Review

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Progress with Immunization Coverage and the Control, Elimination, and Eradication of Vaccine-Preventable Diseases in the WHO African Region Since the End of the COVID-19 Public Health Emergency of International Concern

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Review

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Abstract

The end of the COVID-19 pandemic in May 2023 marked a pivotal transition from emergency response to recovery and rebuilding of health systems across the world. The WHO African Region entered this period with declining routine immunization coverage, widening inequities, and fragile surveillance systems. This review critically synthesizes post-pandemic immunization and vaccine-preventable disease (VPD) trends using publicly available data. Regional coverage for most vaccine doses returned to 2019 pre-pandemic levels by 2024. However, 6.7 million zero-dose children remain concentrated in a small number of countries. Accelerated recovery efforts – including the Big Catch-Up initiative, policy normalization of catch-up vaccination, and strengthened social and behaviour change strategies – have mitigated further backsliding. Concurrently, accelerated disease control initiatives - targeting measles, yellow fever, tetanus, meningitis, and poliomyelitis - have highlighted both renewed momentum toward elimination and eradication, and persistent vulnerabilities driven

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by immunity gaps, climate shocks, urbanization, and conflict. The strongest marker of regained momentum has been accelerated introductions of vaccines against malaria (in 20 new countries), human papillomavirus (in 10 new countries), and other VPDs across the region. However, sustained progress will require institutionalizing catch-up vaccination, systematically using implementation research to strengthen subnational tailoring, enhancing integrated surveillance systems, and securing predictable domestic financing within the framework of the Immunization Agenda 2030.

Keywords: vaccine-preventable diseases; immunization recovery; COVID-19; public health emergency of international concern; measles; meningitis; yellow fever; malaria; disease elimination; Africa; health systems

1. Introduction

Prior to the coronavirus disease 2019 (COVID-19) pandemic, the World Health Organization (WHO) African Region had achieved steady – though uneven – progress in expanding immunization coverage and reducing morbidity and mortality from vaccine-preventable diseases (VPDs) [1,2]. These gains were driven by the expansion of routine immunization services, the introduction of new vaccines, and periodic supplementary immunization activities (SIAs). However, underlying vulnerabilities persisted. Many countries entered the pandemic with stagnant coverage levels, high dropout rates between vaccine doses, substantial subnational inequities, and fragile surveillance systems insufficiently resilient to systemic shocks [3].

The COVID-19 pandemic triggered the most severe disruption to routine immunization services in decades [4]. Lockdowns, movement restrictions, diversion of health personnel, supply chain interruptions, and reduced healthcare utilization contributed to sharp declines in vaccination coverage and delays in outbreak detection and response [3]. Between 2020 and 2022, more than 28 million children in the WHO African Region missed the first dose of diphtheria-tetanus-pertussis containing vaccines (DTP1), the conventional proxy indicator for zero-dose status [5]. These disruptions led to the rapid accumulation of susceptible populations and heightened outbreak risk across multiple VPDs [3].

The declaration in May 2023 of the end of the COVID-19 Public Health Emergency of International Concern (PHEIC) marked a transition from emergency response to recovery and system rebuilding [6]. In the WHO African Region, the post-PHEIC years have been characterized not by a simple return to pre-pandemic norms, but by a deliberate effort to restore, adapt, and reposition immunization programmes amid persistent fragility, competing crises, and fiscal constraints; offering important lessons for the next phase of the Immunization Agenda 2030 (IA2030) [7].

This review examines post-PHEIC recovery trajectories in routine immunization, new vaccine introductions, accelerated disease control, data management, regulatory systems, and the application of implementation science in immunization programmes across the WHO African Region; identifies persistent bottlenecks; and outlines strategic priorities to accelerate progress.

2. Methods

We conducted a critical synthesis of available evidence on post-PHEIC immunization recovery and VPD control in the WHO African Region. Data sources included country programme data reported to the WHO and the United Nations Children Fund (UNICEF) [8]; WHO programme and technical reports [9–14]; dashboards [15–19]; policy documents [20–22]; IA2030 Scorecard [23]; and WHO-UNICEF Estimates of National Immunization Coverage (WUENIC) [24]. The figures reported for surviving infants, immunization coverage, and zero-dose prevalence are WUENIC estimates [24].,

The analysis focused on trends in routine immunization coverage, zero-dose prevalence, outbreak epidemiology, vaccine introductions, surveillance performance, financing, and system strengthening initiatives. Rather than presenting new primary data, the review interprets existing

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evidence to assess recovery trajectories, identifies structural bottlenecks, and outlines priorities for accelerated VPD control.

3. Routine Immunization Coverage and Equity

3.1. Recovery at Scale

The immediate post-PHEIC period demanded prompt large scale recovery efforts. In April 2023, the Big Catch-Up initiative reframed recovery as both a coverage restoration effort and a broader system-strengthening agenda [25]. This initiative – led by WHO, UNICEF, Gavi The Vaccine Alliance, and the Gates Foundation – aimed to support countries in (a) vaccinating children who missed vaccine doses during the COVID-19 pandemic, (b) restoring coverage to at least 2019 levels, and (c) strengthening primary health care (PHC)-based immunization systems to reach zero-dose children in line with goals of the IA2030 and Gavi's fifth five-year strategy [26]. By the end of 2025, all pre-selected 24 priority countries in the WHO African Region had initiated Big Catch-Up implementation, vaccinating more than eight million previously zero-dose children and substantially larger numbers of previously under-vaccinated children [15]. This shift signalled recognition that pandemic-related setbacks could not be addressed through isolated campaigns alone; but required integration of catch-up vaccination into routine service delivery, microplanning, and forecasting processes.

3.2. Coverage Trends and Zero-Dose Dynamics

Demographic growth has intensified programmatic demands [24]. The number of surviving infants in the region increased by approximately 7%, from 36.6 million in 2019 to 39.2 million in 2024. Against this expanding denominator, regional immunization coverage for most antigens returned to pre-pandemic levels by 2024; but did not substantially exceed them.

DTP1 coverage declined from 83% in 2019 to 80% in 2022, before recovering to 83% in 2024 [24]. Similarly, DTP3 coverage fell from 76% in 2019 to 72% in 2022 and rebounded to 76% in 2024. While these recoveries may demonstrate resilience, they also reveal stagnation. The region has largely returned to 2019 pre-pandemic baselines rather than progressing toward IA2030 targets of 90% coverage for all vaccine doses [7].

The annual absolute number of children receiving DTP1 increased from 30.4 million in 2019 to 32.5 million in 2024, reflecting both demographic growth and service restoration [24]. However, the number of zero-dose children in each annual birth cohort rose sharply during the pandemic – from 6.3 million in 2019 to 7.5 million in 2022 – before declining to 6.7 million in 2024. Despite this improvement, the region has not fully reversed pandemic-era setbacks.

Zero-dose children remain highly concentrated geographically [24]. In 2024, ten countries accounted for approximately 80% of the region's zero-dose burden. Nigeria alone accounted for an estimated 2.1 million zero-dose children (31%), followed by the Democratic Republic of the Congo (DRC) at 772,000 zero-dose children (11%). This concentration underscores the need for targeted country-specific strategies, with subnational tailoring, rather than uniform regional approaches.

Country-level performance remains heterogeneous [24]. In 2024, DTP3 coverage ranged from 42% in the Central African Republic through 90-94% in thirteen countries, to ≥95% in four countries including Rwanda with the highest DTP3 coverage at 98%. These disparities highlight both the feasibility of high performance and the persistent structural inequities limiting progress elsewhere.

3.3. Institutionalizing Catch-Up and Addressing Demand

A notable policy evolution during the post-PHEIC period has been the normalization of catch-up vaccination beyond infancy [20]. More than 20 countries revised policies to vaccinate children up to five years of age, embedding catch-up as a routine function rather than a time-bound campaign response [15]. This policy evolution, strongly endorsed by regional technical advice, reflects a more resilient approach to inevitable disruptions; whether from pandemics, conflict, supply constraints, or climate shocks [20].

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Recovery strategies have increasingly recognized that supply restoration alone is insufficient. Several countries have expanded use of behavioural and social data to tailor communication strategies, address vaccine hesitancy, rebuild trust following COVID-19 disruptions, and mitigate indirect access costs faced by caregivers. As of mid-2025, twenty countries had conducted assessments of behavioural and social drivers to guide demand-generation strategies, and 26 had enacted vaccine-related legislation reinforcing immunization as a core public health function [8].

3.4. Persistent Equity Gaps

Despite measurable recovery, equity gaps remain pronounced. Zero-dose and under-vaccinated children continue to be disproportionately concentrated in remote rural areas, informal urban settlements, conflict-affected zones, border regions, and among other marginalized populations [27]. High dropout between DTP1 and DTP3 persists in several settings, indicating challenges in sustaining contact with the health system beyond the first vaccination visit. Overall, in the WHO African Region, the number of infants who started but did not complete the full series of three DTP doses each year increased from 2.5 million in 2019 to 3.1 million in 2022 before decreasing slightly to 2.8 million in 2024; with wide variation across and within countries [24].

Thus, while regional recovery demonstrates that progress is possible even in constrained environments, the evidence suggests that restoration to pre-pandemic coverage levels is insufficient. Achieving IA2030 targets will require deliberate strategies to reduce dropout rates, strengthen the second year of life platform, institutionalize catch-up mechanisms, enhance subnational microplanning, and integrate immunization more deeply within PHC systems [28]. The post-PHEIC period therefore represents not merely a phase of recovery, but a strategic opportunity to redesign immunization delivery for resilience and equity.

4. New Vaccine Introductions

One of the clearest markers of strengthened health system momentum in the post-PHEIC period in the WHO African has been the accelerated introduction and scale-up of new and under-utilized vaccines across the region. In 2023 there were 11 new vaccine introductions and in 2024 there were 28 [23]. In particular, there was accelerated progress in the introduction of malaria vaccines (no new country in 2023 but 13 new countries in 2024), the second dose of the inactivated polio vaccine (IPV2: 7 in 2023 and 6 in 2024), the second dose of measles-containing vaccines (MCV2: 1 each in 2023 and 2024), and human papillomavirus (HPV) vaccines (3 in 2023 and 1 in 2024) [23]. These trends align with IA2030's emphasis on life-course vaccination and integrated service delivery, but they also sharpen a central policy question for the WHO African Region, i.e., how to ensure that the speed of vaccine introductions is matched by the strength of the delivery systems needed to sustain coverage equitably over time.

Beyond their direct disease impact, these introductions have functioned as practical system stress-tests. The introductions require countries to strengthen regulatory systems, delivery platforms, cold chain capacity, data systems, safety surveillance, and community engagement, often under tight timelines and within constrained fiscal space. In several settings, new vaccine introductions have therefore served as catalysts for broader PHC integration, life-course immunization approaches, and renewed attention to reaching missed and under-vaccinated populations [17,19,29]. At the same time, uneven readiness, persistent financing gaps, and variable demand dynamics mean that rapid introduction does not automatically translate into high, sustained coverage, reinforcing the importance of deliberate implementation design [17,19,30].

4.1. Malaria Vaccine Introduction

The malaria vaccine rollout represents a landmark shift from pilot implementation to broader programmatic scale in Africa. Building on the pilot Malaria Vaccine Implementation Programme (MVIP) experience in Ghana, Kenya, and Malawi, a rapid expansion phase has followed, supported by coordinated technical assistance and partner alignment [31]. The WHO-led multi-partner platform

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– Accelerating Malaria Vaccine Introduction and Rollout in Africa (AMVIRA) - launched in January 2024, has helped countries navigate planning, training, logistics, demand generation, and monitoring, while strengthening coordination across national and regional stakeholders [19,32].

By October 2025 there were 23 countries that had introduced malaria vaccines into their national immunization schedules, reflecting a rapid expansion from the three pilot MVIP countries in December 2023 [16,31]. Scale-up has also been accompanied by efforts to strengthen performance intelligence, including digital dashboards and real-time monitoring tools to support rapid corrective actions during rollout [16,19,32]. However, sustaining malaria vaccine delivery will require reliable integration into routine child health platforms, stable financing for operations and supervision, and careful management of community expectations, particularly in settings with high malaria burden and concurrent health system constraints.

4.2. HPV Vaccine Introduction

HPV vaccination has increasingly become a signature example of life-course immunization in the WHO African Region, anchored in the cervical cancer elimination agenda. Despite progress, coverage remains below the levels required to meet the global 90–70–90 targets, and the post-PHEIC period has highlighted that demand-side barriers and delivery complexity can constrain performance even when political commitment exists [33]. Nevertheless, the region has continued to expand HPV introductions and refine delivery strategies, with many countries transitioning to WHO-recommended single-dose schedules, which simplifies implementation and improve feasibility within constrained systems [34,35].

By the end of 2025, a total of 35 countries in the region had introduced HPV vaccination into their routine immunization schedules (up from 25 in 2022), and 47% of girls had received at least one dose by age 15 years in the region [17]. Several countries have achieved high coverage, demonstrating feasibility when school-based strategies are well planned, communities are engaged early, and health worker capacity is strengthened [33]. At the same time, implementation has faced supply and logistics bottlenecks in some settings; vaccine hesitancy and misinformation, including anti-HPV narratives amplified in the post-COVID information environment; and uneven healthcare worker confidence and training on HPV vaccine benefits and eligibility [33–36]. The post-PHEIC period is therefore strategically important, not only for introductions, but also for embedding HPV vaccination within routine platforms in ways that sustain coverage, trust, and protect equity.

Following the recommendation by the African Regional Immunization Technical Advisory Group (RITAG) in November 2023 of single-dose HPV vaccination schedules, 29 countries in the region had transitioned from two-to-three to one-dose schedules by the end of 2025 [17,20]. The transition to single-dose HPV schedules represents one of the most operationally significant policy shifts in the region's immunization programme in recent years. For high-burden, resource-constrained settings, single-dose schedules reduce the logistical complexity of follow-up and extend the reach to adolescent girls who may have limited repeat contact with health services. Evidence from early adopters in the region suggests that single-dose programmes, when paired with strong school-health linkages and community mobilization, can achieve high coverage levels [17]. However, equity considerations must remain central: out-of-school girls, those in humanitarian settings, and adolescents in hard-to-reach communities remain systematically under-reached by school-based delivery, requiring deliberate complementary strategies through community and health facility platforms.

Looking ahead, the integration of HPV vaccination into broader life-course health frameworks - linking adolescent immunization contacts with sexual and reproductive health, nutrition, and mental health services - offers both a programmatic and political opportunity to elevate the visibility of adolescent health on national agendas. Several countries in the region are piloting integrated adolescent health platforms that bundle HPV vaccination with other interventions, an approach that could improve cost-efficiency and strengthen the case for domestic financing [33–35].

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Institutionalizing these platforms, rather than treating HPV delivery as a vertical programme, will be essential to sustaining coverage gains beyond donor-supported introduction phases.

4.3. Introduction of Under-Utilized Vaccines

Beyond malaria and HPV, countries have continued to expand the uptake of multiple under-utilized vaccines that are central to accelerated VPD control and epidemic preparedness. These include the continued rollout of IPV2, meningococcal conjugate vaccines, and broadening the second year of life platform through additional vaccine doses such as MCV2 and rubella-containing vaccines [23]. Collectively, these introductions support a shift away from a narrow infant-only immunization paradigm toward a more resilient life-course approach to immunization.

However, the region's experience also underscores that introduction is not the endpoint. The operational bottlenecks that limit routine coverage – health workforce shortages, weak microplanning for underserved populations, stock management challenges, and fragmented data systems – can also limit the impact of newly introduced vaccines [3,32,33]. Where countries have been most successful, introductions have been paired with deliberate system strengthening, including stronger cold chain planning, integrated supportive supervision, catch-up strategies for missed cohorts, and targeted community engagement to build trust and reduce drop-out [1,4,37].

4.4. Vaccine Introductions as a Platform for System Transformation

The post-PHEIC acceleration of vaccine introductions offers a time-limited opportunity to enable system improvements that extend beyond any single antigen. When designed intentionally, introductions can strengthen PHC platforms, improve data visibility, and build delivery capacity for reaching underserved populations, thus directly advancing equity goals. Conversely, when introductions outpace readiness, they risk becoming episodic events that add workload without improving routine performance, potentially widening inequities if better-served districts adopt and sustain coverage faster than hard-to-reach ones.

A key lesson is therefore that the region's vaccine introduction agenda must be paired with (a) predictable financing for operational delivery, (b) integration into routine contacts beyond infancy, (c) strong safety surveillance and risk communication, and (d) performance management systems that identify and address subnational gaps rapidly [37]. Framed this way, new vaccine introductions are not only a measure of technical progress, but also a practical pathway for strengthening resilient immunization systems capable of sustaining disease control gains in the post-PHEIC era.

5. Accelerated Disease Control

The post-PHEIC period in the WHO African Region has been characterized by a predictable but serious epidemiological aftershock. The accumulation of susceptible cohorts has translated into intensified VPD outbreaks, including (a) the occurrence of large and disruptive measles outbreaks in half of the countries in the region, (b) multiple countries documenting circulating vaccine-derived polio viruses (cVDPVs), and (c) the unusual occurrence of diphtheria outbreaks in at least nine countries [12,13,23,37–41]. These events are not simply episodic shocks; they are symptoms of persistent immunity gaps and a direct test of routine immunization performance, the quality of SIAs, and the timeliness of outbreak response. In this context, immunization functions simultaneously as a child survival intervention and as a core component of health security.

Across the region, preparedness efforts have increasingly emphasized integrated disease surveillance, including expanded environmental surveillance for polioviruses [37,38]. While the speed and quality of outbreak detection and response remain uneven, several countries have demonstrated more coordinated actions than in the pre-pandemic period, drawing explicitly on operational lessons from COVID-19 [20]. This section summarizes progress and remaining constraints in measles and rubella elimination, elimination of yellow fever and meningitis epidemics, maternal and neonatal tetanus elimination, and polio eradication and transition. It highlights the central insight of the post-PHEIC era; outbreak control accelerates when routine systems, second year

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of life platform, and surveillance are strengthened together, rather than treated as parallel workstreams.

5.1. Measles and Rubella Elimination

From 2000 to 2024, the WHO African Region has achieved major reductions in measles mortality, with an estimated 91% decline in annual deaths (from 391,690 to 33,639) [13]. However, progress with measles elimination in the region remains structurally uneven [9,29,42]. Cabo Verde, Mauritius, and Seychelles were verified for measles and rubella elimination in November 2025, demonstrating that elimination is feasible in the region when high routine two-dose measles-containing vaccine (MCV) coverage and sensitive surveillance are sustained [9,22]. However, no large-population country has yet reached verification, and ongoing measles transmission in the region continues to reflect the accumulation of susceptible children in high-burden settings.

Rubella-containing vaccine (RCV) introduction has expanded rapidly in the region, with 35 of 47 countries incorporating RCV into routine immunization schedules by 2024 [14,24]. Surveillance data analyses from early-adopting countries show an average 76% reduction in reported rubella cases by 2024 [14]. However, persistent rubella transmission in countries yet to introduce the vaccine highlights the importance of maintaining high population immunity and sensitive surveillance to achieve regional measles-rubella elimination.

Surveillance data illustrate the persistence of measles transmission across the region [9–12]. In 2024, the region reported 147,564 suspected measles cases through case-based surveillance, with 77,698 confirmed; corresponding to a confirmed measles incidence of 58.8 per million population. These figures signal that routine immunization coverage is not yet high enough to reliably interrupt measles transmission in the region.

The central bottleneck remains low routine two-dose MCV coverage [24]. Coverage with the first dose of MCV (MCV1) decreased sharply from 71% in 2019 to 67% in 2022, before recovering to 71% in 2024. Coverage with MCV2 increased from 32% in 2019 through 43% in 2022 to 55% in 2024, driven by new introductions; 44 of the 47 countries in the region had introduced MCV2 by end of 2024. However, there remains large gaps between MCV1 and MCV2 in many countries. This pattern points to a weak second year of life platform, where drop-out and missed opportunities for vaccination (MOV) remain common. Generally, countries that have integrated additional antigens into second year of life contacts tend to show higher MCV2 uptake and lower dropout, implying that service integration can strengthen measles performance beyond measles-specific programming.

In response to widening immunity gaps, countries have intensified preventive mass vaccination campaigns (PMVCs) and outbreak response campaigns [9–12]. In 2023-2024, a total of 24 countries implemented 28 preventive and six large-scale outbreak-response measles/measles-rubella SIAs, collectively vaccinating more than 164 million children [10]. In addition, in 2025, more than 74 million children in the region were protected against measles through SIAs in 16 countries [9].

Operational refinements, such as shifting from 10-dose to 5-dose MCV vials, appear to have reduced MOV by increasing session flexibility and improving the confidence of healthcare workers to open vials beyond high-attendance days [43]. However, the region's measles-rubella elimination efforts remain constrained by weak surveillance in many countries. In 2024, only 27 of 47 countries met annual targets for the two principal measles surveillance indicators, constraining timely detection, confirmation, and response [10].

The attainment of sustainable measles-rubella elimination in the WHO African Region will require robust routine vaccination delivery systems that reliably achieve high two-dose coverage, alongside consistently high-quality and timely SIAs targeted to known immunity gaps, and surveillance systems capable of rapidly detecting and confirming transmission at subnational levels; particularly in high-burden, conflict-affected, and highly mobile contexts.

5.2. Elimination of Yellow Fever Epidemics

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Yellow fever is a persistent public health challenge in Africa, driven by immunity gaps and increasingly by ecological and demographic change [44–52]. Following yellow fever outbreaks in Angola and DRC with international spread in 2016, the global strategy to Eliminate Yellow Fever Epidemics (EYE) 2017–2026 framed yellow fever control around three linked goals: protecting at-risk populations, preventing international spread, and rapidly containing outbreaks [45]. The African regional framework to operationalize EYE was adopted in 2017 and set clear deliverables by end-strategy in December 2026. The latter include (a) introduction of yellow fever vaccination into routine immunization schedules of all 27 countries at highest risk of yellow fever outbreaks; (b) completion of PMVCs in all 27 priority countries; (c) expanded national diagnostic capacity; and (d) functional regional reference laboratory capacity [46].

Routine vaccine introduction has advanced, but with important caveats for risk stratification and subnational equity [46–48]. By 2025, twenty-five of twenty-seven high-risk countries in the region had introduced yellow fever vaccination into routine schedules, reflecting substantial alignment with the EYE strategy. However, implementation has not been uniform. In Kenya, routine yellow fever vaccination was introduced only in subnational geographies previously classified as high-risk, but subsequent outbreaks have occurred in areas previously classified as low-risk; illustrating the limitations of static risk classifications and the need for adaptive risk mapping. Ethiopia and South Sudan had not introduced routine yellow fever vaccination by the close of 2025, leaving significant immunity gaps in populations already vulnerable to epidemic spread. These variations highlight both the progress achieved and the persistent challenges in ensuring equitable and comprehensive protection against yellow fever outbreaks in the WHO African Region.

Since the inception of EYE in 2017, the scale-up of yellow fever SIAs has been substantial. By the end of 2025, an estimated 444 million individuals had been immunized through SIAs; reflecting one of the largest coordinated mass vaccination efforts in the region [10,46,48]. In 2024 alone, 54.7 million people received yellow fever vaccine doses, of which 48.9 million were vaccinated during PMVCs and 5.8 million through reactive SIAs [46,48]. In addition, about 12.3 million were protected in 2025 (10.9 million through PMVCs and 1.4 million through reactive SIAs) [10]. PMVC implementation is progressing, but remains incomplete [10,46,48]. By the end of 2025, twenty countries had completed PMVCs, strengthening population-level immunity against yellow fever. Two high-risk countries (DRC and Niger) remain in the midst of extended implementation, with ongoing multi-year PMVCs to ensure comprehensive coverage. In contrast, one country (Ethiopia), is still in the planning phase and four countries (Equatorial Guinea, Gabon, Kenya, and South Sudan) have yet to initiate PMVCs, leaving substantial immunity gaps in populations vulnerable to epidemic spread. This heterogeneity underscores the need for sustained political commitment, predictable financing, and adaptive operational strategies to ensure that PMVCs are implemented comprehensively across all high-risk settings.

The substantial immunity gaps perpetuate the risk of yellow fever outbreaks. During the period 2024-2025, seventeen countries in the region reported 248 probable or confirmed yellow fever cases; with the highest-burden countries being Ghana (47 cases), Uganda (N=41), Nigeria (N=37), Burkina Faso (N=24), Cameroon (N=21), and Chad (N=17) [48]. In addition, five deaths were documented, including two in Cameroon, two in Uganda, and one in The Gambia. This corresponds to a case fatality rate of 3.0% for both confirmed and probable cases and 3.3% for confirmed cases. Therefore, yellow fever outbreak risk remains real where population immunity is uneven, vector ecology is favourable for transmission, and surveillance is fragmented [48].

Surveillance and laboratory capacity for yellow fever diagnosis are improving in the WHO African Region but remain a limiting factor for confident risk assessment and rapid response to yellow fever outbreaks [46]. By the end of 2025, a total of 29 national laboratories in 24 high-risk countries had established serological diagnostic capacity for yellow fever. However, only 16 laboratories across 13 countries had achieved full accreditation by WHO and only 16 countries had implemented yellow fever routine molecular testing as evidenced by molecular proficiency assessments conducted by WHO in 2025. This remains a limitation to the reliability and comparability

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of diagnostic outputs across the region. At the regional level, confirmation capacity is supported by three WHO-accredited reference laboratories: the Centre Pasteur du Cameroun, the Institut Pasteur de Dakar, and the Uganda Virus Research Institute [46]. These institutions provide critical support for case confirmation, quality assurance, and training. Despite these advances, the uneven distribution of accredited laboratories and persistent surveillance gaps constrain timely risk assessment and outbreak response, underscoring the need for sustained investment in laboratory systems and integrated surveillance networks.

Despite substantial progress in vaccination and surveillance, several emerging challenges threaten yellow fever control in the WHO African Region [44–52]. The urban proliferation of *Aedes aegypti* mosquitoes and daytime biting patterns have heightened the risk of explosive outbreaks in densely populated cities, where transmission dynamics are amplified by high population mobility and limited vector control. In addition, changing ecological and demographic patterns – including rapid urbanization, climate variability, and shifting migration flows – are increasingly outpacing static risk classifications, underscoring the need for adaptive and dynamic risk mapping. Finally, surveillance gaps and limited laboratory accreditation constrain the timeliness and reliability of outbreak detection and response. Together, these factors highlight the necessity of strengthening integrated surveillance systems, expanding laboratory accreditation, and developing flexible preparedness strategies capable of responding to evolving epidemiological landscapes.

5.3. Elimination of Epidemic Meningitis

The African Meningitis Belt provides one of the clearest demonstrations of what sustained vaccination can achieve at scale [53,54]. Before 2010, *Neisseria meningitidis* serogroup A caused almost 90% of epidemics. The rollout of meningococcal A conjugate vaccine (MenACV) across 24 of 26 meningitis-belt countries from 2010 to 2024, via PMVCs and routine immunization, resulted in a marked decline in serogroup A epidemics and an epidemiological shift toward other serogroups (C, W, X) and *Streptococcus pneumoniae* [53]. Quantitatively, MenACV rollout was associated with a two-third reduction in cases. Separately, adoption of ceftriaxone as first-line treatment from 2015 reduced case fatality rates by half [54].

The post-PHEIC landscape is therefore not a return of serogroup A, but a shift to multivalent complexity requiring vaccine innovation, responsive outbreak tools, and sustained surveillance. In 2024, Niger and Nigeria - which were experiencing serogroup C and W epidemics - introduced the new pentavalent meningococcal ACWYX conjugate vaccine (Men5CV) in reactive SIAs, vaccinating almost five million people aged 1–29 years and stopping the epidemics [54]. Meningitis risk assessments were also conducted in Burkina Faso, Ghana, Mali, Niger, and Nigeria; and PMVCs using ACWY vaccines were conducted in Cameroon and Togo [54]. In addition, surveillance was strengthened through support to 24 meningitis-belt countries and Angola [54].

However, three constraints threaten accelerated progress in meningitis control [20,54]. Firstly, competing demands from multiple new vaccine introductions can delay adoption of MenACV or Men5CV in countries still building fiscal and delivery capacity. Secondly, co-financing for Men5CV may be challenging for countries in transition from Gavi support (such as Ghana and Nigeria), risking delayed routine integration even where outbreak risk is high. Thirdly, recent discontinuation of donor funding for a regional surveillance network in the meningitis belt creates a critical vulnerability. Without stable support for high-quality case-based surveillance at representative sites, decision-making becomes slower and less precise at the moment when multivalent preparedness is most needed [54].

Efforts to eliminate meningitis epidemics in the WHO African Region have moved from a one-vaccine solution to a multivalent preparedness agenda. Sustaining gains will require predictable financing, stronger case-based surveillance and laboratory confirmation, and timely access to next-generation vaccines aligned with the “Defeating Meningitis by 2030” trajectory [20,54].

5.4. Maternal and Neonatal Tetanus Elimination

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Maternal and neonatal tetanus (MNT) remains a marker of inequity in access to clean delivery and effective immunization services. Despite substantial progress over two decades, MNT persists where health system reach is weakest [3,55]. As of December 2025, a total of 44 of 47 countries in the WHO African Region had eliminated MNT [55]. The remaining countries are Angola, Central African Republic, and Nigeria. Nigeria shows subnational progress, with elimination validated in the southeast, southwest, south, and north-central zones.

Progress post-PHEIC includes the validation of MNT elimination in Mali, Guinea and South Sudan, and the successful conduct of post-validation assessments in Gabon and Côte d'Ivoire, demonstrating maintenance of elimination status [55]. However, the binding constraint for the remaining countries is operational rather than technical; limited resources to conduct PMVCs and reach underserved communities especially where conflict, weak routine contact with pregnant women, and health workforce constraints intersect.

Completing MNT elimination in the WHO African Region is achievable, but it is a classical last-mile problem, requiring targeted financing and delivery strategies to reach underserved communities with low skilled birth attendance and weak routine immunization access [55].

5.5. Polio Eradication and Transition

Polio eradication in the WHO African Region captures the dual reality of remarkable achievement and unfinished business [20,37,38]. The region has remained free of indigenous wild poliovirus since August 2020, and paralysis due to cVDPVs has declined by more than 90% from 2022 to 2025 [56,57]. Nevertheless, cVDPV outbreaks continue to occur and remain a persistent risk indicator for immunity gaps and uneven performance in outbreak response and routine coverage.

A critical and underappreciated dimension of the post-PHEIC period has been the increasing complexity of the cVDPV landscape in the region. While the total cVDPV case burden has declined substantially since its 2022 peak, the geographical spread of outbreaks - with transmission occurring simultaneously across multiple countries, often driven by cross-border population movement, insecurity, and zero-dose children - has made outbreak response more operationally demanding [38]. The Lake Chad Basin, in particular, has emerged as a persistent reservoir of cVDPV2 transmission, with Nigeria and Chad together contributing disproportionately to both the regional and global caseload [57,58]. Beyond cVDPV2 outbreaks, cVDPV3 has re-emerged in parts of the WHO African Region, with confirmed detections and cases reported in Guinea, Cameroon, and Chad during 2024–2025, and in Nigeria in early 2026 [59,60]. In addition, cVDPV1 cases have been reported in Algeria and DRC [60]. These trends underscore persistent vulnerability and continued risks of cross-border transmission in areas with large numbers of zero-dose and under-vaccinated children. Additionally, orphan poliovirus detections across the region, reflecting undetected silent transmission chains, further underscore that case counts alone understate the programmatic challenge [61].

Fifteen countries in the region are classified as priority due to persistent transmission or high outbreak risk, receiving targeted support through the Global Polio Eradication Initiative (GPEI), while other countries increasingly rely on integrated VPD surveillance as polio assets transition [60]. The laboratory and surveillance platform remains a key regional strength in Africa [60–62]. Sixteen WHO-accredited polio laboratories in 15 countries support diagnosis from acute flaccid paralysis (AFP) patients and environmental surveillance samples. By 2025, there were 46 of 47 countries in the WHO African region implementing environmental surveillance.

Post-PHEIC, it has become increasingly clear that sustaining polio eradication gains depends less on polio-only programming and more on the durability of routine immunization, surveillance integration, and high-quality outbreak response in every country in the region. Continued political engagement, integration of polio functions into routine immunization services and other public health initiatives, and accelerated introduction of additional IPV doses are central to preventing resurgence and enabling viable polio transition. Polio eradication is now primarily a test of system integration and sustainability; ensuring that the assets built for polio eradication (including surveillance systems, skilled workforce, laboratory networks, microplanning, data systems, and

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accountability mechanisms) are absorbed into routine immunization and broader VPD control rather than lost during transition when it occurs.

The question of polio transition, the process of integrating essential polio functions into national systems and establishing sustainable national financing, has yet to become an immediate operational reality for the WHO African Region [63]. Interrupting cVDPV2 transmission across the region's persistent reservoir countries remains the primary unfinished task, and any premature or poorly sequenced transition risks undermining the very outbreak response capacity that eradication still requires. Nevertheless, the planning horizon for transition must begin now. The institutional knowledge, microplanning discipline, accountability frameworks, and community mobilization infrastructure built under the GPEI represent irreplaceable assets for routine immunization and broader VPD control - assets that have historically proven vulnerable to degradation when donor attention shifts and programme structures are dismantled before systems are ready to absorb them. Ensuring that transition, when it does occur, is managed as a deliberate, phased, and adequately financed process - rather than a default consequence of declining donor interest - must therefore feature prominently in the post-PHEIC immunization policy agenda of the WHO African Region.

6. Monitoring Vaccine Effectiveness

Monitoring vaccine effectiveness (VE) in real-world conditions is essential to inform immunization policies; particularly in the context of population immunity gaps, emerging pathogen variants, and changing epidemiology. To address the limited availability of VE evidence from Africa, the WHO Regional Office for Africa and partners established the African Region Monitoring Vaccine Effectiveness (AFRO-MoVE) Network in March 2021 [64]. The network was initially designed to facilitate and coordinate COVID-19 VE studies across the region, promote the use of standardized study designs to enable pooled regional analyses, and build sustainable capacity among hospitals, laboratories, and research institutions to evaluate vaccines against respiratory pathogens.

AFRO-MoVE supports VE studies using harmonized methodologies, including prospective cohort studies among priority groups such as healthcare workers and test-negative case–control studies embedded within severe acute respiratory infection surveillance systems. Through technical guidance, training, and a centralized data platform for pooled analyses, the network has brought together more than 200 experts from 22 African countries and over 50 organizations. This coordinated platform strengthens the region’s ability to generate locally relevant evidence on vaccine performance, inform immunization strategies, and enhance preparedness for future epidemics and pandemics [64].

Post-PHEIC, sustaining and expanding VE monitoring platforms in countries of the WHO African Region will be critical to inform vaccine policy optimization, guide the introduction of new vaccines, and support preparedness for emerging and re-emerging infectious threats. This was demonstrated in recent rotavirus VE studies in the region [65,66].

7. Governance, Technical Advisory Capacity, and Coordination

Technical progress in immunization is inseparable from governance quality. The post-PHEIC period has reaffirmed that strong immunization systems depend on credible advisory bodies, coordinated partner platforms, and sustained political stewardship [3,67,68]. In the WHO African Region, governance architecture for immunization has matured considerably over the past decade - particularly through the RITAG, Regional Working Groups (RWG) on immunization, National Immunization Technical Advisory Groups (NITAGs), and strengthened national coordination mechanisms such as Inter-Agency Coordinating Committees (ICCs) [3]. However, variability in functionality and maturity continues to shape programme performance [69].

7.1. RITAG

At the regional level, the RITAG provides independent technical advice to the WHO Regional Office for Africa, helping harmonize policy recommendations and interpret emerging evidence in the

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African context [3]. RITAG has played a key role in recommending catch-up vaccination beyond infancy, guiding the measles elimination strategy, advising on HPV schedule transitions, supporting malaria vaccine rollout, and other initiatives [20,21].

Regional advisory coherence is particularly important in Africa, where epidemiological patterns (e.g., meningitis belt dynamics, yellow fever risk stratification, and high zero-dose concentration) differ from global patterns. RITAG serves as the bridge between global normative guidance and regional operational realities, reinforcing policy consistency while preserving national decision-making authority. Post-PHEIC, RITAG has held two online meetings on emerging issues (including mpox, cholera, and yellow fever outbreak response) and one annual face-to-face meeting, with the first meeting taking place in November 2023 in Brazzaville, Congo [20,21].

7.2. NITAGs

NITAGs are multidisciplinary, independent national specialist bodies that provide evidence-informed recommendations to ministries of health on vaccine policy and immunization strategy [68].

As of December 2025, a total of 45 of the 47 countries - representing 99% of the region's population - have established NITAGs. Thirty-six (94%) meet WHO's six criteria for functionality, and 18 have maintained functionality for at least five consecutive years [8]. This marks substantial progress compared with a decade earlier and reflects intensified regional coordination since 2019 [8,68]. However, functionality does not equate to maturity. Twenty-eight countries have applied the NITAG Maturity Assessment Tool; of these, 20 achieved overall maturity scores above 50% [69]. Importantly, maturity levels are not strictly correlated with the age of the NITAG, suggesting that institutional design, secretariat support, access to evidence, and political positioning are as important as longevity.

The post-PHEIC period has increased the strategic relevance of NITAGs. Decisions regarding catch-up vaccination policies, HPV single-dose schedules, malaria vaccine introduction, and Men5CV deployment have required rapid yet evidence-based guidance [3]. Current priority topics on the agenda of NITAGs in the region include vaccine introduction prioritization and sequencing as well as vaccine portfolio optimization. Where NITAGs are strong, vaccine introduction decisions have been more transparent, context-sensitive, and fiscally realistic. Where advisory processes are weak, delays or politically driven decisions have sometimes complicated implementation [68].

7.3. Partner Platforms

ICCs function as coordination hubs linking ministries of health, WHO, UNICEF, Gavi, civil society, and other partners [3,26]. During the Big Catch-Up period and subsequent recovery efforts, effective ICCs facilitated rapid resource mobilization, synchronized campaign planning, and aligned partner support. Conversely, weak coordination structures contributed to fragmented planning and implementation delays.

The WHO African Region has two RWGs; one for the two subregions of West and Central Africa and the other for the subregion of East and Southern Africa [20]. In the post-PHEIC period, RWGs have enhanced partner coordination especially within the context of the Big Catch-Up initiative [26]. During this period also, each of the three subregions (i.e. Central Africa, East and Southern Africa, and West Africa) has held annual face-to-face meetings of National EPI Managers to strengthen peer learning and accountability among countries at the sub-regional level [70]. In addition, high-level political engagements such as the immunization side-event at the 74th Session of the WHO Regional Committee for Africa in August 2024, have reinforced ministerial commitments and elevated immunization within broader health security and development discourse [71].

However, governance challenges remain. In several countries, NITAG recommendations are not always systematically integrated into national immunization policies and budgeting processes [3,68]. ICCs may meet irregularly or function primarily during Gavi application cycles rather than as continuous oversight platforms. Surveillance data are not always systematically fed back into policy deliberations. Strengthening governance therefore requires institutionalizing regular review cycles,

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improving transparency of decision-making, and ensuring that technical advice is directly linked to financing and operational planning.

7.4. Governance as a Determinant of Resilience

The post-PHEIC experience suggests that governance quality is a determinant of resilience. Countries with functional NITAGs and active ICCs were generally quicker to normalize catch-up vaccination, introduce new vaccines strategically, and respond to outbreaks [3,26]. Governance structures act as the connective tissue linking evidence, financing, and implementation. Moving forward, governance strengthening should focus on enhancing NITAG maturity and secretariat capacity; institutionalizing integration between NITAG recommendations and national budget processes; strengthening ICC oversight beyond donor compliance functions; promoting transparency and accountability in vaccine decision-making; and aligning immunization governance with broader PHC reform agendas.

In all, technical capacity alone cannot sustain VPD control. Durable progress requires governance systems that are credible, coordinated, and financially anchored; ensuring that evidence-informed policy translates into sustained implementation.

8. Strengthening Vaccine Regulatory Systems

Strengthened regulatory systems have been an important, though often under-recognized, component of immunization recovery and innovation in the WHO African Region in the post-PHEIC period. The African Vaccine Regulatory Forum (AVAREF), coordinated by the WHO Regional Office for Africa, has continued to serve as a critical platform for regulatory collaboration, capacity building, strengthening, and harmonization among national regulatory authorities (NRAs) and national ethics committees (NECs) [72]. Through joint reviews of clinical trial applications, scientific advice to vaccine developers, facilitated product registrations, and support for expedited regulatory pathways, AVAREF has helped streamline and strengthen decision-making processes while maintaining rigorous standards of safety, quality, and efficacy. The AVAREF platform was used in the facilitated registrations for malaria and Men5CV vaccines. From 2023 to 2025, AVAREF expanded its role beyond clinical trial oversight to support regulatory preparedness for vaccines for emerging pathogens, facilitate reliance mechanisms among countries, and strengthen alignment between regulatory review and immunization programme priorities [73].

The value of this regional regulatory collaboration was recently demonstrated during the mpox outbreaks in Africa, when AVAREF coordinated a multi-country joint review of the mpox vaccine dossier following the declaration of mpox as a PHEIC in August 2024 [74]. Fourteen high-risk countries jointly assessed the available safety and effectiveness evidence and completed the scientific review within approximately 20 working days of the declaration of mpox as a PHEIC, enabling NRAs to proceed with emergency use authorization for their use in their country immunization programmes. By September 2025, seventeen African countries had authorized the use of the vaccine, illustrating how regulatory reliance and coordinated review mechanisms can accelerate access to life-saving countermeasures during public health emergencies while preserving national regulatory sovereignty.

Beyond emergency response, AVAREF has increasingly positioned itself as a strategic platform supporting Africa's broader research and innovation agenda [75]. The AVAREF programme is using an ecosystem and life cycle approach to support end-to-end production from research and development (R&D), clinical research, ethical and regulatory oversight, manufacturing, and safety monitoring [76]. Through coordinated scientific advice meetings, early engagement with developers, and the development of regulatory guidance and toolkits, the forum has helped strengthen the regulatory environment for vaccine R&D conducted in Africa. These efforts contribute to shortening timelines for clinical trials, improving regulatory predictability, and fostering greater confidence among global and regional partners investing in vaccine development on the continent [73–76]. Looking ahead, the operationalization of the African Medicines Agency (AMA) offers an opportunity

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to institutionalize many of the collaborative regulatory practices pioneered by AVAREF, further strengthening regulatory convergence, preparedness for public health emergencies, and equitable access to vaccines in the WHO African Region [77].

9. Implementation Research and Data-Driven Programme Transformation

Implementation research as a tool for data-driven programme management is central to post-PHEIC immunization strengthening in the WHO African Region. While rapidly restoring coverage levels is crucial, sustained progress depends on the effectiveness of translating policies into operational delivery across diverse, often fragile contexts. Implementation research focuses on understanding and addressing the factors that affect the adoption, integration, and sustainability of health systems interventions in the real world [78]. When combined with systems thinking, stakeholders are better equipped to understand and navigate the inherent complexity of systems.

In the post-PHEIC period, there should be intensified action towards mainstreaming implementation research in immunization programmes across the region, especially in large countries with substantial accumulation of zero-dose and under-vaccinated children. This shift will require greater reliance on robust subnational immunization data systems and the institutionalization of data triangulation across multiple sources to guide adaptive learning within routine programme cycles in specific contexts. Development of evidence-based implementation plans, their monitoring, and use of data from implementation could go a long way in supporting programme transformation.

9.1. Immunization Implementation Research

There has been a stronger strategic focus on implementation research and systems thinking in the WHO African Region post-PHEIC to increase the use of theory-informed determinant frameworks to describe factors influencing vaccination efforts, illustrate the complexity of these factors by uncovering their interrelationships, and develop documentation frameworks to support cross-context learning [78].

At the regional level, the Consolidated Framework for Implementation Research (CFIR) has been employed in rapid reviews to investigate the factors influencing the second dose of measles vaccination, human papillomavirus vaccination, malaria vaccination, and polio SIAs in the region [79–82]. In these studies, researchers also integrated causal loop diagramming to qualitatively depict a more holistic system map of the interconnections among determinants and feedback loops. Identifying feedback loops within the relationship between determinants can inform more precise interventions.

Within countries, there has been an emergence of various embedded implementation research activities in immunization programmes [83,84]. All these efforts are yielding newer, practical, evidence-based implementation strategies for vaccination within PHC that can be useful even beyond where they are originally tested.

As novel strategies for enhancing vaccination efforts are demonstrated to be effective in specific settings, it is essential to disseminate them rapidly and with sufficient detail to enable cross-context learning, whether within or across countries. This motivated regional experts to develop the Documenting and Reporting Implementation strategies of Vaccination Efforts (DRIVE) framework, an eight-component tool that leverages existing implementation research guidance for documenting strategies [85]. The aim of this documentation framework is to improve the systematic dissemination of implementation strategies employed in vaccination programmes, thereby supporting learning and knowledge exchange.

9.2. Data Systems and Digital Health

The recovery period has also witnessed the expanded use of digital immunization platforms, including District Health Information Software 2 (DHIS2)-based modules, electronic immunization registries, and interactive dashboards that provide near real-time visibility of surveillance and

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immunization coverage indicators [62,86]. These systems are increasingly central to programme performance management, enabling monitoring of antigen-specific coverage, dropout rates, stock levels, and surveillance sensitivity indicators at both national and subnational levels.

By triangulating routine immunization data with surveillance information, campaign monitoring results, and demographic estimates, countries are better able to identify zero dose and under-vaccinated populations. Such integrated analysis supports targeted microplanning, prioritization of underperforming districts, and more responsive supervisory action, particularly in settings affected by conflict, population displacement, or urban informal settlements.

Digital systems have also strengthened vaccine introductions and outbreak response [15–19]. Real-time dashboards enable tracking of rollout progress, identification of operational bottlenecks, and rapid course correction during rollout of new and under-utilized vaccines. Similarly, strengthened electronic surveillance platforms improve the timeliness of outbreak detection and laboratory confirmation for measles, yellow fever, polio, and other VPDs; reinforcing the link between surveillance and immunization performance.

However, digital transformation alone does not guarantee improved outcomes. Sustained impact requires investment in data quality assurance, workforce analytical capacity, interoperability between surveillance and immunization platforms, and structured feedback mechanisms that translate data into action. Embedding data triangulation and routine performance review processes within national and subnational programme cycles will be essential for accelerating equity gains and advancing toward IA2030 targets [23].

10. Immunization Financing and Sustainability

If the post-PHEIC period exposed weaknesses in immunization coverage and surveillance, it has also laid bare the fragility of immunization financing in the WHO African Region [3]. The paradox is striking; as vaccine portfolios expand and technical tools improve, domestic financing has stagnated or declined in many countries. The sustainability of immunization programmes is therefore increasingly determined not by vaccine availability, but by fiscal commitment, co-financing capacity, and the predictability of operational funding.

Gavi, the Vaccine Alliance, provides substantial funding to immunization programmes in many countries in the WHO African Region [87]. However, five countries in the region (Congo, Côte d'Ivoire, Ghana, Kenya, and São Tomé and Príncipe) are in the Gavi accelerated transition phase, facing rising co-financing obligations. Two (Eswatini and Cabo Verde) are within Gavi's Middle-Income Country framework, while nine countries are fully self-financing or were never eligible for Gavi support. For countries in accelerated transition, sustaining vaccine introductions such as Men5CV or HPV multi-age cohort campaigns requires fiscal planning that extends beyond donor cycles. Without predictable domestic resource mobilization, progress risks reversal once external catalytic funding diminishes.

The cost structure of national immunization programmes has evolved substantially over the past decade [3]. Countries eligible for Gavi support are now expected not only to finance traditional EPI antigens, but also to co-finance newer vaccines, maintain cold chain expansion, fund data systems, conduct periodic SIAs, and sustain outbreak preparedness and response [87]. This has occurred amid broader macroeconomic constraints, debt pressures, and competing health priorities. This evolving cost structure is further compounded by emerging external financing shocks. In particular, recent reductions in United States Government contributions to key multilateral health financing mechanisms, including Gavi and WHO, alongside broader stagnation or reprioritization of donor funding, have introduced new uncertainty into the global immunization financing landscape [88–90]. These shifts risk widening existing financing gaps at a time when programme costs are increasing and countries are transitioning toward greater domestic responsibility, thereby heightening concerns about the sustainability of immunization gains in the region.

In 2024, only 12 of 47 countries reported increases in immunization expenditure compared with the previous year, while 23 countries reported decreases – on average around 50% relative to prior-

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year spending [8]. Twenty-seven countries fund less than 50% of their vaccine requirement costs from domestic resources. Only a small number allocate more than 2% of PHC budgets to vaccines. These patterns underscore structural dependence on external financing and highlight vulnerability as countries transition from Gavi support.

The IA2030 and the Addis Declaration on Immunization (ADI) both emphasize that immunization is a core government responsibility, requiring stable budget lines, medium-term expenditure frameworks, and integration into PHC financing platforms [3]. Sustainable financing is not simply the presence of funds, but the capacity to mobilize and use domestic and external resources efficiently to meet current and future immunization goals. In practice, this means aligning immunization with broader PHC and health security investments, embedding vaccines within national health insurance schemes where feasible, and strengthening public financial management systems to reduce delays in fund disbursement.

However, opportunities do exist. The renewed political visibility of health security following the COVID-19 pandemic, the economic framing of vaccination as a human capital investment, and integration with PHC reforms create entry points for stronger domestic commitment [90]. Nonetheless, the post-PHEIC period suggests that political recognition has not yet translated consistently into sustained fiscal prioritization [90,91]. Without deliberate action to stabilize and increase domestic financing, the region risks a cycle in which vaccine introductions expand while operational funding for delivery, supervision, and surveillance remains insufficient; undermining the very impact those vaccines are intended to achieve.

The next phase of immunization recovery in the WHO African Region must treat financing reform as central, not peripheral to system resilience. Predictable domestic financing, aligned with PHC reform and transition planning, is a precondition for sustaining disease control gains and advancing toward IA2030 targets.

11. Discussion

The end of COVID-19 Public Health Emergency of International Concern marked a critical transition for immunization programmes in the WHO African Region, but it did not, in itself, resolve the structural weaknesses exposed by the pandemic. The experience of 2023-2025 in the region suggests three overarching lessons. Firstly, recovery must be designed as transformation – embedding flexibility, catch-up, and integration into routine practice. Secondly, outbreak prevention and response are inseparable from strong immunization systems and surveillance, requiring predictable financing and accountability. Thirdly, new vaccines can be catalysts for system strengthening when introduced deliberately, in a way that strengthens each of the immunisation system components, with community engagement and PHC integration at the core.

As the region looks beyond immediate recovery, the challenge is to consolidate these gains into durable progress toward IA2030. The post-PHEIC period has shown that even after profound disruption, immunization can regain momentum; through steady leadership, partnership, and evidence-informed adaptation. The task now is to ensure that this momentum is accelerated, equitably financed, and translated into lasting protection against VPDs.

Despite the gains, equity gaps have persisted in the post-PHEIC period. Zero-dose and under-vaccinated children remain disproportionately concentrated in remote rural areas, informal urban settlements, conflict-affected regions, and among marginalized populations [92]. While many national recovery plans emphasize catch-up vaccination, implementation has often been constrained by limited domestic financing, competing health priorities, and weak subnational delivery capacity [3]. The high levels of inequity underscore the potential of implementation research in vaccination programmes in the WHO African Region [78]. Health systems are inherently complex adaptive systems, and the interplay of contextual factors can differ from one community to another, leading to disparities in vaccination coverage [93]. Therefore, to go beyond current coverage levels and ensure equitable progress across diverse contexts, vaccination programmes need to embed implementation research as a management practice at both national and subnational levels. This allows for routine

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investigation of granular context-specific barriers and facilitators of vaccination efforts and co-develop practical solutions to overcome barriers and maintain facilitators [78]. In addition, strengthened and harmonized regulatory systems facilitate clinical research and ultimately increase access to quality assured vaccines that are safe and effective.

Supplementary immunization activities have been a central component of post-PHEIC recovery efforts in the WHO African Region, particularly for measles-rubella elimination, considering the rapid accumulation of unvaccinated young cohorts of children which poses a direct risk for outbreaks. However, heavy reliance on mass vaccination campaigns risks obscuring persistent weaknesses in routine immunization systems. While campaigns can rapidly boost population immunity and prevent outbreaks, it is critical for countries to make parallel investments in routine service delivery, supply chains, and community engagement, in order to ensure durable control of vaccine-preventable diseases in the WHO African Region.

Strong surveillance systems constitute a critical backbone of disease elimination and eradication efforts. High quality case-based surveillance enables early detection of outbreaks, timely laboratory confirmation, and rapid implementation of response measures. In the WHO African Region, surveillance platforms initially strengthened through the polio eradication initiative have been increasingly used to support the monitoring of multiple VPDs. With the winding down of the GPEI and the declining donor resources for VPD surveillance, it is high time that countries mobilize their own resources to sustain the gains and strengthen their integrated surveillance systems [88]. It is impossible to attain VPD elimination and eradication targets and monitor the impact of interventions without having clear visibility on the epidemiological trends. Therefore, continued investment in surveillance sensitivity, laboratory capacity, and real-time data analysis will be essential for identifying immunity gaps, guiding targeted immunization interventions, and verifying progress toward elimination and eradication goals. The Regional Investment Case for VPD Surveillance (2021-2030) outlines the key elements that countries can use to tailor and build upon their surveillance systems [94].

By preventing infections and reducing the need for antibiotic treatment, vaccines lower the selective pressure that drives antimicrobial resistance (AMR). Surveillance systems also provide an opportunity to generate evidence on how vaccination contributes to mitigating AMR. Laboratory surveillance can track changes in resistance patterns in pathogens such as *Streptococcus pneumoniae* following vaccine introduction, while routine surveillance of vaccine-preventable diseases can indicate reductions in antibiotic use. Integrating immunization, laboratory, and antimicrobial use data through existing surveillance platforms can strengthen evidence for the vaccine-AMR linkage [95]. However, vaccines remain an underexplored tool for addressing AMR in Africa, highlighting the need for stronger integration of vaccination strategies within national AMR policies and surveillance frameworks [96].

An additional strategic opportunity emerging in the post-PHEIC period is the accelerated digital transformation of immunization and PHC systems across the WHO African Region. Digital platforms – including electronic immunization registries, interoperable health information systems, and real-time programme dashboards – are increasingly enabling countries to track vaccination status, identify zero-dose and under-vaccinated populations, and guide targeted outreach strategies at subnational levels [15–19,62,86]. Evidence suggests that integrated digital health systems can improve programme management, enhance service coordination, and support personalized communication with caregivers through reminders and alerts, thereby reducing missed opportunities for vaccination and improving equity in coverage [97]. The Africa Centres for Disease Control and Prevention (Africa CDC) has articulated a continental vision for PHC digitalization, emphasizing interoperable digital public infrastructure, data intelligence, and integrated surveillance as foundational elements for universal health coverage and health security [98]. The alignment of immunization data systems with broader PHC digital architectures offers an opportunity to strengthen data-driven decision-making, support real-time monitoring of vaccine introductions and outbreak response, and enhance the visibility of underserved populations. However, realizing these

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benefits will require sustained investment in interoperability standards, workforce analytical capacity, data governance, and integration of digital tools into routine programme management rather than treating them as parallel technological initiatives. The digitalization of PHC and immunization systems represents a critical enabling strategy for accelerating progress toward IA2030 goals while strengthening health system resilience in the WHO African Region.

The mixed recovery observed since the end of the COVID-19 PHEIC reflects deeper structural constraints within health systems in the WHO African Region. Chronic underinvestment in PHC, over dependence on external financing, and health workforce shortages continue to limit the resilience and reach of immunization programmes [99].

12. Conclusions

Regional coverage for most vaccine doses in the WHO African Region has returned to 2019 pre-pandemic levels, but restoration of pre-pandemic performance is not an adequate benchmark for success. Many countries in the region entered the COVID-19 pandemic with suboptimal routine immunization coverage, persistent inequities, and fragile surveillance systems. Returning to this baseline risks normalizing vulnerability to recurrent outbreaks and undermines commitments under IA2030. Post-PHEIC recovery must therefore be framed as a transformational agenda, not a corrective one.

The persistence of large cohorts of under-vaccinated and zero-dose children underscores the need for deliberate prioritization of equity in immunization policies. Catch-up strategies and supplementary immunization activities remain essential, but they cannot substitute for sustained investment in routine services that reliably reach children beyond infancy. Policymakers should explicitly align immunization recovery plans with PHC strengthening, ensuring predictable financing, adequate workforce capacity, and community-centred service delivery models.

Recurrent outbreaks of measles and other vaccine-preventable diseases in the post-PHEIC period also highlight the strategic importance of surveillance as a core public good, rather than a supplementary programme function. Strengthening integrated, case-based surveillance systems - supported by functional laboratory networks and timely use of data - should be treated as a non-negotiable component of health system resilience and epidemic preparedness.

Implementation research is needed to understand how best to integrate immunization recovery within broader PHC reforms and to sustain surveillance performance in fragile and resource-constrained settings. Strengthening the evidence base in these areas will be essential to support resilient, equitable, and sustainable VPD control, elimination, and eradication in the WHO African Region in the post-PHEIC era.

Finally, the post-PHEIC period offers a narrow but important window to position immunization as a pillar of health security, social protection, and economic recovery. The accelerated introduction of new and under-utilized vaccines, alongside strengthening national and regional technical advisory systems, demonstrates that progress is possible when innovation is matched with strong governance and coordinated partnerships. Sustained progress will require political leadership at national and regional levels, increased domestic resource mobilization, and more effective alignment of partner support with country-led priorities. Without such shifts, the region risks entering a cycle of repeated outbreaks, reactive mass vaccination campaigns, and missed opportunities - outcomes that are neither inevitable nor acceptable given the tools and knowledge currently available.

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