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Workshop/Consensus Report

A Learning Agenda to Address Immunization Equity and Access for Nigeria to End Zero-Dose Children by 2030: Report from a National Stakeholder Consensus Workshop

*Yahaya Mohammed,[1] Adam Attahiru,[1] Oludotun Adeniyi Babayemi,[2] Heidi W. Reynolds,[3] Gustavo Caetano Corrêa,[3] Hyelshilni Waziri,[1] Fiyidi Mikailu,[1] Fatima Ja'afar Gidado,[4] Margeret Osas Wisdom,[1] Amina Haladu,[5] Aminu Garba Magashi,[5] Teemar Fisseha,[6] Nancy Vollmer,[6] Moreen Kamateeka,[1] Ndadilnasiya Endie Waziri, [1] Yusuf Yusufari, [7] Maimuna Umar Babangida,[8] Success Abah,[1] Ene Gbenewei,[4] Nememma Agu,[1] Talatu Buba Bello,[1] Ahmed Olowo-okere,[9] Muhammad Usman,[5] Mashin Muhammad,[4] Obioma Azurunwa,[10] Amina Shehu Adamu,[4] Belinda Vernyuy Uba,[1] Ahmed Rufai Garba, [4] Binta Aduke Ismail,[3] Amal Ja'arat Oladimeji,[1] Olawunmi Adeoye,[1] Olasoji Fasogbon,[1] Abayomi Olufemi,[11] Sulaiman Etamesor,[4] Ridwan Yahaya,[12] Nuruddeen Aliyu,[1] Garba Bello Bakunawa,[4] Ismail Ndalami Salihu,[4] Lukman Abdulaziz Abdulsalam, [13] Anointed David Oriaku,[14] Muknaan David Nshe,[14] Omotayo Anastasia Giwa,[7] Khalifa Mohammed,[15] Ibrahim Dadari,[16] Ijeoma Mmirikwe,[17] Hadiza Hussayn Jibril,[18] Reward Nsirim,[3] Mohammed Musa Abubakar,[17] Patrick Mboya Nguku.[1]

[1]African Field Epidemiology Network, Abuja, Nigeria, [2]Cloneshouse, Nigeria, [3]Gavi - The Vaccine Alliance, [4]National Primary Health Care Development Agency (NPHCDA), Nigeria, [5]Africa Health Budget Network (AHBN), Abuja, Nigeria, [6]John Snow Incorporated (JSI), [7]Gates Foundation, Abuja, Nigeria, [8]UNICEF, Abuja, Nigeria, [9]University of Abuja, Nigeria, [10]Centre for integrated Health Programs (CIHP), [11]Ministry of Defence, Abuja, Nigeria, [12]Nigeria Center for Disease Control and Prevention (NCDC), Abuja, Nigeria, [13]World Health Organization (WHO), Abuja, Nigeria, [14]Christian Health Association of Nigeria (CHAN), [15]Population Health Sciences Institute. Newcastle University, United Kingdom, [16]UNICEF Headquarters, New York City, USA, [17]SCIDaR - Solina Centre for International Development and Research, [18]Centre for Vaccine Innovation & Access, PATH Nigeria

Abstract

Background: Nigeria has one of the highest burdens of zero-dose (ZD) children, those who have not received the first dose of pentavalent vaccine, despite multiple national and partner initiatives to strengthen routine immunization. A coordinated national learning agenda is required to guide evidence generation and use for reducing ZD children. The study objective is to describe the process and outcomes of a national stakeholder workshop that used a modified Delphi approach to prioritise learning questions on ZD children in Nigeria.

Methodology: The Zero-Dose Learning Hub (ZDLH) convened a national workshop of immunization stakeholders from government, development partners, and civil society. A three-round modified Delphi process was used. In Round 1 (pre-workshop), participants independently scored learning questions derived from global Gavi learning priorities and Nigerian political-economy analyses. In Round 2 (during the workshop), participants discussed and re-scored questions in plenary and small groups. In Round 3 (post-workshop), participants completed a final independent ranking.

Results: Ten learning questions were prioritised under three themes: equity, health systems, and innovation. The highest-ranked questions consistently focused on identifying and monitoring zero-dose & under-immunised children; understanding who and where they are and why they are missed; and health-system factors influencing their identification and measurement. Community engagement, data harmonisation, and capacity-building emerged as secondary but important areas.

Conclusion: The workshop generated a nationally owned learning agenda that highlights Nigeria's most urgent evidence needs for reaching ZD children. The prioritised questions provide a practical roadmap for NPHCDA and partners to strengthen immunization equity, guide operational research, and support targeted programme implementation.

Keywords: Immunization Programme; Delphi Technique; Health Systems; Vaccination Coverage; Nigeria

***Correspondence:** Yahaya Mohammed, Email: yahyakt@yahoo.com

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Introduction

Immunization remains one of the most cost-effective public health interventions, preventing substantial morbidity and mortality from vaccine-preventable diseases (VPDs). [1] Nigeria, however, continues to face major challenges in achieving equitable immunization coverage, particularly among zero-dose children, those who have not received the first dose of the pentavalent vaccine.[1–3] Recent estimates suggest that Nigeria has about 2.1 million zero-dose children, with coverage for the first and third doses of pentavalent vaccine at approximately 70% and 57%, respectively.[2] These gaps undermine herd immunity and increase the risk of VPD outbreaks.

The burden of zero-dose children in Nigeria is concentrated in northern states and informal urban settlements characterised by poverty, insecurity, weak health systems, and social marginalisation. [2, 3] The 2018 Nigeria Demographic and Health Survey (NDHS) documented marked inequities in immunization coverage by wealth, maternal education, and place of residence. [4] Children from the poorest households and those whose mothers have no formal education are far less likely to be fully immunized than their better-off counterparts, while rural and conflict-affected areas lag substantially behind urban areas.[4] Multiple factors contribute to these disparities, including inadequate primary healthcare infrastructure, inconsistent outreach services, workforce shortages, vaccine hesitancy, low risk perception, and distrust of government programmes.[1–3, 5]

In response, the Federal Ministry of Health and Social Welfare (FMOH&SW) and the National Primary Health Care Development Agency (NPHCDA), with partners, have implemented several strategies such as Optimized Integrated Routine Immunization Services (OIRIS), Periodic Intensification of Routine Immunization (PIRI), and the Identify, Enumerate, and Vaccinate (IEV) strategy. [2, 5] In addition, Gavi's Zero-Dose Reduction Operational Plan (ZDROP) seeks to systematically identify and reach zero-dose children in underserved communities.[6] Despite these efforts, progress towards universal coverage remains uneven, highlighting the need for more coordinated, context-specific learning to inform policy and programming.[6]

Globally, the Immunization Agenda 2030 (IA2030) emphasises equity, life-course vaccination, and integration of immunization with primary health care.[7, 8] Gavi's learning priorities, organised around the Identify-Reach-Monitor-Measure-Advocate (IRMMA) framework, provide a structured approach to understanding zero-dose children and missed communities.[9] Nigeria's Zero-Dose Learning Hub (ZDLH), led by Gavi in partnership with John Snow Incorporated (JSI), the African Field Epidemiology Network (AFENET), the Africa Health Budget Network (AHBN) and other stakeholders under the guidance of NPHCDA aims to generate actionable evidence to support these goals. [2, 5, 10] While multiple studies and programme assessments have examined barriers and facilitators to routine immunization in Nigeria, [1–3, 5] evidence generation has often been fragmented, with limited alignment to an explicit national learning agenda. This can lead to duplication of research, under-investment in critical questions, and missed opportunities to use evidence for decision-making in programme implementation and support. Publishing this workshop-derived learning agenda has important scholarly and practical value. It makes transparent the consensus process, criteria, and trade-offs used by national stakeholders to prioritise learning questions and provides a structured, replicable model for other countries seeking to align evidence generation with immunization equity goals. It also situates programme-driven learning within the wider IA2030 and Gavi frameworks, bridging policy, practice, and research.[7, 8]

Objective: This workshop report describes the consensus-building process used to prioritise learning questions on zero-dose children in Nigeria and presents the resulting national learning agenda, organised around three thematic areas: equity, health systems, and innovation.

Methods

Study design and overall approach: This manuscript is a product of a national stakeholder workshop report using a modified Delphi approach. We conducted a workshop-based, three-round modified Delphi exercise to develop and prioritise a national learning agenda on zero-dose children in Nigeria.[11] The process combined pre-workshop virtual engagement, an in-person national stakeholder workshop, and a post-workshop independent ranking round. The primary output was a ranked list of learning questions derived from global and country-specific evidence.

Setting and governance: The consensus workshop was held in Abuja, Federal Capital Territory (FCT), Nigeria, on 8th December 2023 under the leadership of NPHCDA, with technical support from AFENET and AHBN as part of the Nigeria Zero-Dose Learning Hub (ZDLH) project.[1–3, 5] The process was embedded within the implementation of Gavi's ZDROP and aligned with national immunization policies and IA2030.[6–8, 10, 12, 13]

Participants: Participants were purposively selected to represent a broad mix of stakeholders involved in routine immunization and zero-dose programming at national and sub-national levels. This included representatives from:

- Federal and State Ministries of Health, NPHCDA, relevant federal agencies and Primary Health Care Development Agencies.
- Development partners like the Gavi, World Health Organization (WHO), United Nations Children's Fund (UNICEF) and bilateral agencies.
- Implementing partners and civil society organisations.
- Academia and research institutions.

Across the three Delphi rounds, participation ranged from 12 to 28 individuals, reflecting differing availability at each stage but maintaining representation from key stakeholder groups.

Development of candidate learning questions: Candidate learning questions were identified through a structured desk review and synthesis of multiple sources:

- Gavi 5.0/5.1 global learning priorities on zero-dose children and the IRMMA framework. [9]
- Nigeria ZDLH situation analysis.[5]
- A political economy analysis of evidence uses for zero-dose programming in Nigeria.[13]
- Relevant literature on immunization equity and zero-dose children in low- and middle-income countries. [14–17]

Questions were grouped into three thematic areas that reflected Nigeria's strategic priorities:

1. **Equity**: understanding who and where zero-dose children are and why they are being missed.
2. **Health systems**: structural and operational determinants of zero-dose children and missed communities.
3. **Innovation**: new approaches, tools, and partnerships to identify and reach zero-dose children.

After iterative refinement by the ZDLH technical team and NPHCDA, 10 learning questions were agreed upon for prioritisation **(Table 1).**

Table 1: Thematic areas and learning questions for the Nigeria Zero-Dose Learning Agenda

Themes	Learning Questions
Equity	1. Where and who are zero-dose children and missed communities? Why are they being missed? 2. What are the key enablers and barriers at each level of the health system (policy to community) to identifying, monitoring, and measuring zero-dose children and missed communities? 3. What are the most effective approaches and methods for identifying zero-dose and under-immunised children and for monitoring and measuring their coverage through to full vaccination?
Health systems	4. How have partnerships contributed to strengthening immunization programmes to date, and what is the potential of strategic partnerships for improving equitable immunization coverage, including zero-dose children? 5. How has integration of campaigns with other primary health care services been used to reach zero-dose children and missed communities? What has worked well, or not, and why? 6. What are the evidence gaps at national and sub-national levels related to the identification, monitoring, and measurement of zero-dose children and missed communities?
Innovation	7. What community engagement strategies are most effective at reducing the number of zero-dose children? 8. What capacity-building strategies or interventions are effective in strengthening the capacity of data managers at the health-facility level? 9. What approaches are being used to harmonise parallel systems for data collection to identify, reach, and measure zero-dose children? 10. What can we learn from the introduction of other vaccines as an opportunity to identify and reach zero-dose children?

Modified Delphi process: We used a three-round modified Delphi process to prioritise the 10 learning questions.[11]

Round 1: Pre-workshop independent ranking
Prior to the workshop, participants received the 10 learning questions by email and were asked to independently rate each question using a five-point Likert scale (1 = least critical, 5 = most critical) based on its perceived importance for reducing zero-dose children in Nigeria **(Figure 1).** Respondents submitted their ratings electronically.

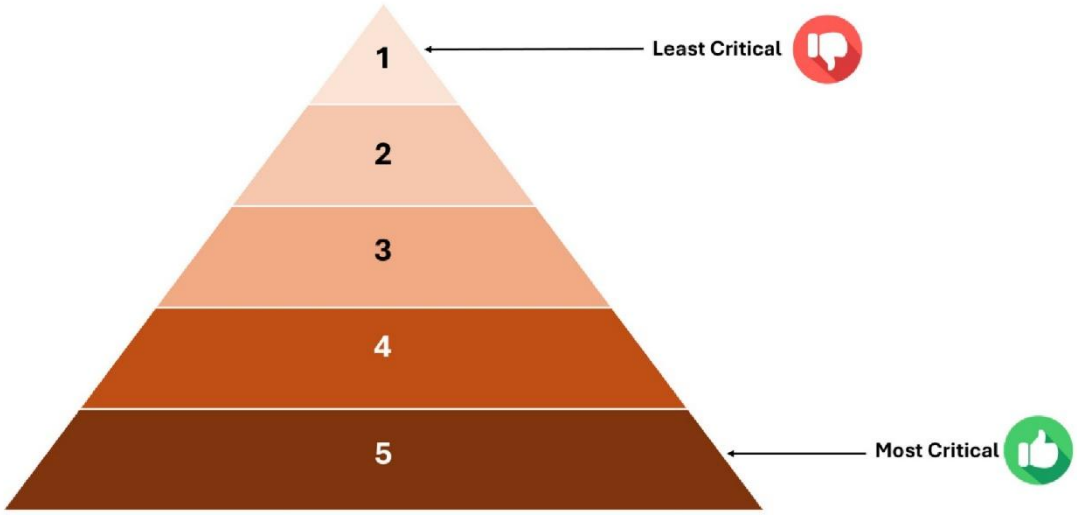


Figure 1: Five level scales of ranking utilized in the study

Round 2: In-person deliberation and re-ranking
During the national stakeholder workshop, aggregated Round 1 results were presented to participants. Facilitated small-group and plenary discussions explored the rationale behind ratings, equity considerations, feasibility, and alignment with ongoing programmes. Participants then re-scored each question using the same five-point scale. Ratings were recorded using simple visual tools (example, the flip charts and dot-voting) and consolidated electronically.

Round 3: Post-workshop independent ranking
Following the workshop, participants received a summary of the Round 2 results and key discussion points. They were then invited to complete a final independent ranking exercise, again using the five-point scale. This round was designed to allow reflection outside the group setting and to confirm or adjust earlier views.

Data analysis: For each round, we calculated the mean (weighted) score for each learning question on the five-point scale and then ranked the questions from 1 (highest priority) to 10 (lowest priority). Because minor differences in how participants used the scale occurred between rounds, we focused on relative ranking rather than comparing absolute scores across rounds.

To visualise changes in priorities over time, we generated:

- A summary table showing each question's rank across Rounds 1–3 and its final consolidated rank **(Table 2).**

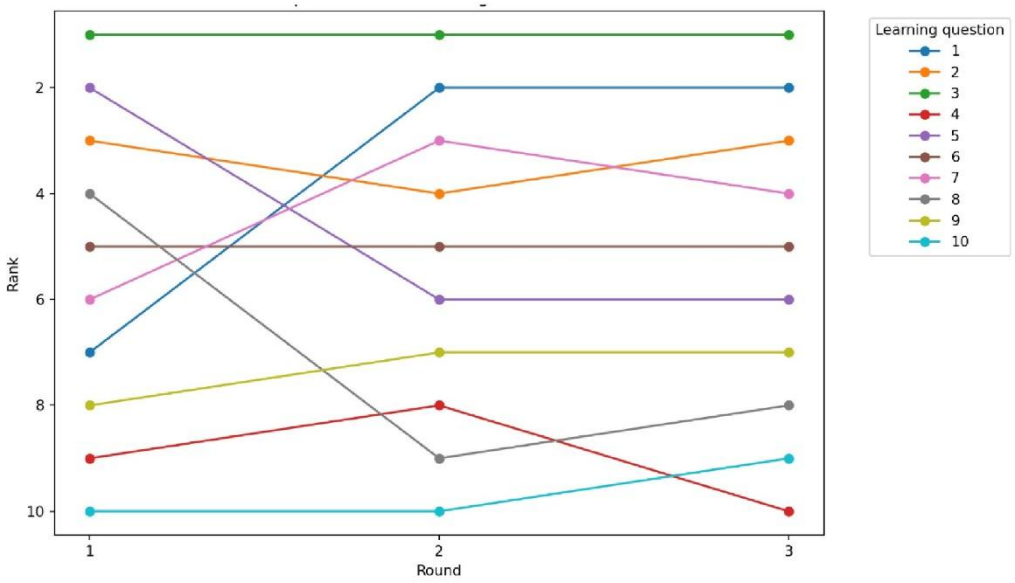
Table 2. Ranks of learning questions across three Delphi rounds and final consolidated priority

Question ID	Thematic area	Learning Questions	Rank Round 1	Rank Round 2	Rank Round 3	Final consolidated rank
1	**Equity**	**Where and who are zero-dose children, and missed communities? Why are they being missed?**	**7**	**2**	**2**	**2***
2	**Equity**	**What are the key enablers and barriers at each level of the health system (policy to community) to identifying, monitoring, and measuring zero dose children and missed communities?**	**3**	**4**	**3**	**3***
3	**Equity**	**What are the most effective approaches and methods for identifying zero-dose and under-immunized children and for monitoring and measuring their coverage through to full vaccination?**	**1**	**1**	**1**	**1***
4	Health Systems	How have partnerships contributed to strengthening immunization programmes to date, and what is the potential of strategic partnerships for improving equitable immunization coverage, including zero-dose?	9	8	10	9

5	Health Systems	How has integration of campaigns with other primary health care (PHC) services been used to reach zero-dose children and missed communities? What has worked well, or not, and why?	2	6	6	6
6	Health Systems	What are the evidence gaps at national/sub-national levels related to the identification, monitoring and measurement of zero-dose and missed communities?	5	5	5	5
7	Innovation	Community engagement strategies most effective at reducing the number of zero-dose children	6	3	4	4
8	Innovation	What capacity-building strategies/interventions (or combination of strategies) are effective in strengthening capacity of data managers at the health facility level?	4	9	8	8
9	Innovation	What approaches are been used to harmonize parallel systems for data collection to identify, reach, and measure Zero Dose (ZD)?	8	7	7	7
10	Innovation	What can we learn from the introduction of other vaccinations as an opportunity to identify and reach ZD children?	10	10	9	10

- ****The first three major ranked learning questions were made in bold and with an asterisks***

- A bump chart showing the trajectory of each question's rank across the three rounds **(Figure 2).**



- **Figure 2: A bump chart showing rank changes of learning questions over 3 rounds of Delphi method**

Analyses were descriptive and aimed at highlighting areas of consensus and shifts in expert opinion.

Ethical considerations: This work formed part of a broader study on zero-dose reduction in Nigeria. Ethical approval was obtained from the National Health Research Ethics Committee of Nigeria (NHREC) under protocol number **NHREC/01/01/2007-31/08/2023** and approval number **NHREC/01/01/2007-11/09/2023**. Participation in the Delphi process was voluntary, and individual responses were anonymised during analysis and feedback to reduce the risk of social desirability bias or dominance by more senior participants.

Results

Description of participants: Twelve participants completed the Round 1 pre-workshop ranking, 23 participated in the Round 2 in-person workshop ranking, and 28 contributed to the Round 3 post-workshop independent ranking. Across rounds, participants represented federal and state governments, development partners, implementing partners, and academic institutions.

Priority learning questions by thematic area: Table 1 summarises the 10 learning questions by thematic area. Equity-focused questions examined who and where zero-dose children and missed communities are and why they are missed. Health-system questions addressed partnerships, integration with primary health care, and evidence gaps. Innovation-related questions explored community engagement, capacity-building for data managers, data system harmonisation, and use of new vaccine introductions as opportunities to identify and reach zero-dose children.

Evolution of priorities across Delphi rounds

Table 2 shows the rank of each learning question across the three Delphi rounds and its final consolidated rank.

Across all three rounds, **Learning Question 3** (What are the most effective approaches and methods for identifying zero-dose and under-immunised children and for monitoring and measuring their coverage through to full vaccination?) remained the top priority. Experts consistently emphasised that without robust methods to identify and track zero-dose children, other interventions would remain sub-optimal.

Learning Questions 1 and 2, both under the equity theme, also ranked consistently high. Stakeholders highlighted the need to understand *who* zero-dose children are, *where* they live, *why* they are being missed, and the multi-level health-system factors that enable or hinder identification and monitoring.

Questions related to **community engagement (Question 7)** moved upward between rounds, reflecting recognition during workshop discussions that social, cultural, and demand-side factors are central to reaching zero-dose children.

Health-system questions on **evidence gaps (Question 6)** and **campaign integration with PHC services (Question 5)** occupied middle ranks, indicating that while they are important, stakeholders viewed foundational equity and identification questions as more urgent.

Innovation-related questions on **data harmonisation (Question 9)** and **capacity-building for data managers (Question 8)** were consistently ranked lower, although participants acknowledged that these areas could become more prominent once priority equity and health-system gaps are addressed.

Questions on **strategic partnerships (Question 4)** and **leveraging new vaccine introductions (Question 10)** remained at the bottom of the rankings, suggesting that experts perceived these as secondary levers in the immediate term, or that existing evidence and experience already address them to some extent.

Figure 2 (bump chart) illustrates the modest shifts in rankings across rounds, showing convergence towards a stable set of top-priority questions by Round 3.

Discussion

This workshop-based modified Delphi exercise led to the development of a nationally endorsed learning agenda on zero-dose children in Nigeria. The process engaged a diverse group of immunization stakeholders that helped to surface and refine priorities across three thematic areas of equity, health systems, and innovation. Consensus was reached on the most critical learning questions for the next phase of programme and research investments.

The most striking finding is the consistent prioritisation of **Learning Question 3** on effective approaches to identify and monitor zero-dose and under-immunised children. This reflects a clear recognition that data and methods for identifying who is being missed, and tracking them through to full vaccination, are foundational to all other efforts. The prominence of **Learning Questions 1 and 2** underscores the central role of equity-focused inquiry: understanding *who* zero-dose children are, *where* they are located, and *why* systemic and social barriers persist at multiple levels of the health system. The emphasis on equity, identification of missed communities, and community engagement is consistent with findings from global

and regional analyses of zero-dose children.[14–17] Multi-country modelling suggests that prioritising zero-dose children can avert a substantial number of deaths if interventions are targeted to the most underserved populations.[14] Systematic reviews have highlight that socio-economic disadvantage, geographic remoteness, conflict, and weak health systems are common determinants of under-immunisation, while community engagement interventions can significantly improve uptake.[15–17]

The Delphi process also demonstrated the value of structured deliberation. Questions related to community engagement **(Question 7)** increased in priority between rounds, suggesting that the workshop discussions helped participants explicitly connect demand-side factors and social dynamics with the technical challenge of reaching zero-dose children.[18] This aligns with evidence from other low- and middle-income countries showing that community engagement interventions can substantially improve child immunization uptake.[15–17]

In contrast, questions on strategic partnerships and leveraging new vaccine introductions ranked lower, despite the recognised importance of these areas for long-term system strengthening.[19] This may indicate that stakeholders perceive more immediate gains from focusing on core equity and identification issues, or that partnership dynamics and vaccine introductions are already relatively well understood from past experience. The relatively lower priority assigned to partnerships and new vaccine introductions in this exercise differs somewhat from some global perspectives that emphasise these as critical levers for broader health-system strengthening.[19, 20] In Nigeria, this may reflect a perception that foundational equity and data challenges must be addressed first, or that specific partnership models and introduction experiences are already being documented in other fora.

In general, the learning agenda produced through this process is strongly aligned with IA2030's focus on equity and life-course immunization,[8] and with Gavi's IRMMA framework and learning priorities.[9] It provides a practical bridge between global frameworks and Nigeria's specific operational realities.

Sub-national heterogeneity and implications for the learning agenda

Although this learning agenda reflects a national consensus in Nigeria, its application will necessarily differ across Nigeria's diverse sub-national contexts. Immunization inequities are not uniform; the highest concentrations of zero-dose children occur in the North-West and North-East, where insecurity, poverty, nomadic populations, and weaker PHC systems pose substantial barriers.[1, 3] In contrast, southern states often grapple with challenges related to informal urban settlements, high-density migrant populations, and variability in data-quality systems.[1, 2] Conflict-affected LGAs, remote riverine communities, and border areas also present distinct operational realities that influence which learning questions become most urgent locally.[1, 2] These geographic and contextual differences highlight the need for state-level adaptation of the national learning agenda, allowing geopolitical zones to prioritise and sequence learning questions according to their unique epidemiologic and health-system profiles. Ensuring such contextualisation will enhance the usability, equity orientation, and operational relevance of the learning agenda across Nigeria's diverse implementation settings.

Policy and programmatic implications for Nigeria

The prioritised learning questions have several concrete implications for policy and programming:

1. **Guiding the implementation of Gavi's Zero-Dose Reduction Operational Plan (ZDROP):**
    - ZDROP can use the top-ranked questions to guide operational research, pilot interventions, and monitoring indicators in high-burden states.[6]

   - Priority should be given to investments that improve identification and tracking of zero-dose children, particularly in conflict-affected, remote rural, and densely populated informal urban settlements.
2. **Informing NPHCDA's strategic plans and annual operational planning:**
   - NPHCDA can embed these learning questions into its strategic plans, annual workplans, and supportive supervision guidelines, ensuring that states systematically generate and use evidence on zero-dose children.[5]
   - States can adapt the national learning agenda to their specific contexts, using it to inform microplanning, outreach strategies, and integrated campaigns.
3. **Strengthening primary health care and data systems:**
   - Priority questions highlight the need to strengthen routine data systems for identifying and monitoring zero-dose children, including alignment between community registers, facility records, and digital tools.[2]
   - Investments in capacity-building for data managers and front-line workers, though ranked slightly lower, remain essential to ensure that new approaches are implemented reliably and sustainably.
4. **Enhancing community engagement and demand generation:**
   - The rise in priority of the community engagement question (Question 7) underscores the need to systematically test and scale approaches that address mistrust, misinformation, gender-related barriers, and competing priorities faced by caregivers as documented in several reports.[1, 2]
   - Lessons from successful community engagement models, like the use of local influencers, faith-based actors, and women's groups can be synthesised and adapted for zero-dose contexts.
5. **Aligning partner investments and avoiding duplication:**
   - Donors and implementing partners can use the learning agenda as a common reference to ensure complementarity of studies, avoid duplication, and pool findings across states and projects.
   - Joint learning reviews and knowledge-sharing platforms can be structured around the prioritised questions to promote collective sense-making and rapid learning.
6. **Embedding learning within routine programme cycles:**
   - The learning agenda should not be treated as a standalone research plan, but rather integrated into existing review platforms such as technical working groups, Joint Appraisals, and state-level performance reviews.
   - Simple learning questions on microplanning, outreach, and community engagement can be incorporated into supervision tools, after-action reviews, and programme dashboards.

Limitations

This work has some limitations:

- **Selection and perspective bias:** Although the workshop included a diverse set of stakeholders, it may not fully represent all perspectives, particularly those from frontline health workers or communities in the most underserved areas.
- **Small sample size per round:** The number of participants in each Delphi round was modest; however, panel sizes of around 10–30 participants are common in Delphi studies on specialised

policy and health-systems topics,[11] and the consistency of the highest-ranked questions across all three rounds in our study suggests a robust signal.

- **Delphi process constraints:** As with any Delphi method, participants may have been influenced by group discussions or perceived emerging consensus, potentially dampening divergent views.
- **Scope of questions:** The learning agenda focuses on high-level questions rather than detailed study designs. Further work is needed to translate these into specific research protocols, implementation studies, and monitoring frameworks.

Conclusion

The Nigeria Zero-Dose Learning Hub (ZDLH) national workshop successfully generated a consensus-based learning agenda to address immunization equity and access for zero-dose children. Priority learning questions centre on identifying and monitoring zero-dose and under-immunised children, understanding why they are missed, and addressing key equity and health-system barriers. These priorities are strongly aligned with IA2030 and Gavi's learning frameworks and provide a concrete roadmap for NPHCDA, ZDROP, and partners to direct operational research, innovation, and programme investments.

It is our hope that adopting and domestication of this learning agenda at national and state levels and embedding it within routine planning, implementation, and review cycles can help ensure that evidence generation is coordinated, demand-driven, and directly linked to improving immunization coverage for the most vulnerable children in Nigeria.

What is already known on this topic

- Zero-dose children are highly concentrated in poor, rural, conflict-affected, and informal urban settings.
- Nigeria has multiple ongoing initiatives to strengthen routine immunization and reach zero-dose children, but evidence generation has often been fragmented.
- Global frameworks such as IA2030 and Gavi's IRMMA approach emphasise equity and data-driven strategies to identify and reach missed communities.

What this study adds

- Presents a nationally endorsed learning agenda for zero-dose children in Nigeria, derived from a structured stakeholder workshop and modified Delphi process.
- Identifies three top-priority learning areas: effective methods to identify and monitor zero-dose children, understanding who and where they are and why they are missed, and system-level enablers and barriers to their identification and measurement.
- Provides practical guidance on how the learning agenda can be used to inform ZDROP, NPHCDA strategic plans, and partner investments in operational research and implementation learning.

Competing interests

Some authors are affiliated with donor agencies, implementing partners, and government bodies involved in immunization programming in Nigeria. These affiliations did not influence the conduct of the workshop, analysis, or interpretation of findings. The authors declare no other competing interests.

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Authors' contributions
The work is published under group authorship as the "Zero-Dose Learning Hub (ZDLH), Nigeria Study Group." The group conceptualised the learning agenda, designed and facilitated the workshop, conducted the Delphi process, and contributed to data interpretation. All authors reviewed and approved the final manuscript.

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References

1. Mohammed Y, Reynolds HW, Waziri H, *et al.* Exploring the landscape of routine immunization in Nigeria: A scoping review of barriers and facilitators. *Vaccine X*. 2024;20:100563. https://doi:10.1016/j.jvacx.2024.100563
2. AFENET/AHBN (ZDLH). 2024. Closing The Immunization Gap: Enhancing Routine Immunization in Nigeria by Reaching Zero-Dose and Under Immunized Children in Marginalized Communities: Report of a Rapid Assessment. 2024. Accessed December 9, 2024. https://zdlh.gavi.org/sites/default/files/2024-07/Rapid_Assessment_of_Immunization_Landscape_in_Nigeria_ZDLH_Nigeria.pdf
3. Mahachi K, Kessels J, Boateng K, *et al*. Zero- or missed-dose children in Nigeria: Contributing factors and interventions to overcome immunization service delivery challenges. *Vaccine*. 2022;40(37):5433-5444. https://doi:10.1016/J.Vaccine.2022.07.058
4. NPC. Nigeria; 2018 Demographic and Health Survey. Accessed September 19, 2024. https://dhsprogram.com/pubs/pdf/SR264/SR264.pdf
5. Gavi Zero-Dose Learning Hub. *Nigeria Zero-Dose Situation Analysis.*; 2023. Accessed September 19, 2022. https://zdlh.gavi.org/sites/default/files/2023-12/ZDLH_Nigeria_Situation_Analysis_2023.pdf
6. MOMENTUM Routine Immunization Transformation and Equity Turning Data and Data Systems into Action: Reaching and Monitoring Zero-Dose Children in Nigeria. Published online 2024. Accessed November 21, 2024. https://publications.jsi.com/JSIInternet/Inc/Common/_download_pub.cfm?id=24359&lid=3
7. Lindstrand A, Mast E, Churchill S, *et al*. Implementing the immunization agenda 2030: A framework for action through coordinated planning, monitoring & evaluation, ownership & accountability, and communications & advocacy. *Vaccine*. 2024;42:S15-S27. https://doi:10.1016/J.vaccine.2021.09.045
8. WHO. Immunization Agenda 2030. 2020. Accessed November 25, 2024. https://www.who.int/teams/immunization-vaccines-and-biologicals/strategies/ia2030
9. Exploring Gavi 5.0/5.1 Learning Priorities: shaping immunisation strategies. Accessed January 28, 2025. https://www.gavi.org/our-alliance/strategy/learning-system-strategy/exploring-gavi-50-51-learning-priorities-shaping-immunisation-strategies

10. Homepage | Zero-Dose Learning Hub. Accessed January 28, 2025. https://zdlh.gavi.org/
11. Brauer P, Desroches S, Dhaliwal R, *et al.* Modified Delphi Process to Identify Research Priorities and Measures for Adult Lifestyle Programs to Address Type 2 Diabetes and Other Cardiometabolic Risk Conditions. *Can J Diabetes*. 2022;46(4):411-418. https://doi:10.1016/J.JCJD.2022.01.003
12. Zero-Dose Learning Hub (ZDLH) Learning Agenda Workshop. Accessed January 30, 2025. https://zdlh.gavi.org/sites/default/files/2024-09/ZDLH%20Nigeria%20Learning%20Agenda%20Workshop%20Report.pdf
13. Assessment of the Political Economy Context Surrounding Evidence Use for Zero-Dose Programming and Policies in Nigeria. Published online 2024. Accessed January 28, 2025. https://zdlh.gavi.org/.
14. Carter A, Msemburi W, Sim SY, A.M. Gaythorpe K, Lindstrand A, Hutubessy RCW. Modeling the Impact of Vaccination for the Immunization Agenda 2030: Deaths Averted Due to Vaccination Against 14 Pathogens in 194 Countries from 2021-2030. *SSRN Electronic Journal*. Published online April 27, 2021. https://doi:10.2139/SSRN.3830781
15. Ali HA, Hartner AM, Echeverria-Londono S, *et al.* Vaccine equity in low and middle income countries: a systematic review and meta-analysis. *International Journal for Equity in Health 2022 21:1*. 2022;21(1):1-30. https://doi:10.1186/S12939-022-01678-5
16. Wigley A, Lorin J, Hogan D, *et al*. Estimates of the number and distribution of zero-dose and under-immunised children across remote-rural, urban, and conflict-affected settings in low and middle-income countries. *PLOS Global Public Health*. 2022;2(10): e0001126. Accessed March 28, 2025. https://doi:10.1371/Journal.Pgph.0001126
17. Jain M, Shisler S, Lane C, *et al*. Use of community engagement interventions to improve child immunisation in low- and middle-income countries: A systematic review and meta-analysis. *Campbell Systematic Reviews*. 2022;18(3):e1253. Accessed May 8, 2025. https://doi:10.1002/CL2.1253
18. Bell J, Lartey B, Spickernell G, *et al.* Applying a social-ecological model to understand factors impacting demand for childhood vaccinations in Nigeria, Uganda, and Guinea. *SSM - Qualitative Research in Health*. 2022; 2: 100180. Accessed April 9, 2025. https://doi:10.1016/J.SSMQR.2022.100180
19. Wang SA, Hyde TB, Mounier-Jack S, *et al.* New vaccine introductions: Assessing the impact and the opportunities for immunization and health systems strengthening. *Vaccine*. 2013;31(0 2): B122. Accessed April 14, 2025. https://doi:10.1016/J.Vaccine.2012.10.116
20. Fousseni S, Ngangue P, Barro A, *et al*. Navigating the Road to Immunization Equity: Systematic Review of Challenges in Introducing New Vaccines into Sub-Saharan Africa's Health Systems. *Vaccines 2025, Vol 13*. 2025;13(3). Accessed June 10, 2025. https://doi:10.3390/vaccines13030269