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India Needs Innovative Strategies to Eliminate TB

Context

- More than a century after the introduction of the **BCG vaccine**, **tuberculosis (TB)** remains one of the world's deadliest infectious diseases.
- Despite significant medical advances, TB continues to impose a heavy burden, particularly in **low- and middle-income countries (LMICs)** such as India.
- Recent findings from the **PreVenTB trial** provide evidence that moderately effective vaccines can play a meaningful role in this effort.

Understanding the Complexity of Tuberculosis

- **Multiple Disease Pathways**
 - TB is caused by **Mycobacterium tuberculosis**, but its progression varies widely among individuals.
 - Following exposure, some people develop **latent infection** and remain symptom-free for years. Others may develop subclinical disease before progressing to active TB.
- **Pulmonary and Extrapulmonary Tuberculosis**

- Active TB manifests in two major forms:
 - **Pulmonary TB (PTB)**, which affects the lungs and drives disease transmission.
 - **Extrapulmonary TB (EPTB)**, which affects organs outside the lungs and is often difficult to diagnose.
- The existence of multiple disease pathways makes it unrealistic to expect a single vaccine to prevent every form of TB.
- Effective disease control therefore requires multiple interventions working together.

Significance of the PreVenTB Trial and Key Findings

• Real-World Evidence

- The PreVenTB trial, conducted across 18 sites in India, involved more than 12,700 participants who were household contacts of TB patients.
- The study evaluated two vaccine candidates: VPM1002 and Immuvac.

• Key Findings

- The trial reported:
 - Around **50% efficacy** of VPM1002 against **EPTB**.
 - More than **60% efficacy** among certain groups of children and adolescents.
 - Evidence of protection against progression from infection to disease.
- These findings are significant because they demonstrate effectiveness under real-world conditions and address forms of TB that have often received less attention in vaccine research.

Addressing the Hidden Burden of Extrapulmonary TB

• Why EPTB Matters

- Extrapulmonary TB is frequently underdiagnosed and associated with substantial morbidity and mortality.
- Its diagnosis is often delayed due to the absence of typical respiratory symptoms.

• Public Health Benefits

- Reducing EPTB cases can lower healthcare costs, decrease patient suffering, and improve quality of life.
- The strong efficacy signals observed among children and adolescents also support the possibility of a future booster-dose strategy for TB prevention.

The Role of Nutrition in TB Prevention

• Impact of Nutritional Status

- The trial demonstrated lower vaccine effectiveness among individuals with low Body Mass Index (BMI).
- This finding highlights the close relationship between nutrition and immune function.

• Integrating Nutrition with TB Control

- Addressing undernutrition should be considered an essential component of TB control strategies.
- Vaccination programs are likely to achieve better outcomes when combined with nutritional support initiatives.

Policy Implications and Operational Advantages

- **Benefits of VPM1002**

- It is a **single-dose vaccine**.
- It is based on a modified BCG platform.
- It can be produced through **large-scale manufacturing**.
- It is suitable for cost-effective deployment in resource-constrained settings.

- **Lessons from Previous Public Health Decisions**

- India has previously adopted innovative health technologies before international endorsement was fully established. Examples include:
 - **TrueNat** for TB diagnosis.
 - **Covaxin** during the COVID-19 pandemic.
 - Indigenous **rotavirus vaccines**.
- These experiences demonstrate the value of acting on strong evidence rather than waiting indefinitely for perfect solutions.

Steps Required in Achieving TB Elimination

- **Strengthening Diagnostic Systems**

- Improved **diagnostics** can identify infections at earlier stages, including latent and subclinical cases, enabling timely intervention and reducing transmission.

- **Expanding Preventive Therapy**

- Preventive treatment can stop latent infections from progressing into active disease, thereby reducing the overall burden of TB.

- **The Importance of Vaccination**

- Vaccination remains a critical component of TB control, especially in regions where access to healthcare services is uneven.
- Even vaccines with moderate effectiveness can contribute significantly when deployed strategically.

- **Towards a Smarter TB Strategy**

- TB elimination requires an integrated approach that combines:
 - Diagnostics
 - Preventive therapy
 - Targeted vaccination
 - Case management
 - Nutritional supplementation
 - Sustained public health investment
- No single intervention can eliminate TB on its own. A combination of complementary strategies is essential for long-term success.

Conclusion

- The complexity of the disease demands a **multi-layered strategy** that addresses prevention, diagnosis, treatment, and broader social determinants of health.
- The **PreVenTB trial** provides encouraging evidence that vaccines such as **VPM1002** and **Immuvac** can reduce both **PTB** and **EPTB**, particularly among high-risk populations.
- Rather than waiting indefinitely for an ideal vaccine, policymakers should prioritise evidence-based interventions capable of delivering immediate public health benefits.
- A pragmatic and integrated approach offers the most realistic pathway toward controlling one of humanity's oldest and most persistent diseases.

India Needs Innovative Strategies to Eliminate TB FAQs

Q1. What is El Niño?

Ans. El Niño is a climate phenomenon that can weaken monsoon rainfall and increase temperatures in India.

Q2. How does heat stress affect workers?

Ans. Heat stress reduces workers' productivity and limits their working hours.

Q3. Why is agriculture vulnerable to El Niño?

Ans. Agriculture is vulnerable because it depends heavily on monsoon rainfall for crop production.

Q4. How can El Niño contribute to inflation?

Ans. El Niño can reduce crop yields, leading to higher food prices and increased inflation.

Q5. Why is climate change considered a development challenge?

Ans. Climate change affects employment, agriculture, food security, and social equality, thereby influencing overall development.

Source: **The Hindu**

When El Niño Becomes an Economic Crisis

Context

- India has traditionally viewed extreme heat and uncertain monsoons as recurring natural phenomena, however, the anticipated return of **El Niño** in 2026 signals a much deeper challenge.
- A weaker monsoon and rising temperatures threaten not only environmental stability but also economic growth and social well-being.
- In a country where a large proportion of employment remains dependent on climate-sensitive sectors, **climate risk** has become a significant **development challenge**.
- The impacts of El Niño extend through labour markets, agriculture, food prices, and urban living conditions, exposing the vulnerabilities of the **informal economy** and widening existing inequalities.

Climate Change as an Economic Challenge

- Climate-related shocks no longer remain confined to the environment. They directly influence employment, production, consumption, and household welfare.
- A **below-normal monsoon** can weaken rural incomes, reduce agricultural output, and trigger inflationary pressures.
- Consequently, climate disturbances function as an **economic transmission mechanism**, affecting multiple sectors of the economy simultaneously.

Impact on Labour and Employment

- **Heat Stress and Worker Productivity**
 - One of the most immediate consequences of El Niño is increasing **heat stress**.
 - Outdoor workers such as **construction labourers**, street vendors, delivery personnel, and agricultural workers face prolonged exposure to extreme temperatures.
 - Higher temperatures reduce physical efficiency, shorten working hours, and lower overall **productivity**.
- **Income Insecurity in the Informal Economy**
 - Since many workers depend on daily wages, any reduction in work opportunities directly affects household income.
 - Limited access to social protection and healthcare further increases their vulnerability.
 - As a result, rising temperatures make earning a livelihood increasingly difficult for millions of workers.

Impact on Agriculture and Rural Livelihoods

- **Dependence on Monsoon Rainfall**
 - Indian agriculture relies heavily on **monsoon rainfall** for crop cultivation, reservoir replenishment, and groundwater recharge.
 - A weaker monsoon creates uncertainty regarding sowing decisions and agricultural planning.
- **Rising Costs and Rural Instability**
 - Reduced rainfall often increases dependence on irrigation and **groundwater extraction**, raising production costs for farmers.
 - For **small and marginal farmers**, already burdened by volatile market prices and rising input expenses, climatic uncertainty can significantly weaken income and productivity.
 - Consequently, agricultural disruption becomes a major obstacle to rural development.

Inflation and Household Welfare

- **Rising Food Prices**
 - Climate-related disruptions frequently translate into **food inflation**. Lower agricultural output can increase the prices of vegetables, pulses, and other essential commodities.
 - Since food constitutes a large share of household expenditure, rising prices place considerable pressure on consumers.
- **Policy Challenges**

- El Niño creates a complex policy dilemma. While economic growth may slow because of reduced agricultural production and lower labour productivity, inflation may simultaneously increase.
- Managing these competing pressures becomes a significant challenge for policymakers.

Urban Inequality and Climate Vulnerability

• Cities as Heat Traps

- Rapid **urbanisation**, extensive concretisation, and shrinking **green cover** have transformed many Indian cities into **heat traps**.
- Rising temperatures intensify discomfort and health risks, particularly during prolonged heat waves.

• Unequal Capacity to Adapt

- The burden of climate change is distributed unevenly. Wealthier households can access better housing, cooling technologies, and reliable water supplies.
- In contrast, poorer communities often experience overcrowding, **water scarcity**, and prolonged heat exposure.
- As a result, climate change reinforces existing social and economic inequalities.

Need for Climate Adaptation

• Building Resilient Systems

- Addressing the challenges posed by El Niño requires comprehensive **climate adaptation**
- Investments in **heat-resilient cities**, improved **worker protection**, sustainable **water management**, and **climate-resilient agriculture** are essential for reducing vulnerability.

• Protecting the Most Vulnerable

- Special attention must be directed toward protecting low-income households, informal workers, and small farmers who bear the greatest burden of climate-related shocks.
- Strengthening resilience at the local level can help mitigate long-term economic and social consequences.

Conclusion

- The return of **El Niño** should not be viewed merely as a weather event but as a broader test of India's developmental resilience.
- Its effects on employment, agriculture, inflation, and urban living conditions demonstrate the close relationship between climate and economic stability.
- As climate shocks become more frequent and intense, effective adaptation strategies will be essential for ensuring sustainable growth and protecting vulnerable populations.
- Ultimately, recognising that **climate risk is economic risk** is crucial for securing India's future development.

When El Niño Becomes an Economic Crisis FAQs

Q1. Why is tuberculosis still a major public health challenge?

Ans. Tuberculosis remains a major public health challenge because it continues to cause a high number of deaths worldwide despite existing prevention and treatment measures.

Q2. What are the two main forms of active tuberculosis?

Ans. The two main forms of active tuberculosis are Pulmonary TB (PTB) and Extrapulmonary TB (EPTB).

Q3. What was the main objective of the PreVenTB trial?

Ans. The main objective of the PreVenTB trial was to evaluate the effectiveness of the vaccines VPM1002 and Immuvac in preventing tuberculosis.

Q4. Why is nutrition important in TB prevention?

Ans. Nutrition is important in TB prevention because undernourished individuals may respond less effectively to vaccines and are more vulnerable to disease.

Q5. What approach is needed to achieve TB elimination in India?

Ans. India needs a multi-layered approach that combines diagnosis, preventive therapy, vaccination, nutritional support, and public health investment to achieve TB elimination.

Source: **The Hindu**

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