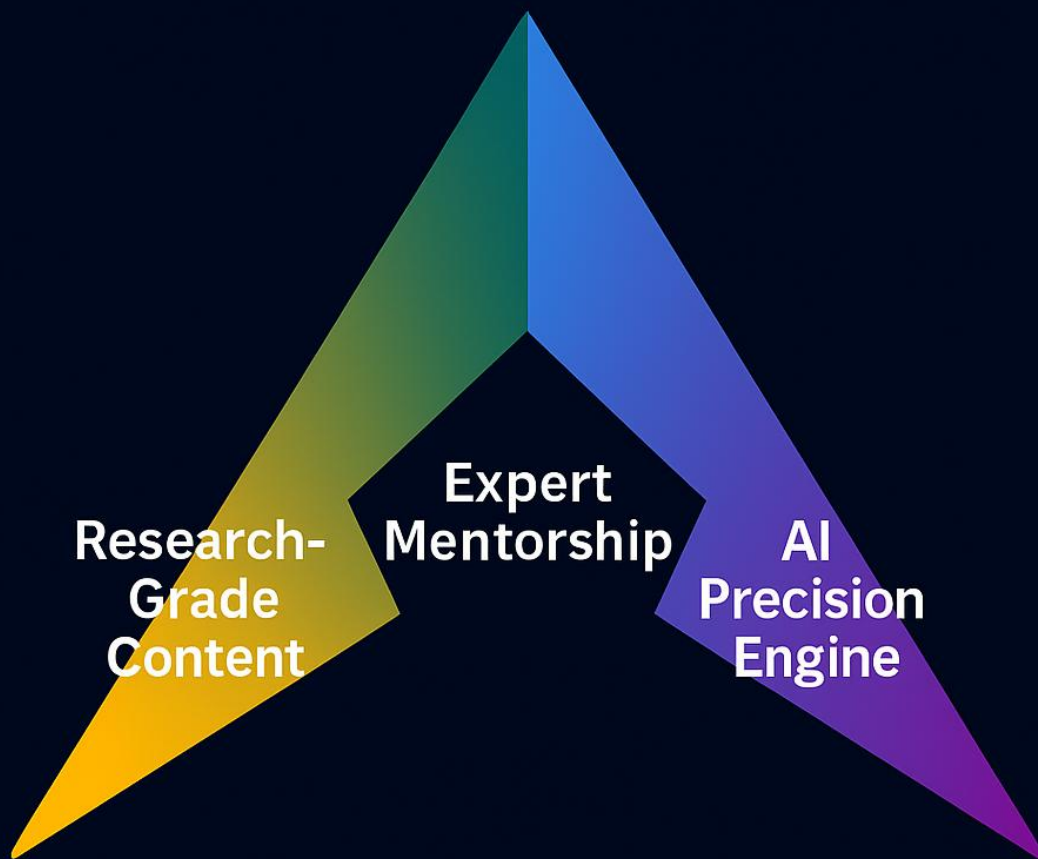


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GS Paper II: Current Affairs

1. Innovative TB Elimination Strategy in India

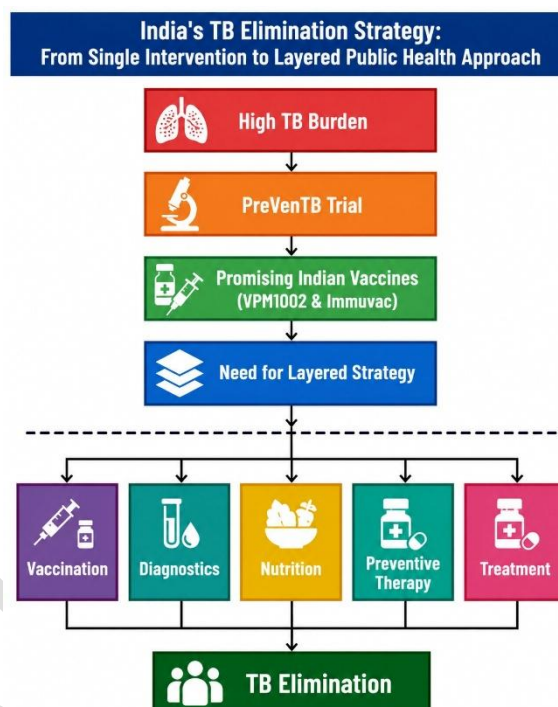
a. Introduction

Tuberculosis remains one of India's most serious public health challenges. Although India has set an ambitious goal of eliminating tuberculosis, the disease continues to impose a heavy burden, especially on vulnerable groups such as the poor, undernourished, children, adolescents and household contacts of tuberculosis patients. The challenge is not merely medical. It is deeply connected with nutrition, access to diagnostics, quality of public health delivery, preventive care and community-level trust.

Recent evidence from the Indian Council of Medical Research-led PreVenTB trial, published in the *BMJ*, has added an important new dimension to India's tuberculosis elimination strategy. The trial found meaningful protection from two Indian tuberculosis vaccine candidates, VPM1002 and Immuvac, especially against extrapulmonary tuberculosis and among children.

The central policy message emerging from this evidence is that India should not wait indefinitely for a perfect tuberculosis vaccine. Instead, it should adopt a layered, pragmatic and evidence-based strategy that combines vaccination with diagnostics, preventive therapy, nutrition and strong primary health care.

Thus, tuberculosis elimination must be understood not as a single-vaccine challenge, but as a multi-dimensional public health mission requiring biomedical innovation and governance capacity.



b. Understanding the Nature of the Tuberculosis Burden

- **Diversity of Disease Pathways:** Tuberculosis is not a uniform disease. After exposure to *Mycobacterium tuberculosis*, individuals may experience different disease pathways. Some may develop latent tuberculosis infection, where the person remains infected but does not show symptoms.
- **Subclinical and Active Tuberculosis:** Others may develop subclinical tuberculosis, where symptoms are minimal or absent but the infection persists. In many cases, the disease develops into active pulmonary tuberculosis, which affects the lungs and is the main driver of transmission.
- **Extrapulmonary Tuberculosis:** Another important form is extrapulmonary tuberculosis, where the disease affects organs beyond the lungs, making it harder to diagnose and often more debilitating.
- **Need for Multiple Interventions:** This diversity makes tuberculosis control difficult. A single universal solution is unlikely to eliminate the disease. India therefore needs a strategy that recognises the biological complexity of tuberculosis and responds through multiple public health interventions rather than relying only on one medical tool.

This understanding is essential because tuberculosis policy must address prevention, diagnosis, treatment and social vulnerability together.

c. Significance of the PreVenTB Trial

- **Real-World Trial Design:** The PreVenTB trial was conducted across 18 sites in India and included more than 12,700 household contacts of tuberculosis patients aged six years and above. This makes the trial significant because it tested vaccines in real-world, high-risk conditions rather than in an abstract laboratory setting.
- **Findings on VPM1002:** The trial produced several important findings. VPM1002 showed nearly 50 per cent efficacy against extrapulmonary tuberculosis. Among children aged 6 to 14 years, it showed more than 60 per cent protection against all forms of tuberculosis.
- **Findings on Immuvac:** Immuvac also showed more than 60 per cent efficacy against extrapulmonary tuberculosis in younger children.
- **Operational Advantage:** Another important operational advantage is that VPM1002 is a single-dose vaccine based on a modified BCG platform, which makes it easier to deploy through public health systems.
- **Importance of Protection Against Extrapulmonary TB:** These findings are especially important because extrapulmonary tuberculosis is often underdiagnosed and is frequently excluded from global vaccine trial endpoints. Protection against such a form of tuberculosis can reduce suffering, long-term complications and health-care costs, even if the vaccine does not offer complete protection against all forms of the disease.

Thus, the trial provides India with a practical public health opportunity rather than a complete biomedical solution.

d. Policy Importance for India

- **Opening for National TB Elimination Programme:** The trial offers a major policy opening for India's National TB Elimination Programme. It challenges the tendency to wait for an ideal vaccine that can provide near-complete protection. In public health, a moderately effective intervention can still save lives and reduce disease burden if it is deployed intelligently among high-risk groups.
- **Relevance for Children and Adolescents:** The findings are particularly relevant for school-age children and adolescents. India currently has a tuberculosis vaccination strategy mainly centred around infancy through the BCG vaccine. However, the risk of tuberculosis does not end in infancy.
- **Booster or Targeted Vaccination Strategy:** A targeted booster-dose strategy or a carefully designed vaccination programme for older children and adolescents could help address this gap.
- **Indigenous Public Health Innovation:** The evidence also strengthens the case for indigenous public health innovation. India has earlier shown the capacity to develop and deploy locally relevant health technologies, including TrueNat, Covaxin and rotavirus vaccines. The tuberculosis vaccine evidence should be seen in the same broader context of using Indian research to meet Indian public health needs.

Therefore, the PreVenTB evidence should be used to design a realistic, India-specific vaccination and prevention strategy.

e. Governance Dimension

- **TB Elimination as a Governance Challenge:** Tuberculosis elimination is not merely a biomedical challenge. It is a governance challenge requiring coordination across several systems. The National TB Elimination Programme must work closely with immunisation services, nutrition schemes, primary health-care networks, diagnostic platforms, surveillance systems and community-level health workers.
- **Integration with Health Systems:** The success of a tuberculosis vaccine will depend not only on its scientific efficacy but also on how effectively it is integrated into the health system. Vaccination must be linked with screening, early diagnosis, preventive therapy, treatment adherence, nutritional support and social protection.

- **Need for a Layered Public Health Framework:** Without such convergence, even a promising vaccine may have limited impact. This is why India needs a layered public health framework.
- **Combining Multiple Interventions:** Vaccination can reduce severe disease and protect vulnerable groups, but it cannot replace early detection, treatment completion, nutritional support or community awareness. The central goal should be to combine multiple partially effective interventions into one coherent public health strategy.

This governance approach is essential because tuberculosis elimination depends on delivery capacity as much as medical innovation.

f. Concerns and Implementation Challenges

- **Vaccine Efficacy Is Meaningful but Limited:** Despite the promise of VPM1002 and Immuvac, the findings must be interpreted with caution. Vaccine efficacy is meaningful but not absolute. Therefore, vaccines cannot be treated as a substitute for diagnostics, treatment and preventive therapy.
- **Nutrition-Linked Concerns:** Another concern is the reduced vaccine efficacy among people with low body mass index. This shows that tuberculosis outcomes are closely linked with nutrition and broader social determinants of health. In a country where undernutrition remains an important risk factor for tuberculosis, vaccination must be combined with nutritional support.
- **Need for Prioritisation:** Large-scale deployment will also require careful prioritisation. India cannot immediately treat vaccination as a universal solution for all population groups. A phased and targeted approach would be more practical. Household contacts of tuberculosis patients, school-age children, adolescents and high-risk communities may be prioritised in the initial stages.
- **Public Trust and Communication:** Public trust will also be essential. Transparent communication, safety monitoring, post-deployment evaluation and clarity about the limits of vaccine protection will help prevent misinformation and unrealistic expectations.
- **Avoiding Policy Extremes:** A tuberculosis vaccine strategy must avoid both extremes: excessive enthusiasm that ignores limitations, and excessive caution that delays useful public health action.

Thus, implementation must be scientifically cautious, socially sensitive and operationally realistic.

g. Way Forward

- **Adopt Targeted Vaccination:** India should consider targeted vaccination rather than immediate universal rollout. Household contacts, school-age children, adolescents and high-risk communities can be prioritised because they are more likely to benefit from additional protection.
- **Link Vaccination with Nutrition:** Vaccination must be linked with nutrition. Since undernutrition weakens immunity and worsens tuberculosis outcomes, vaccine deployment should be aligned with schemes that provide nutritional support to vulnerable individuals and families.
- **Strengthen Diagnostics:** Diagnostics must be strengthened. Detecting latent infection, subclinical tuberculosis and early active disease is essential for reducing transmission and preventing severe outcomes. India should expand access to modern diagnostic tools and ensure that primary health centres are better equipped to identify tuberculosis early.
- **Expand Preventive Therapy:** Preventive therapy must be used more effectively. Household contacts and people with latent infection should receive timely preventive treatment so that infection does not progress into active disease.
- **Adopt Phased Evidence-Based Rollout:** A phased evidence-based rollout should be adopted. India can begin with pilot deployment, strong safety monitoring, transparent data collection and independent evaluation before expanding to wider groups.
- **Link TB Elimination with Social Policy:** Finally, tuberculosis elimination must be linked with broader social policy. Housing, nutrition, poverty reduction, workplace health, school

health programmes and community awareness must all become part of the tuberculosis response.

A strong way forward must therefore combine vaccination, nutrition, diagnostics, preventive therapy, social protection and health-system integration.

Conclusion

India's tuberculosis elimination strategy must move beyond the search for a perfect biomedical solution. The evidence from the PreVenTB trial suggests that moderately effective vaccines such as VPM1002 and Immuvac can still provide meaningful public health gains, especially when used among high-risk groups.

However, vaccination alone cannot eliminate tuberculosis. The way forward lies in a pragmatic, multi-layered public health model that combines vaccines with diagnostics, preventive therapy, nutritional support, treatment adherence and sustained public investment.

Such an approach would be more realistic, more equitable and better suited to India's complex tuberculosis burden.

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