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Domestic Vaccine Production as a Health-System Resilience Strategy under Protracted Conflict: Reflections from Iran

Vahid Marandi*

Pasteur Institute of Iran, Technology Management Department, Tehran, Iran

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Commentary

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***Corresponding Authors:**

Vahid Marandi;
Pasteur Institute of Iran, Technology Management Department, Tehran, Iran.
Email: Vahid.marandi@gmail.com
Tel: +989121240543 / +982164112553

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ABSTRACT

Protracted conflicts and sanctions impose sustained constraints on health systems, particularly vaccine supply chains and routine immunization services. This commentary examines domestic vaccine production as a resilience strategy under such conditions, using Iran as a case study in the Eastern Mediterranean Region (EMR). Drawing on publicly available global and regional immunization data, policy reports, and institutional documentation, the analysis explores how domestic manufacturing can serve as a governance instrument in conflict-affected and sanction-constrained settings. Framed within health governance and system-resilience perspectives—particularly the adaptive resilience model (emphasizing flexibility and continuity under ongoing stress)—it highlights Iran's sustained production of essential childhood vaccines, which has supported national coverage despite external pressures. However, governance gaps—including regulatory alignment, limited regional integration, and restricted access to international quality-assurance mechanisms—limit its broader potential. Four policy considerations are proposed to enhance resilience: regulatory convergence, pharmacovigilance strengthening, health diplomacy, and integration into national/EMR planning.

Protracted conflicts and long-term geopolitical instability have profoundly affected health systems across the Eastern Protracted conflicts and geopolitical instability profoundly disrupt health systems in the Eastern Mediterranean Region (EMR), home to more conflict-affected populations than any other WHO region [1]. Infrastructure damage, workforce exodus, and supply chain interruptions severely undermine essential services, including routine immunization—leading to surging outbreaks of vaccine-preventable diseases like polio, measles, and diphtheria in fragile settings [2]. Global data underscore this vulnerability: despite progress elsewhere, childhood vaccination coverage has stagnated post-COVID, leaving millions of zero-dose children annually, with disproportionate impacts in conflict zones [3].

Figure 1 illustrates trends in global coverage for key infant vaccines (BCG, DTP3, polio [OPV3], hepatitis B [HepB3], measles [MCV1], and rubella) from 2000 to 2023 [3]. Historical gains through the Expanded Programme on Immunization are evident, yet recent plateaus—and dips during shocks—highlight systemic fragility, amplified in the EMR by border closures, funding gaps, and sanctions that delay imports [4]. In such environments, over-reliance on distant suppliers proves precarious. Sanctions, logistical insecurity, and financial barriers can halt deliveries, eroding immunity gaps and fueling resurgence [5]. Here, domestic or sub-regional production emerges as a vital buffer—preserving continuity when external chains falter.

Iran offers a compelling EMR case. Decades of investment have sustained production of essential childhood vaccines via institutions like the Pasteur Institute of Iran and Razi Vaccine and Serum Research Institute [6,7]. This capacity has maintained national coverage rates above 95% for most antigens, even amid prolonged sanctions restricting international trade [8].

The COVID-19 pandemic further tested this resilience: Iran mobilized local platforms for rapid development, production, and distribution of over 150 million doses domestically, mitigating global shortages [9]. Though challenges persisted (e.g., technology access delays), these efforts affirmed domestic manufacturing's role in safeguarding access under isolation.

Yet potential remains under-realized. Regulatory hurdles, limited WHO prequalification engagement, and transaction barriers have kept production largely national, limiting support for EMR neighbors facing analogous disruptions [10]. This inward focus represents a regional opportunity cost, as proximate, quality-assured supply could shorten delays and bolster collective defenses against outbreaks.

Four interlinked considerations could guide policy in conflict-constrained settings with manufacturing capacity:

1. **Pursue regulatory convergence**, including WHO prequalification for priority vaccines, to enable safe cross-border sharing while upholding standards.
2. **Enhance pharmacovigilance systems**, building post-marketing surveillance to foster trust amid perceptions of quality variability.

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3. **Leverage health diplomacy**, creating neutral mechanisms (e.g., WHO-facilitated pacts) to separate immunization cooperation from political frictions—as in regional polio efforts.
4. **Integrate domestic production into resilience planning**, framing it as a health security asset in national and EMR strategies, aligned with WHO's emergency frameworks [4, 11].

Protracted conflicts will persist in the EMR, demanding adaptive strategies. Iran's experience illustrates how sustained domestic vaccine production can mitigate immunization disruptions under sanctions and instability—not as a panacea, but as a stabilizing pillar. While this analysis primarily emphasizes access and continuity, additional dimensions such as cost-effectiveness, financial burden on government budgets, and long-term sustainability under reduced public funding merit further evaluation in future studies. By addressing barriers and reframing such capacity as a regional resilience tool, EMR countries could diversify supplies, reduce vulnerability, and protect gains in child health amid crises.

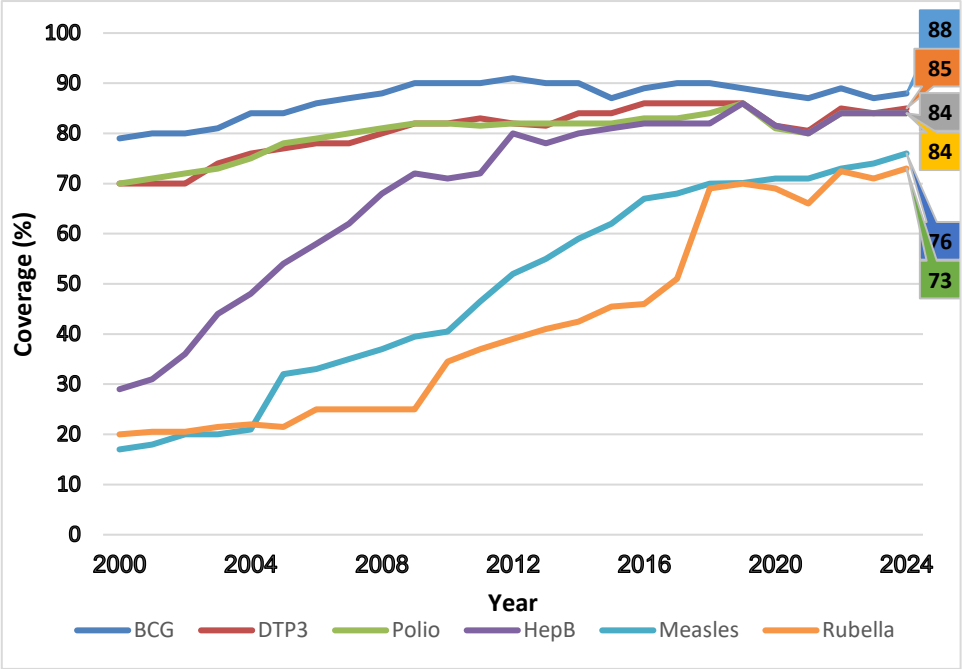

Fig 1. Global vaccination coverage trends for major infant vaccines (BCG, DTP3, polio [OPV3], hepatitis B [HepB3], measles [MCV1], and rubella), 2000–2023. Coverage (%) reflects WHO/UNICEF joint estimates; note post-2020 disruptions from COVID-19. Source: Adapted from Statista/WHO-UNICEF joint estimates [3].

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CONFLICT OF INTERESTS

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