

ZAMBIA

Findings from the 2014 Gavi Full Country Evaluation



This brief presents findings for Zambia from the 2014 Gavi Full Country Evaluation (FCE) Annual Dissemination Report. It was prepared by the Institute for Health Metrics and Evaluation (IHME) at the University of Washington in collaboration with members of the Gavi FCE Team: the University of Zambia (UNZA), Zambia; the Infectious Diseases Research Collaboration (IDRC), Uganda; University of Eduardo Mondlane (UEM), Mozambique; Health Alliance International (HAI), Mozambique; International Centre for Diarrhoeal Disease Research, Bangladesh (icddr,b); and PATH, USA. This work is intended to inform evidence-based improvements for immunization delivery in Zambia, partner FCE countries, and more broadly, in low-income countries, with a focus on Gavi funding.

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Summary of 2014 evaluation activities

Assessment of progress, successes, and challenges

- Collected and reviewed documents relevant to Gavi funding, operational plans and budgets, guidelines, and planning and reporting.
- Conducted brief interviews to confirm factual information.
- Observed Child Health Technical Working Group (TWG) meetings, Expanded Program on Immunization (EPI) TWG meetings, Interagency Coordinating Committee (ICC) meetings, Health Systems Strengthening (HSS) proposal inception workshop, post-training evaluation of rotavirus vaccine Training of Trainers (TOT), and the pneumococcal conjugate vaccine (PCV)/rotavirus vaccine Post-Introduction Evaluation (PIE) debriefing.

Key informant interviews

- Conducted 32 interviews at the national and district levels and with stakeholders from the Ministry of Community Development, Mother and Child Health (MCDMCH) and partner organizations.

- Conducted nine interviews with the Gavi Secretariat and Vaccine Alliance partners.

Health facilities survey

- Preliminary analysis of stratified random sample of Zambian health facilities.

Analysis of administrative data on vaccine coverage

- Analysis of Health Management Information System data collected from health facility survey.

Small area analysis

- Compiled and analyzed all available survey and census data sources.

Inequality analysis

- Compiled and analyzed all available survey data sources of household wealth and vaccination coverage.

ANALYSIS

of immunization coverage,
child mortality, and inequality

Coverage rates have been highly variable among districts since 2000. The full 2014 Annual Dissemination Report provides district-level maps for 2000 and 2013 for all antigens.

- **Diphtheria, pertussis, tetanus vaccine (DPT3).** Coverage increased in a majority of districts between 2000 and 2013, but in both periods there are large within-country inequalities in coverage. By 2013, DPT3 coverage exceeded 80% in approximately half of districts, while in about 10% of districts coverage was below 65% (Figure 1).

- **Fully vaccinated child** (received Bacillus Calmette-Guérin [BCG] vaccine, three doses of oral polio vaccine [OPV3], three doses of DPT, and measles vaccine). Nearly 40% of districts experienced increases between 2000 and 2013. Full vaccination coverage was even more variable than coverage of DPT3 in 2013, with a handful of districts below 20% and the best-performing district at 99% (Figure 2).

Figure 1: District-level DPT3 coverage, using small area analysis techniques

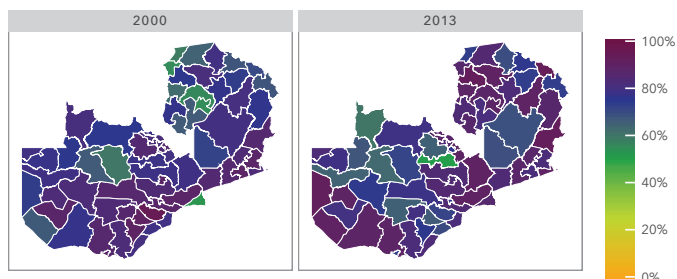
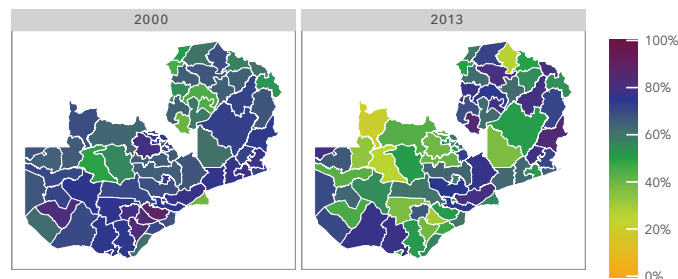


Figure 2: District-level fully vaccinated child coverage, using small area analysis techniques

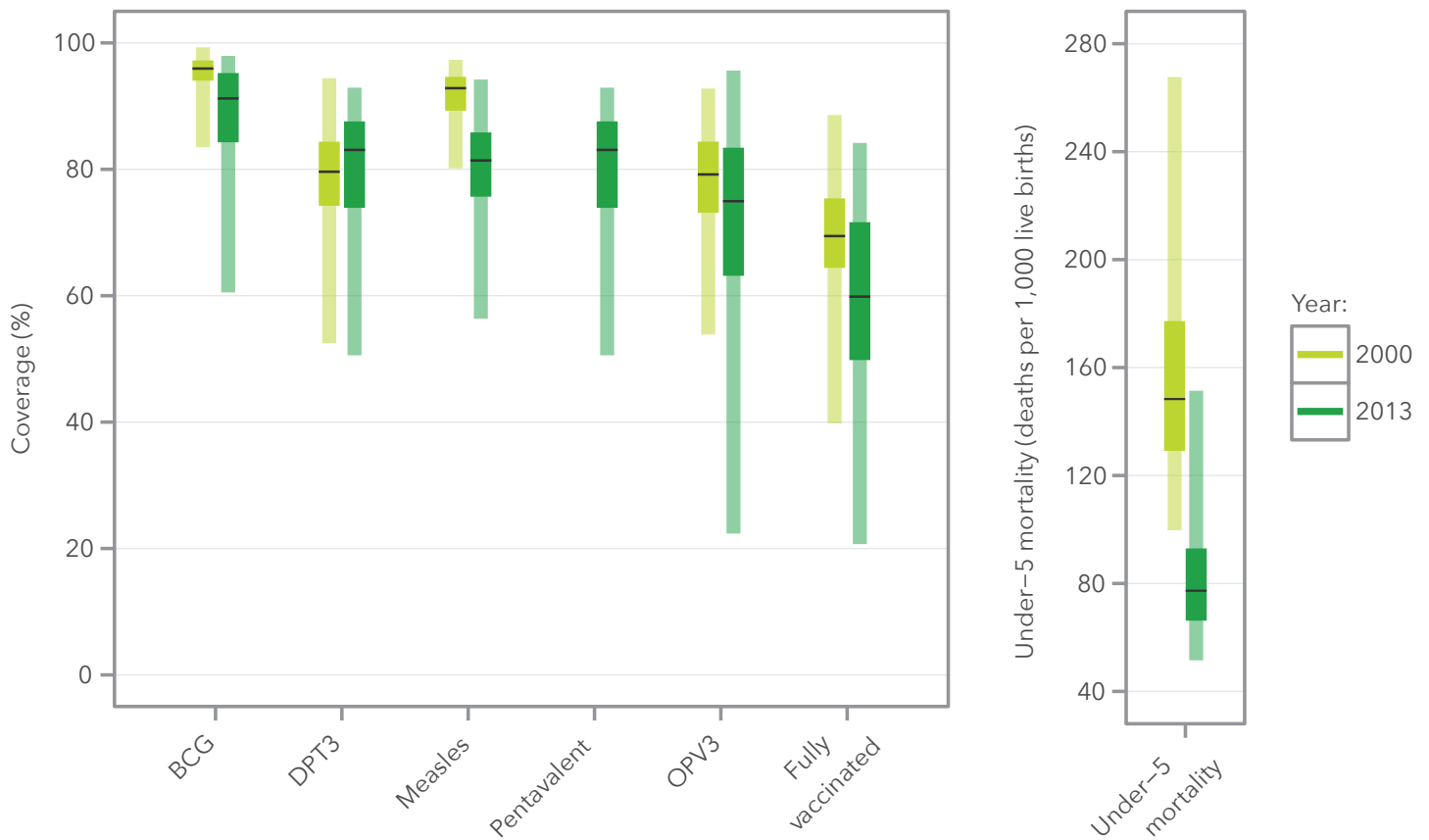


District-level estimates of vaccine coverage for 2000 and 2013 show that median coverage has largely stayed the same or declined, particularly for full vaccination.

- At the same time, within-country inequalities, as measured by the range and interquartile range, have increased dramatically for most antigens (Figure 3).

Figure 3: Distribution of the district-level vaccine coverage and under-5 mortality

The horizontal line represents the median across districts. The thick vertical bar represents the interquartile range, while the thin vertical bar represents the range across districts.



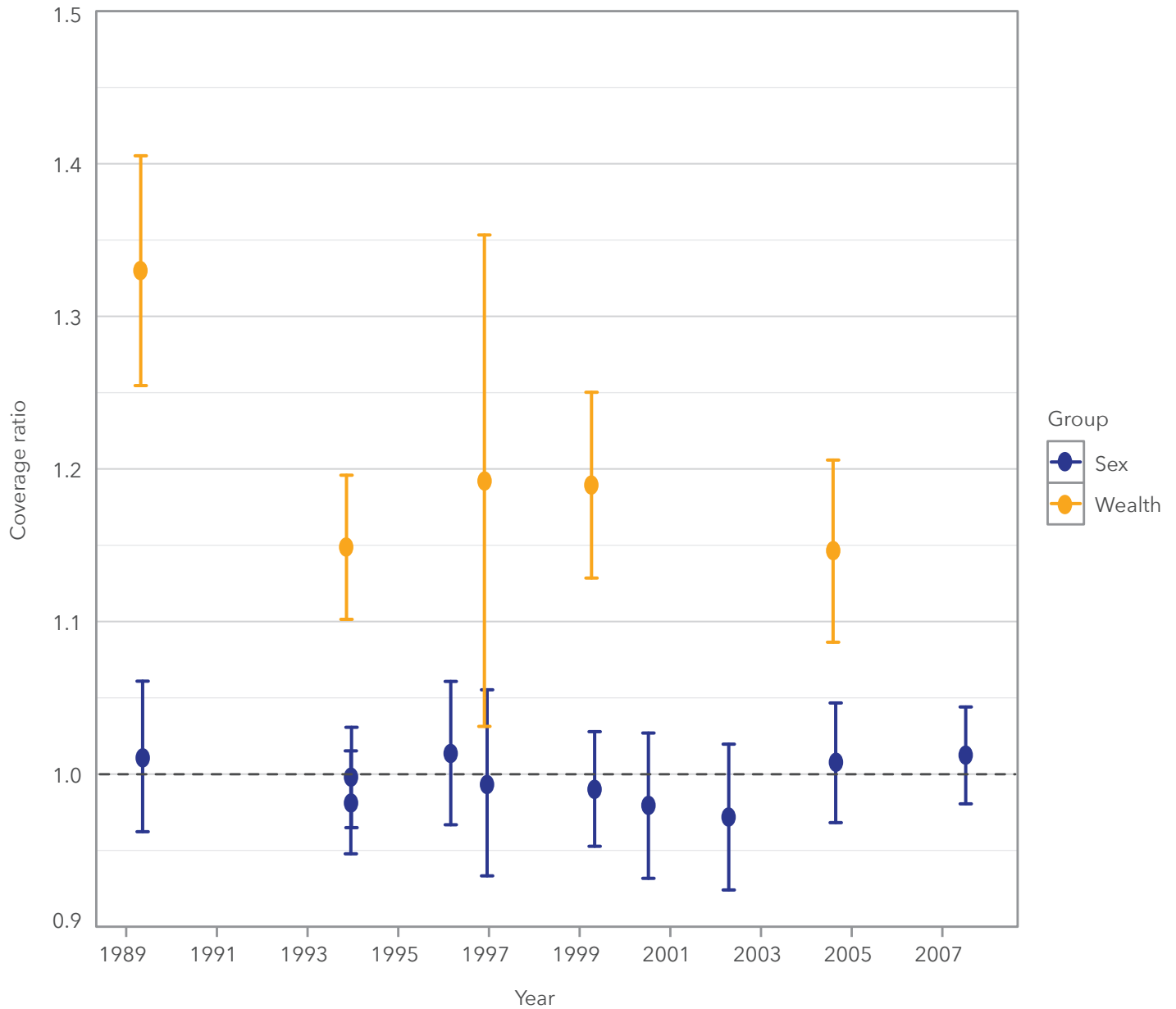
In addition to within-country place-based inequalities, there is inequality of coverage by level of household wealth.

- The ratio of DPT vaccine coverage in the richest income quintile to coverage in the poorest income quintile is well above one, indicating that coverage is greater in higher-income households (Figure 4).

- Despite initial declines in wealth-based inequality over the course of the early 1990s, there is little evidence of progress over the last two decades (Figure 4).
- In contrast, there is little evidence of inequality in coverage between male and female children (Figure 4).

Figure 4: Coverage ratios of DPT3 vaccine by sex and wealth

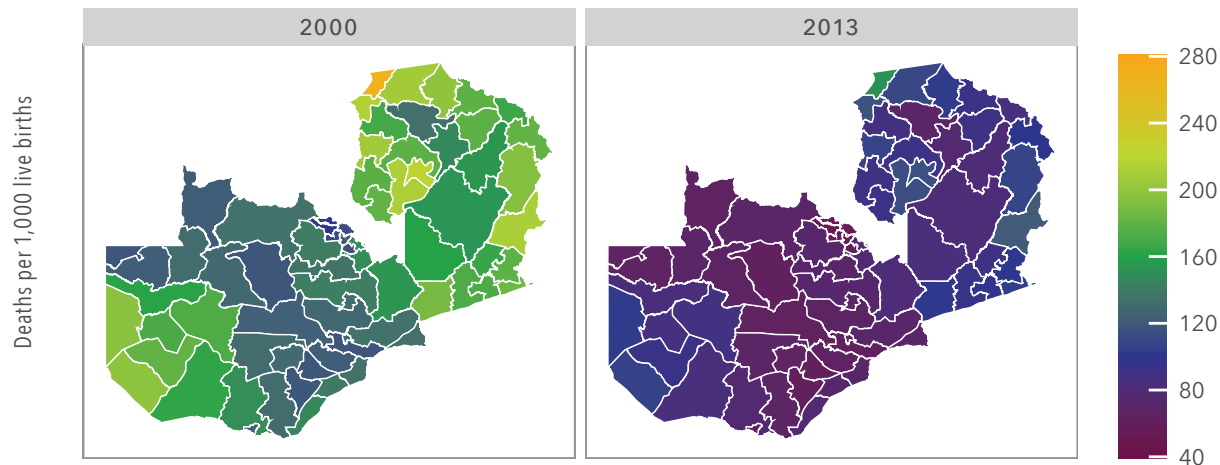
Wealth ratio is the ratio of DPT3 coverage in the richest quintile to coverage in the poorest quintile. Sex ratio is the ratio of DPT3 coverage in males versus females.



There are large disparities in under-5 mortality among districts.

- Children in districts on the perimeter of the country, particularly in the north, north-east, and southwest, experienced noticeably higher risk of under-5 mortality than children in more centrally located districts (Figure 5).
- Mortality has declined in all districts since 2000, leading to a decline in the median risk of under-5 death as well as a decline in between-district inequality as measured by both the range and the interquartile range (Figure 3).

Figure 5: District-level under-5 mortality, using small area analysis techniques



These estimates should be interpreted with caution. In some cases different surveys give disparate results, suggesting data-quality issues. Additionally, not all data are identified at the lowest geographic level.

ANALYSIS of major challenges and successes

We used a Root Cause Analysis (RCA) approach to identify the root causes of observed successes and failures.

- A “root cause” is a key factor in a causal chain of events that, if removed from the sequence, would prevent the final undesirable or desirable event from occurring or recurring.
- The RCA and accompanying diagrams were produced by testing assumptions against multiple data sources and through collective deliberation.

Each finding is accompanied by a ranking that reflects the robustness of evidence. The four-point ranking scale is summarized below:

Ranking	Rationale
A	The finding is supported by multiple data sources (good triangulation), which are generally of good quality. Where fewer data sources exist, the supporting evidence is more factual than subjective.
B	The finding is supported by multiple data sources (good triangulation) of lesser quality. Where fewer data sources of good quality support the finding (limited triangulation), the supporting evidence is perhaps more perception-based than factual.
C	The finding is supported by few data sources (limited triangulation) and is perception-based, or generally based on data that are considered to be of lesser quality.
D	The finding is supported by limited evidence (single source) or by incomplete or unreliable evidence. Findings with this ranking may be preliminary or emerging, with active and ongoing data collection to follow.

PCV, MEASLES SECOND DOSE, AND ROTAVIRUS vaccines

PCV and measles second dose

Pneumococcal conjugate vaccine (PCV) and measles second dose (MSD) were jointly launched in mid-2013. In 2014, expansion of the cold chain continued, which has improved the delivery of PCV and other vaccines. In early 2014, the Child Health Unit (CHU) launched a set of PCV and rotavirus vaccine post-introduction monitoring and supervisory visits to assess vaccine implementation progress in conveniently selected provinces and districts across Zambia. In July 2014, WHO and other partners (UNICEF, CDC) conducted a joint PCV, rotavirus vaccine, and MSD Post-Introduction Evaluation (PIE) as part of its routine vaccine introduction evaluation activities. The combined PIE was part of a comprehensive program review that also included disease surveillance review.

At the time of the launch, the EPI adapted the existing surveillance system to include pneumonia case reporting and investigation. Simultaneously, the Health Management Information System (HMIS) was adjusted to capture PCV coverage. Additionally, a reporting tool was developed and utilized

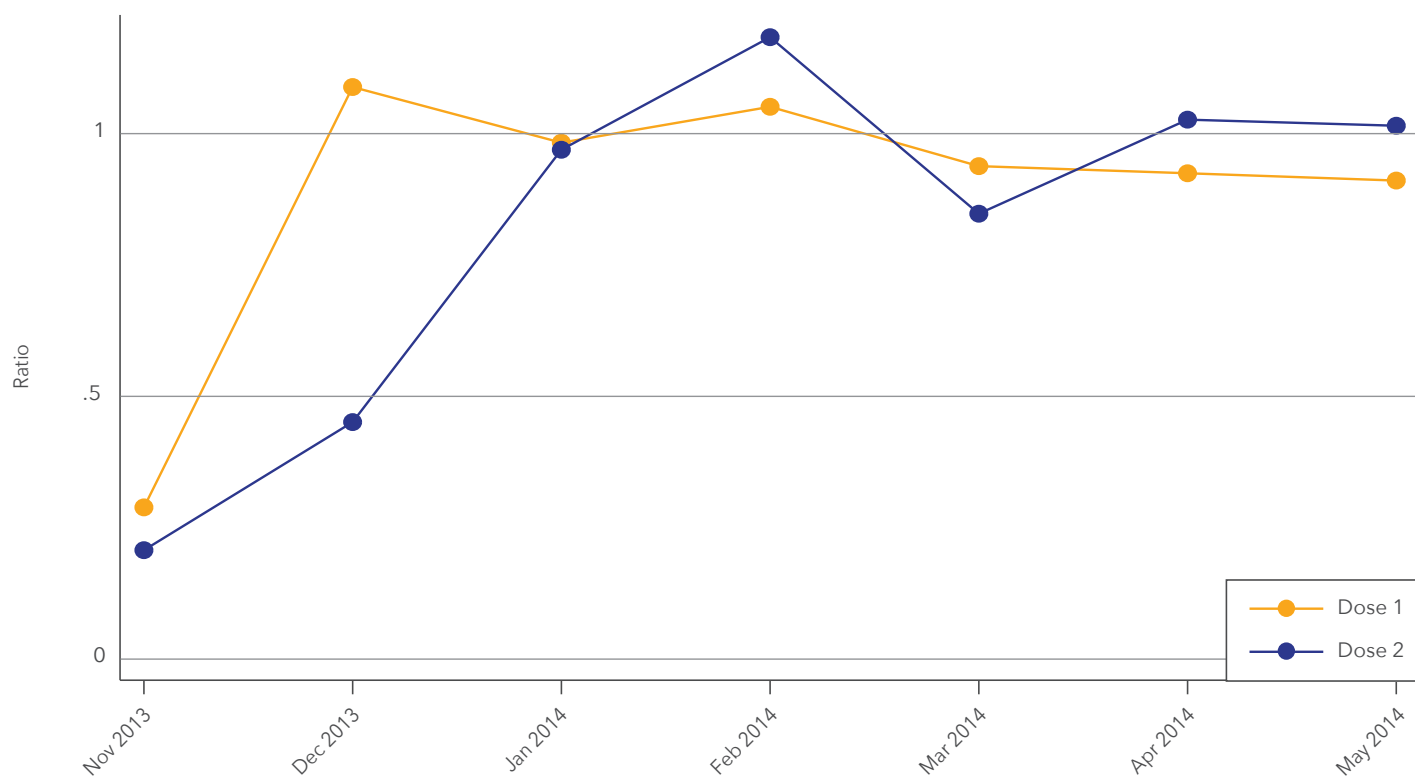
for the reporting of adverse events following immunization (AEFI). In contrast to other countries where PCV was introduced, there was no parallel system implemented specifically for capturing PCV.

Rotavirus vaccine

Two-dose rotavirus vaccine (Rotarix) was launched in Zambia in November 2013, about four months after the simultaneous launch of PCV and MSD. Prior to the national rollout, a pilot was conducted in January 2012, led by the Centre for Infectious Disease Research in Zambia, in three districts of Lusaka province. The pilot study informed the subsequent national introduction of rotavirus vaccine. Rotavirus vaccine delivery appears to have been scaled up over a shorter time period than PCV and was at similar levels to that of pentavalent vaccine one to two months following the introduction month (Figure 6). This suggests that the introduction and routinization of rotavirus vaccine were smoother than those of PCV.

Figure 6: Ratio of rotavirus vaccine doses to pentavalent vaccine doses, Zambia, May 2013–May 2014

A ratio of 1 indicates that rotavirus vaccine has the same coverage rate as pentavalent vaccine within the present birth cohort of children.

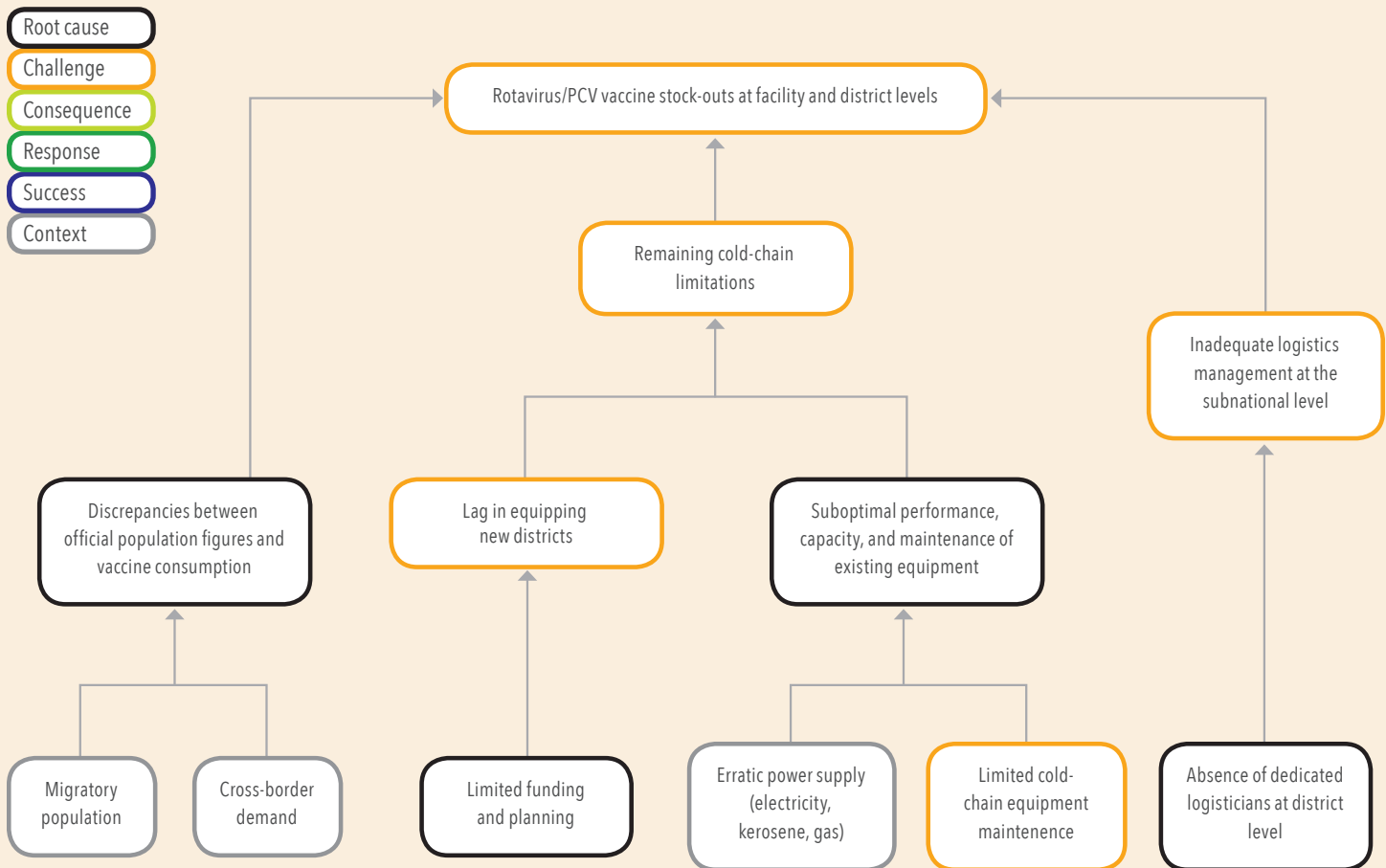


FINDING 1

Discrepancies between vaccine consumption and official target population figures that are used to determine vaccine supply, remaining cold-chain inadequacies at facilities, and lack of adequate planning and vaccine stock management at the subnational level contributed to stock-outs of both PCV and rotavirus vaccines.

RCA for PCV and rotavirus vaccine stock-outs

Ranking: A



RECOMMENDATIONS

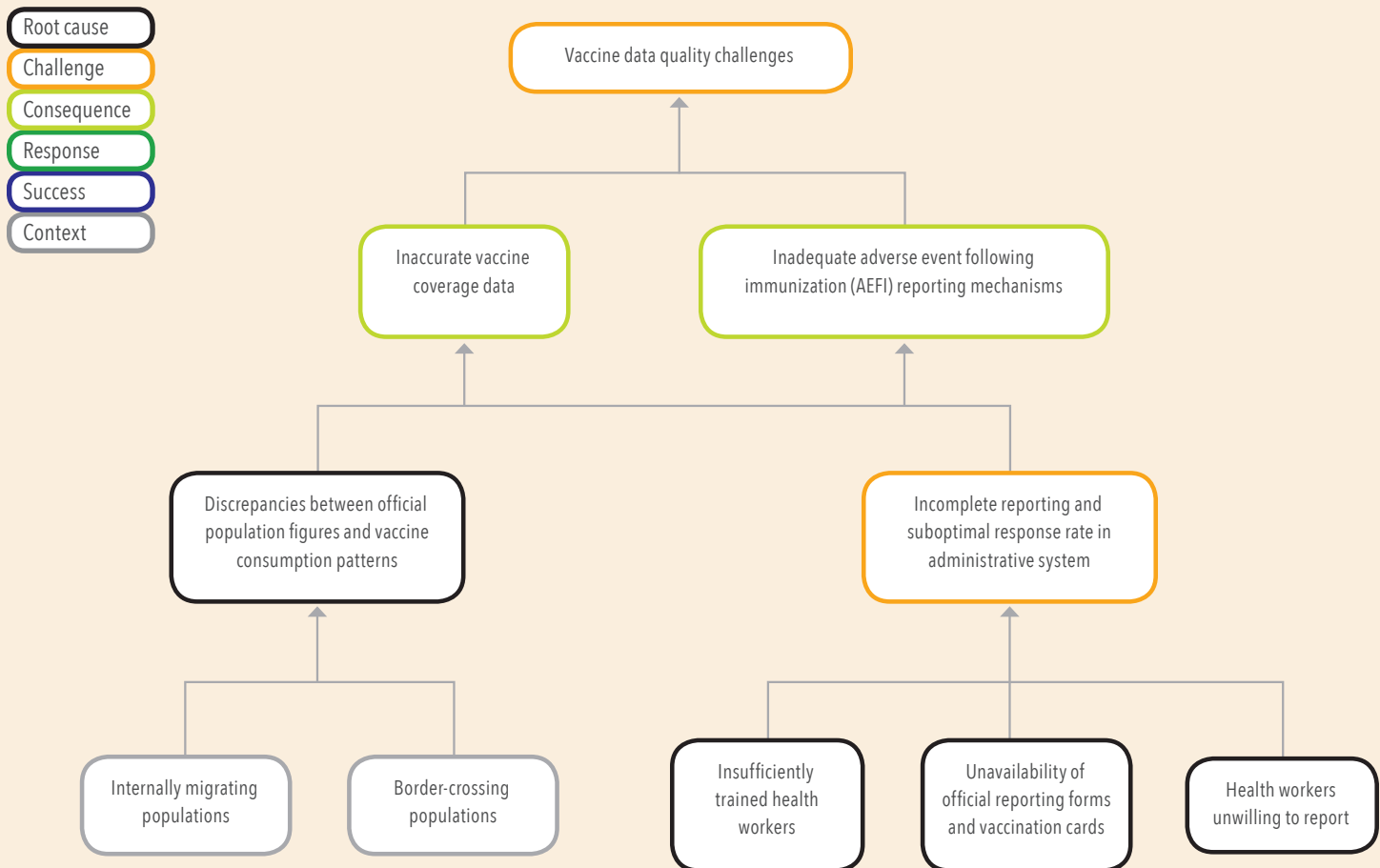
1. In Zambia, substantial long-term investment and multi-sectorial involvement are required to develop more accurate estimates of target populations for measuring vaccine coverage and determining vaccine supply. In the nearer term, the EPI program with appropriate stakeholders, including districts, Central Statistical Office (CSO), and partners such as WHO and UNICEF, should identify solutions to mitigate the effect of inaccurate denominators leading to vaccine stock-outs.
2. There should be continued investment in cold-chain capacity; maintenance and logistics should be a key focus on health system strengthening activities in Zambia.

FINDING 2

Ongoing limitations of the vaccine surveillance system, including lack of tools and forms at facility levels, inaccurate denominators, insufficient health worker training, and incomplete reporting, limit the ability of the EPI program to track the rollout of PCV and rotavirus vaccine in terms of vaccine coverage, adverse events, and other indicators.

RCA for vaccine data quality challenges

Ranking: A



RECOMMENDATION

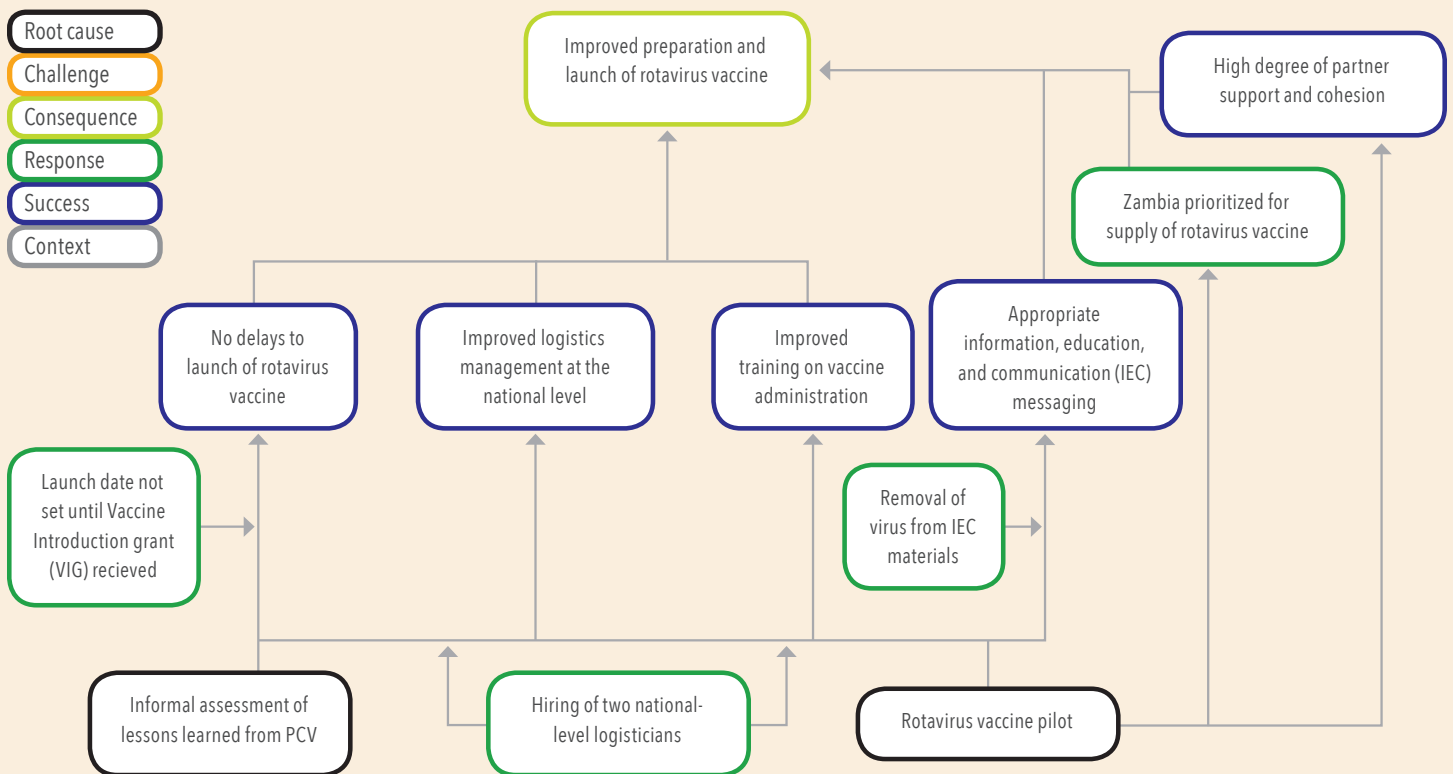
Data quality is a key focus of the latest HSS support stream. Consistent with this focus and the findings of the evaluation, the upcoming application for HSS in Zambia should include substantial investments to address the issue of data quality, including ensuring availability of forms and tools, as well as training to ensure accurate reporting.

FINDING 3

Experience gained through the pilot implementation of rotavirus vaccine in Lusaka province and adaptations based on informal lessons learned during the launch of PCV in 2013 contributed to improved preparation, launch, and rollout of the rotavirus vaccine compared to previous introductions. A formal PIE and a longer time period between the introductions could have potentially allowed for greater learning and opportunity to address past limitations prior to the rotavirus vaccine introduction.

RCA for the improved preparation and launch of the rotavirus vaccine

Ranking: B



RECOMMENDATION

EPI programs, country-partners, and Gavi should ensure that learning experiences are maximized for new vaccine introductions. Learning from previous introductions should be based on robust post-launch monitoring and evaluation, including post-introduction evaluations. This should also include sufficient time between introductions to allow

corrective actions to be taken. Another option is to explore further the use of phased introductions such as through the use of pilot or demonstration projects that provide opportunities for early identification and resolution of bottlenecks and partnership strengthening.

CASH-BASED SUPPORT: Health System Strengthening

The government of Zambia began to implement the initial Health System Strengthening (HSS) grant program in 2008. However, the program could not be completed due to the freezing of funds following alleged financial irregularity in the Ministry of Health. Later, the government of Zambia was given the option to either reprogram the grant for the undisbursed funds or submit an application for a new grant. The government opted to submit a new application. An Expression of Interest (EOI) to apply for Gavi HSS support was subsequently submitted in May 2014. The government had aimed to submit the application in the September 2014 application

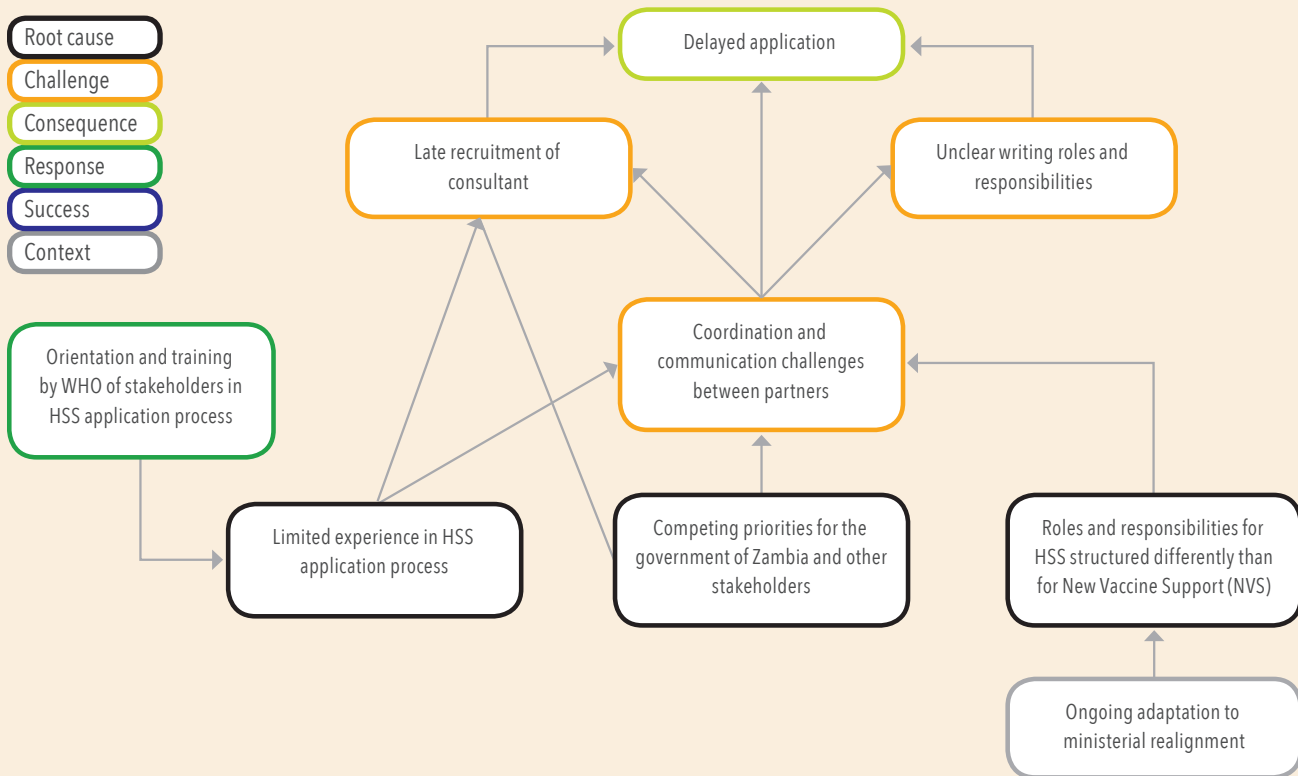
window. However, this date was not met, and the application was expected to be submitted in the first quarter of 2015.

FINDING 1

Coordination challenges stemming from the different partnership structure for HSS compared to new vaccine introductions, limited experience with the new HSS application process, and multiple competing priorities led to a revision of the timeline for the HSS application submission from September 2014 to January 2015.

RCA for the delayed application for HSS

Ranking: C



RECOMMENDATION

MCDMCH should identify a dedicated point person within the Department of Planning and Information to coordinate the application of the HSS grant in Zambia.

UPCOMING areas of evaluation

Inactivated polio vaccine

The government of Zambia through MCDMCH submitted an EOI for IPV to the Interagency Coordinating Committee for endorsement in May 2014. After it was approved, a small team representing MCDMCH, WHO, and UNICEF began preparing the full IPV proposal. Technical support was provided by WHO and UNICEF in September 2014, through a regional workshop for the development of IPV applications. The full application was submitted in September 2014. The revision of the Comprehensive Multi-year Plan was finalized in early September 2014 and included the introduction of IPV in 2015.

The Full Country Evaluation will investigate the IPV decision and application development process in the near future, following up on these key issues:

- The influence of the Government of Zambia, global stakeholders, and international stakeholders in this application.
- The influence of the time and resources devoted to IPV on the preparation of the HSS proposal, given that the core team was the same for both applications.
- The extent of stakeholder consultation in proposal development.

CROSS-STREAM findings for Zambia

Vaccine data quality

Data-quality issues affected the availability of vaccines.

- The volume of vaccines received by the government of Zambia and the allocation of these vaccines to districts and facilities is based on official Central Statistical Office (CSO) figures of vaccine-eligible children.
- Due to patterns of seasonal migration of populations within and into Zambia, vaccine consumption differs from CSO figures, with health facilities experiencing higher vaccine demand than the allocated amount. Combined with transportation challenges, vaccines were stocked-out in the facilities.

Data-quality issues affected the accurate surveillance of vaccine coverage and adverse events following immunization (AEFI).

- Data quality of vaccine administration was suboptimal due either to absent or incomplete reporting or absence of official forms for vaccine and AEFIs in a significant proportion of health facilities.
- Data on vaccine administration were missing for certain periods in the Health Management Information System (HMIS) at many facilities.
- Some facilities did not have a system in place to report AEFIs, or health workers avoided reporting them for fear of being the cause behind the adverse event.
- HSS provides an opportunity to address these vaccine data-quality challenges, including strengthening HMIS through system expansion, training, data management, and analysis.

Human resources

Health worker shortages, in terms of both quantity and skill level, affect not only the EPI, but the entire health system.

- At the national level, limited program staff at MCDMCH must manage high workloads with many competing priorities.
- At the subnational level, the absence of logisticians contributed to gaps in logistics management. However, the hiring of two national-level logisticians with support from the Centre for Infectious Disease Research in Zambia (CIDRZ) eased the burden of logistics management on other staff and improved logistics management generally at the national level.
- Building capacity of health workers through training may be an area of investment for HSS.

Cold chain

Zambia has achieved accelerated expansion of the cold chain in the past two years with significant partner support.

- The Japan International Cooperation Agency (JICA) and CIDRZ were instrumental in providing funds for the procurement and installation of cold chain equipment at both the national and subnational levels.

Despite improvements, there are severe, persistent challenges in many districts' cold chains, which have incapacitated the effective management of vaccine stocks in general.

- Erratic power supply, lack of timely maintenance services, and the absence of vaccine storage equipment in many facilities contributed to the failure to stock vaccines in many facilities and the interruption of immunization service delivery.

The challenges surrounding the cold chain are critical bottlenecks in health system delivery in the HSS application that is under development and are likely to be an area of further investment.

- Vaccine introduction grants did not prove enough to solve the cold-chain problems; a successful application for HSS will provide an opportunity for the improvement of cold-chain capacity in the country.

Partnership

Clarity in roles and responsibilities of partners in the preparation and launch of rotavirus vaccine was crucial to the smooth launch and roll out of the vaccine.

- This strong partnership may be due to the learning and experience from partnership in the pilot of the rotavirus vaccine, or to the strong leadership role CIDRZ played in the implementation and in supporting MCDMCH in preparing for the roll out.

CONCLUSIONS

In 2013, Zambia expanded its vaccination program substantially with support from Gavi.

- The government of Zambia has now introduced three new vaccines with support from Gavi: PCV, MSD, and rotavirus vaccines.
- Both PCV and rotavirus vaccine were routinized fairly quickly following their respective national launches. The scale-up of rotavirus was notably faster than that of PCV.
- At the subnational level, PCV and rotavirus vaccines were well-received and integrated into the local immunization programs, and their delivery benefits from annual government planning and budgeting.

Gavi support is generally well aligned with Zambia's priorities, which are described in the national health strategic plan and the Comprehensive Multi-Year Plan (cMYP), and contribute to Zambia's priority of accelerating reductions in child mortality.

- The cMYP was revised to include IPV just prior to the application for Gavi support.
- Pneumonia and diarrhea are leading causes of child deaths in Zambia; the introduction and routinization of PCV and rotavirus vaccine are likely contributing to the country's efforts toward reducing child mortality.

Lack of clarity about the roles and responsibilities of partners in developing the HSS application delayed the development and submission of an HSS application.

- Though relevant partnership developed a road map for the HSS application, weak coordination and communication between partners contributed to delays in development and submission.

The value of Gavi partnership at the country level is a key theme for evaluation.

- Partnership has a recognized contribution in the context of the new vaccine- and cash-based streams of support and will be a key area for further investigation, especially in the context of the ongoing HSS application development.

Gavi support to Zambia is implemented with a network of local partners.

- All planning and implementation activities were undertaken with support from country partners.
- Gavi's support played a catalytic role in securing support from local donors to support the cold chain and other components of the EPI:

Support from JICA and CIDRZ for the cold chain is well documented.

National logistics planning and management were boosted by the addition of two national-level logisticians based at CHU, one of whom was funded by CIDRZ.

The FCE suggests that there was a stronger and broader partnership around the rotavirus vaccine introduction compared to previous introductions.

A number of challenges in the EPI remain, and fully reaching the target population is constrained by persistent deficiencies of the immunization system.

- Monitoring and demand forecasting are hampered by data-quality issues.
- Although the cold chain was expanded around the introduction of PCV and rotavirus vaccine, it remains inadequate at the subnational level and is compounded by breakdowns in the cold chain.

- There is a lack of trained logisticians at the subnational level to manage logistics planning and management.
- There is an overall shortage of staff to deliver immunizations, especially in rural areas.
- The vaccine introduction grant provided by Gavi remains inadequate to cover all these deficiencies, and these are all key areas of focus that we recommend for health system strengthening activities, especially given the upcoming HSS application.

There is limited use of monitoring and evaluation tools to inform policy and program performance.

- There is little regular feedback from the surveillance unit situated at the University Teaching Hospital to the planning department in the MCDMCH.
- During the Technical Working Group meetings, there is low emphasis on accessing regular reports to facilitate monitoring of program performance to inform program implementation, indicating the perception of low data quality.
- This is an important area for future investment.

POSITIVE AND NEGATIVE

unintended consequences of Gavi support in Zambia

New vaccine support stimulated local donors to provide funding to the EPI.

- Funding for cold-chain expansion, support for surveillance for diarrheal diseases, and national-level training were examples of this support.

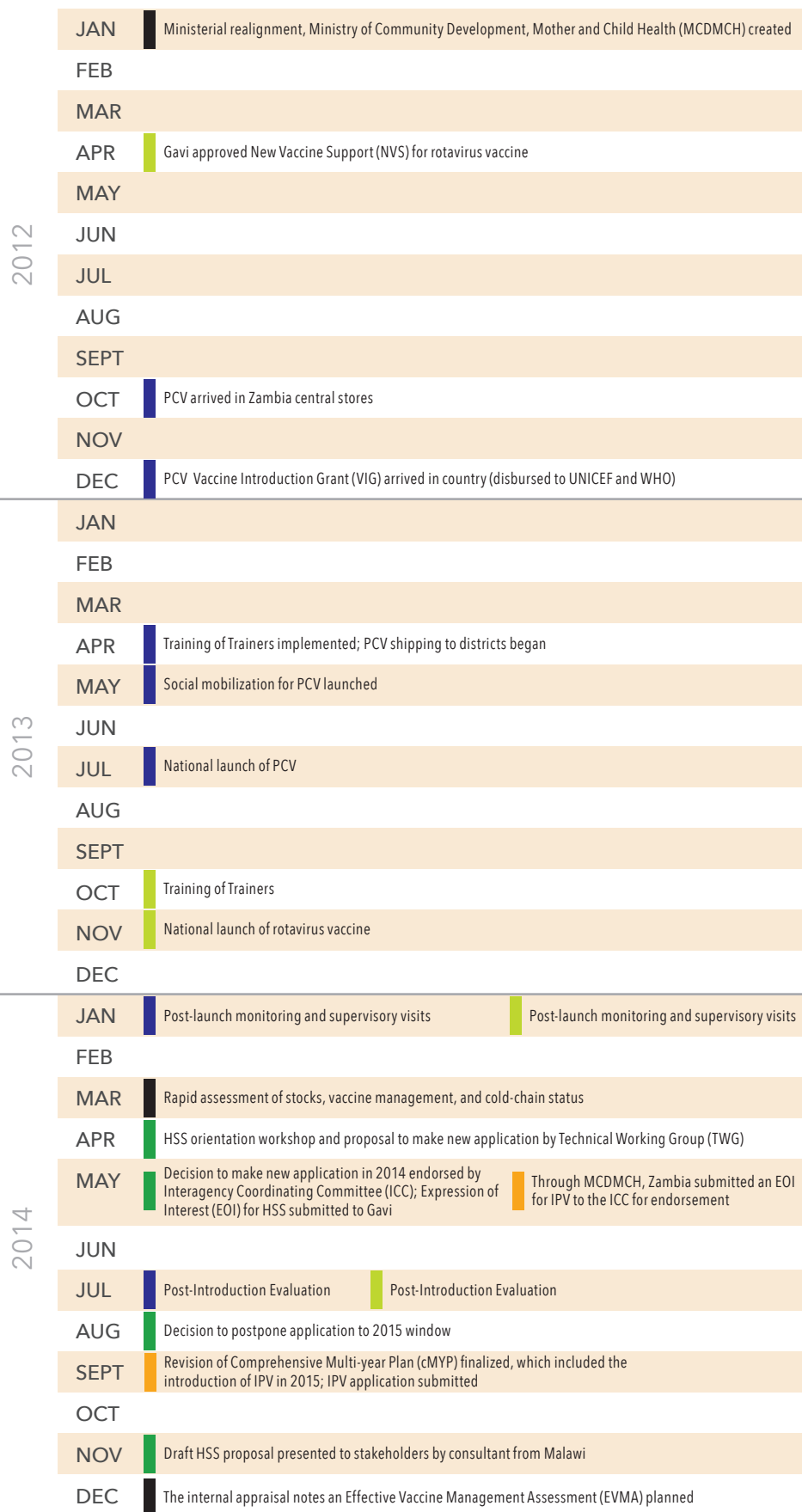
There was not enough time to perform a formal evaluation of the PCV/MSD introduction to inform the introduction of rotavirus vaccine and to implement solutions for evaluation-identified deficiencies.

- The introduction of several new vaccines by Zambia with the support of Gavi over a short time period was a notable achievement and will contribute to averted burden of vaccine-preventable disease.
- However, there was insufficient time to formally evaluate the PCV/MSD introduction, so lessons from this experience did not inform the introduction of rotavirus vaccine or lead to the implementation of solutions for evaluation-identified deficiencies.

Prioritization of activities related to the new vaccine application, introduction, and routinization process likely contributed to delays in the HSS process.

- The development of the IPV application took priority over the HSS application and was finalized and submitted, while the HSS application was deferred to a later date.
- Consequently, critical investments to strengthen the immunization programs and facilitate smoother introductions were delayed.
- It is important that ambitious programmatic goals and plans are balanced with effective technical capacity and implementation.

TIMELINE of major immunization events in Zambia



Streams of support evaluated in 2014

- Implementation of pneumococcal conjugate vaccine (PCV)
- Rotavirus vaccine
- Cash-based support through Health System Strengthening (HSS)
- Inactivated polio vaccine (IPV)
- Not vaccine-specific

NVS for PCV was approved by Gavi on September 26, 2011. The proposal was submitted on June 11, 2011. NVS for rotavirus vaccine was approved by Gavi on April 12, 2012; the application was submitted November 15, 2011. ISS support was approved by Gavi on April 21, 2009. HSS support was approved on August 1, 2007; the application was submitted in May 2007. EVMA occurred in July 2011.

