Based Financing for CHWs for MCV2.

Zambia

The Zambia team joined EPI LAMP with a problem of low MR2 Coverage in Lusaka District. The coverage in this district was 56% in 2017, lower than the district target of 80% and the team set an objective of increasing MR2 Coverage from 56% to 80% by 2020 in this district. Leveraging the Post Introduction Evaluation (PIE) Report in May 2018 targeting both healthcare providers and community members, the Zambia delegation found that **if children were brought in before 18 months or after 18 months, they were not given MR2 because the guidelines and supporting documents were not clear on timeframe for MR2 and the immunization cards were printed in a way that allowed for misinterpretation of the guidelines. Through this analysis, the team concluded that the root cause was misinterpretation of the MR2 schedule/guidelines by healthcare providers** To address this identified root cause, the team chose as best srategy to revise guidelines, immunization card, and IEC materials to provide explicit immunization timing information.

Cohort II Breakthrough Projects

Burkina Faso

Burkina Faso has experience insecurity in regions across the country leading to reductions in MR2 coverage of 10-20%. As a result, the Burkina Faso delegation targeted MR2 coverage and set a goal of increasing MR2 vaccination coverage by at least 20% in regions experiencing insecurity (Center North, East, North and Sahel) by the end of 2022. The team analyzed available data on vaccine stockout, cold chain equipment, accessibility to health services, and human resources and concluded **the departure of health center staff due to insecurity contributed to the decrease in vaccine coverage in these insecure regions**. This resulted in the decrease of vaccine services, the closing of some health centers, and the lack of necessary maintenance for cold chain equipment. The team developed a strategy to recruit local, qualified technical staff for routine immunization activities to address high health staff departure rates.

Burundi

The Burundi delegation began EPI LAMP by conducting a thorough review of available data and Observed that 67% of children aged 24 to 35 months did not receive the second dose of Measles-Rubella combined vaccine (MR2). The team then set an objective of increasing their rate MR2 coverage from 67% to 90% by 2023. During the root cause analysis, the team reviewed the 2018 Final Report on the Equity Analysis in the Provision of vaccination services in Burundi, a national mixed methods survey. The results from the study demonstrated that **42% of mothers ignore the**

importance of vaccination at 18 months, which led the team to conclude that this was the main cause of the drop in MR2 coverage. In response, the team developed a strategy to strengthen community education of mothers, specifically targeting messaging for the vaccination of children at 18 months.

Cameroon

The Cameroon delegation conducted a thorough review of available data and observed 63% of fixed strategy immunization sessions were not conducted and 5 regions of Far North, South West, North, Adamaoua and South offered less than 4 sessions per 10 target children in a year. The team set an objective of increasing the number of fixed strategy vaccination sessions by 20% in the Far North, South West, North, Adamaoua and South regions by the end of 2021. The team conducted an extensive document review which led them to identify **insufficient skills of providers in routine vaccination** as the main cause of decreased immunization services in these regions. To address this root cause, the team developed a strategy to strengthen service provider capacities gradually and regularly at all levels of the health system using the method of "Low Dose High Frequency" to establish an effective mentoring system for service providers.

Congo Republic

The Congo Republic's breakthrough project's core problem centered on the 18 of the 52 health districts where 88.6% of DTP3 unvaccinated children are located. In order to solve this problem within their EPI programme, the team set an objective of reducing the number of children not vaccinated with DTP3 in the 18 targeted health districts by at least 75% by 2020. Through the analysis of EPI documents, the team concluded **poor performance of vaccinators as a major cause to the drop in DTP3 coverage in the 18 health districts**. To address low coverage, the team developed a strategy of formative supervision for vaccinators across the 18 health districts.

Democratic Republic of Congo

The Democratic Republic of Congo delegation conducted a thorough review of available data and observed 65% of children from 12-23 months did not receive all necessary antigens before their first birthday in 2018. The team set an objective of reducing children not receiving all antigens from 65% to 35%. Through an extensive review of available EPI documents, the team observed that the country's health system is largely dependent on donors such that in 2012 the government provided only 8% of the budget for immunization and that the non-disbursement of the counterpart fund does not meet vaccine needs for the whole country. Following this, the team identified that the **non-payment of the Government's counterpart for the purchase of vaccines was the cause of stock-outs of vaccines and delay of the regular organization of vaccination sessions**. To address this, the team selected a political advocacy campaign in favor of the disbursement of funds for the purchase of vaccines by the Government as their strategy and identified all the stakeholders to engage in the implementation of their project with primary stakeholders including: the Head of State and his advisor as well as the First lady through her Foundation.

Guinea

The Guinea delegation observed that in 2018, at least 70% of children aged 12 to 23 months did not receive the third dose of Penta before their first birthday with a 35% dropout rate between the first and third dose of Penta in the regions of Labé, Mamou et Boké. The team set an objective of reducing the proportion of Penta 3 unvaccinated children from 70% to 45% in the regions of Labé, Mamou and Boké. The Guinea delegation reviewed multiple EPI documents and observed that the **major cause of non-vaccination in the regions of Lamé, Mamou et Boké is that parents do not receive the correct information on vaccination**. The team then selected a strategy of reinforcing parents' knowledge of vaccination through community awareness raising and health extension worker outreach

Cohort III Breakthrough Projects

Ethiopia

The Ethiopia team joined EPILAMP and worked on addressing over reporting of administrative data for pentavalent 3 coverage. The team set a goal of reducing over reporting of administrative data for pentavalent 3 by 30% in two woredas (one in Somali and one in Oromia) by the end of 2021. After reviewing facility level data, WHO Data Quality and conducting in-depth interviews, the team concluded **weak performance monitoring was the primary cause of data inconsistency, specifically shortcomings in supportive supervision and substantive reviews of meeting minutes**. To address this problem, the team chose to digitize supportive supervision with a focus on data and will implement the strategy following the completion of EPILAMP.

Myanmar

To support Myanmar’s transition out of Gavi support, the Myanmar team in EPILAMP focused on reducing transportation costs by 50% by the end of 2021 after observing that transportation costs accounted for 29% of all EPI costs.Working with a Health Economist from PATH and EPILAMP coaches, the team used a regression analysis to project the operational costs associated with vaccine collection in a township versus a rural health center. Results showed cold chain expansion at RHCs was the most cost effective, allowing a net savings of 6.1 million USD over 10 years. This strategy is expected to lead to improved service availability at RHC and decreased transportation costs without changing routine immunization coverage.

Tanzania

The Tanzania team in EPILAMP focused on increasing the proportion of girls in Ilala district receiving their first dose of HPV vaccine to 70% by December 2020 after observing that 52% of girls in the Ilala district of Dar es Salaam were not receiving the first dose of their HPV vaccine. The team conducted a thorough desk review and conducted data collection on caregiver awareness, perceptions, and practice of the HPV vaccine and observed **87% of planned outreach services were not conducted in most of the health facilities.** Following the completion of the EPI LAMP program, the team plans to further analyze the cause of outreach service cancellations in Ilala through ongoing analysis and the selection of a strategy to address the problem, following with the creation of a budget, and development of an implementation and evaluation plan.

Pacific Islands

Kiribati

In collaboration with EPI LAMP management and technical coaches, the Kiribati delegation conducted a thorough review of available data,and observed unsustainable government contributions to the national EPI programme especially as Kiribati approaches graduation from Gavi support. Through the review of multiple documents, the team determined the lack of a wastage monitoring system at the primary health care level to be their highest risk. Then, the team conducted interviews amongst pharmacist and hospital staff and **found hospital staff fear accountability and, as such, were hesitant to report vaccine wastage**. The team's selected strategy was to update the national EPI policy to reflect the vaccine wastage monitoring system including supportive supervision and incentives for proper reporting of vaccine wastage**.**

Solomon Islands

The Solomon Islands delegation focused on resolving stagnant coverage of the Hepatitis B birth dose, targeting the Guadalcanal Province where coverage is lowest (28%). The team set a goal of increasing Hep B-BD in the Guadalcanal Province from 28% to 65% by 2021. The team conducted short surveys for post-partum mothers and health workers in three health facilities and compared child immunization cards and the health facility baby registry. The team found vaccination was conducted and recorded in vaccination cards, but not in health registries, then concluded **poor documentation of Hep B-BD in the health facilities led to under reporting** and therefore inaccuracy in the coverage data of Hep B-BD in Guadalcanal province. The team then selected a strategy to integrate vaccine management training into the monitoring and supervision of national staff and provincial EPI teams.