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The Market Shaping Goal

Shape vaccine markets to ensure adequate supply of appropriate, quality vaccines at low and sustainable prices for developing countries.

Supply and Procurement Roadmap

Yellow Fever Vaccine

PUBLIC SUMMARY

Public Summary

GAVI has been engaged in Yellow Fever (YF) vaccination since 2001 in support of WHO efforts to control the disease and has invested over USD 300 million to date. Most of the burden of the disease lies in Africa where over 90% of cases have been reported since 1980. Yellow fever is a non-eradicable disease for which there is currently no specific anti-viral drug. Vaccination is the most important means of yellow fever prevention, with a single dose providing life-long protection against the disease. Gavi's support is based on three vaccination strategies:

1. Routine immunisation in high-risk countries. Over 90 million children have been vaccinated in 17 African countries by 2015.
2. Emergency vaccine stockpile to ensure enough vaccines are immediately available to control outbreaks when they occur.
3. Mass preventive vaccination campaigns. Approximately 99 million people have been vaccinated in Africa to date.

Gavi also funds operational costs; USD 51 million was invested by 2015.

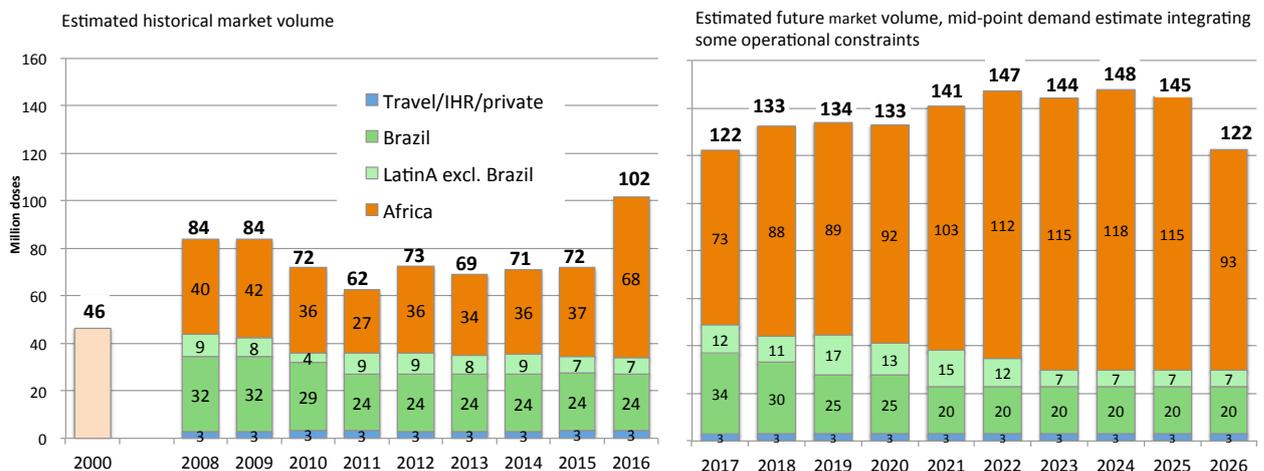
The assessment of the global threat that Yellow Fever (YF) poses was revised in 2016 following an epidemic in Angola and Democratic Republic of Congo. In particular, WHO confirmed the risk of large urban outbreaks and the risk of international epidemic extensions.

- WHO's October 2016 Strategic Advisory Group of Experts (SAGE) endorsed a revised WHO strategy to Eliminate Yellow fever Epidemics (EYE) that proposes to accelerate, intensify, and broaden the effort against YF.
- Gavi's December 2016 Board agreed that *Gavi's support for Yellow Fever vaccine be based on the "EYE Strategy"*. The resulting funding requirement for Gavi 2016 to 2020 is approximately USD 427 million including operational costs and the purchase of vaccines.

The outbreak that is progressing in Brazil since December 2016 also highlights the risk of YF extension, although it remains sylvatic for now.

Market overview

Supply to Africa (UNICEF-SD) 2011-2015 was 27% below demand. Routine immunisation was globally unaffected while campaign volumes were notably affected. During that period, 3 of the 4 manufacturers experienced issues and the prequalification of their YF vaccines was temporarily suspended for periods ranging from half a year to 3 years.

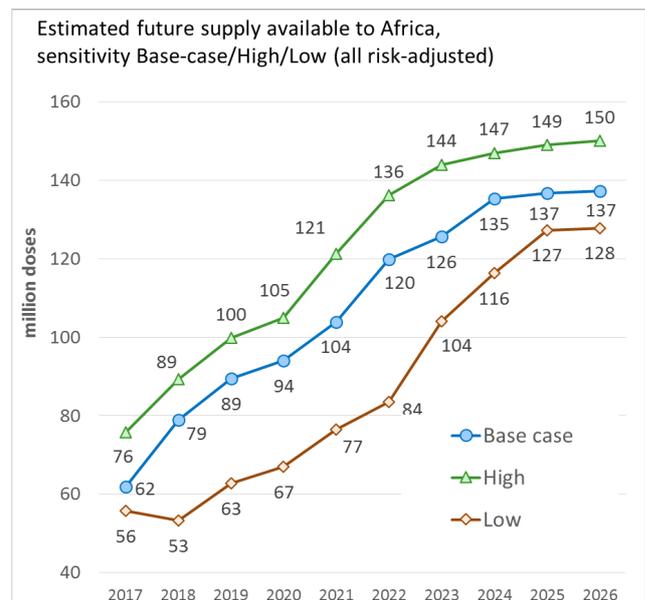


The EYE Strategy defined a partly supply-unconstrained and partly operationally-unconstrained demand forecast that is a high demand scenario. A sensitivity analysis was conducted resulting in two further forecasts that are adjusted for operational constraints based on past experience with the roll-out of routine immunization or campaign programs. A country-validated forecast should be available later in 2017.

- According to the mid-point scenario, global demand is expected to grow from approximately 102md supplied in 2016 to approximately 133md in 2018, and to approximately 140md in 2021.
- The demand for Africa after integrating some operational constraints may increase from approx. 68 md supplied in 2016 to approx. 90 md in 2019, and to approx. 105 md in 2021.
- After campaign vaccinations are completed, possibly between 2025 and 2027, demand will decrease to a plateau of approx. 60md/y for routine immunization and stockpile.
- EYE demand estimates assume no major change in epidemiology patterns such as concomitant major urban outbreaks in Africa and Latin America, or extension of YF to Asia; should epidemiological shifts occur, the EYE strategy and the Gavi involvement would need to be reviewed – this is out of the scope of the roadmap.

During the period 2012-2016, the four current YF vaccine manufacturers invested resources in manufacturing equipment, systems, and procedures. As a result, the market is expected to benefit from significantly increased supply capacity and improved supply reliability. No new vaccine is expected to add significant supply capacity before 2023/2025.

- Supply is expected to meet the 10-year needs for the EYE strategy after integration of operational constraints. Any major disruption by one manufacturer would have an impact on the implementation of campaigns. If demand reaches the high estimate (EYE data), the base-case supply available to Africa 2017-2021 would likely be 14% short of demand.
- If the control of outbreaks require more than 6 million doses a year (stockpile), the supply capacity is likely to be insufficient to cover the additional demand. In such a case, some campaigns would be temporarily suspended and/or the use of fractionated doses for outbreak control will provide additional volume. Routine immunisation is not expected to be impacted in countries where it is already implemented.



The 2016 weighted average price (WAP) for UNICEF-SD is expected to reach between USD 1.05 and USD 1.15; it increased by approximately 45% in ten years.

The global market value for YF vaccines reached approximately USD 225 million in 2016, of which approximately 55% for supply of the travel/IHR/private segment, and 31% for supply to Africa.

Healthy Market Framework Evaluation

The YF market is in a low state of health: supply may not meet demand reliably for the next 5 years, or almost every dose produced will be used with no or limited room for unpredictable spikes in demand in the context of an epidemic disease.

Of the eight market health attributes, the YF market currently meets three (NRA risk, product innovation, and long-term competition, highlighted green), and partially meets three (highlighted yellow).

Supply meets demand: **Unmet.** From 2017, the increase in forecasted demand is linked to the implementation of the EYE strategy and may be in excess of the increase in supply availability. Supply to Africa/UNICEF may be 4 to 14% below demand 2017-2021.

Country presentation preference: **Partially met.** Chumakov and IPD YF vaccines are ampoule presentations that are inferior to vial presentations from an operational perspective. Of the three available multidose presentations (5, 10, 20 dose), the 20 dose is most often not accepted by countries while it may be acceptable for stockpile and specific campaigns.

Buffer capacity: **Unmet.** Buffer capacity will be achieved when demand decreases as campaign vaccinations cease, likely between 2026 and 2027 when the market will have significant buffer capacity.

Individual supplier risk: **Partially met.** The YF vaccine production process is technically challenging and prone to unexpected quality or yield issues. Furthermore, some of the future supply depends on the progress of on-going manufacturing investments.

NRA risk: **Met.** Manufacturers are diversified across 4 National Regulatory Agencies (NRA).

Long-term competition: **Met.** Four manufacturers have committed to long-term supply of YF vaccines through investments for additional capacity.

Product innovation: **Met.** Yellow Fever vaccines provide lifelong protection with one dose and satisfy the requirements for achieving the Gavi objective.

Total systems effectiveness: **Partially met.** Available vaccination estimates suggest that YF vaccination carries a wastage rate above 40% that reduces effective vaccination in the context of insufficient supply and additional costs. Vaccine prices follow a continued increasing trend.

Total System Effectiveness	Long Term Competition	Product Innovation
Buffer Capacity	Individual Supplier Risk	NRA Risk
Meet Country Preferences		
Supply Meets Demand		
Inadequate Supply		

Supply and Procurement Objectives

The supply and procurement objectives were analysed resulting in the following target outcomes:

- Manufacturers increase their supply offer to UNICEF-SD to ≥ 80 million doses by 2018 and to ≥ 105 million doses in 2021, and to ≥ 440 million doses for the period 2017-2021.
- During the 2017-2021 period, no manufacturer experiences a disruption of more than 15%/year on its expected supply output, no vaccine is suspended from requalification.
- The UNICEF-SD WAP in 2020 is \leq target value (confidential).
- The overall YF vaccination wastage rate is well understood and \leq to 25% by 2020 (\leq 40% routine, \leq 10% campaigns), without reducing coverage.

Gavi's future market shaping exit conditions: Gavi will stop its market shaping efforts on yellow fever vaccines when supply meets demand for Gavi investments, if buffer capacity reaches over 33% of expected demand and if none of the three major suppliers leave the market. This is not expected to occur before 2026, at which point Gavi will only engage in procurement through tendering.

Supporting Stakeholder Action Plan

A concerted action plan ensures the coordination between Gavi Alliance stakeholders, designed to facilitate the achievement of the above supply and procurement target outcomes.

- Periodically review with manufacturers improvement in manufacturing output and processes, rapidly identify potential issues or opportunities. Provide technical support if required.
- Periodically review the progress and sustainability of contract manufacturing activities to use excess bulk. Provide technical support if required and appropriate.
- Share demand forecasts with manufacturers, including detailed assumptions and potential ranges. Engage manufacturers to input and make suggestions to improve forecast reliability and confidence.
- As epidemiological trends emerge, as risk evaluations evolve, and as vaccination coverage increases, engage manufacturers on how to manage the long-term decline of the demand volume when campaign vaccinations are completed (expected 2025 or beyond).
- UNICEF-SD's last procurement cycle for YF vaccines covers 2017 supply. The next procurement process for YF vaccines will take place first half of 2017 for supply 2018 and beyond.
- Undertake a review of the actual wastage rate for YF vaccination in Gavi-supported countries. If the wastage is confirmed to be globally above 40%, analyse its root-causes.
- If the wastage is confirmed to be globally above 40%, propose and implement a wastage reduction plan derived from the findings aimed at reducing the global wastage to $\leq 25\%$ by 2020. Propose a supply optimisation plan, including a recommended supply ratio of 5/10 dose presentations.