

EDITORIAL HIGHLIGHTS

06-06-2026

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India needs innovative strategies to eliminate TB

More than a century after the first tuberculosis vaccine was introduced, the world is struggling to control one of its oldest diseases. Tuberculosis (TB) continues to kill more people annually than any other infectious disease, surpassing even the COVID-19 pandemic at its peak. Yet, there is still no effective vaccine for adolescents and adults.

Once exposed to *Mycobacterium tuberculosis*, individuals may get infected and remain asymptomatic for years. Others develop subclinical disease, showing minimal or no symptoms while harbouring infection. A subset progresses to active TB, which may manifest as pulmonary TB (PTB) – the infectious form that drives transmission – or as extrapulmonary TB (EPTB), which affects organs beyond the lungs and is harder to diagnose, more debilitating, and sometimes fatal.

No one-size-fits-all vaccine

With such diversity in disease pathways, expecting a single “one-shot” vaccine to prevent all forms of TB may be unrealistic. This expectation has shaped global disappointment in TB vaccine development especially since most previous trials have focused primarily on preventing pulmonary TB.

Meanwhile, the burden remains immense. In many low- and middle-income countries, TB incidence ranges between 200 and 300 per 100,000 population. Reducing this to 10-20 per 100,000 – the threshold for elimination – will require sustained effort and enormous public health investment. For India, which carries one of the world's highest TB burdens, the challenge is systemic.

India's goal of eliminating TB is ambitious and necessary. But achieving it will require a holistic approach towards all forms of disease and all age groups moving beyond the search for a perfect solution and embracing a layered, pragmatic approach. As tools are discovered and tested, decisions will need to be made on their deployment.

The first layer is better detection. Advances in diagnostics, including tools for identifying subclinical TB, can help identify individuals at risk earlier. The second is preventive therapy, ensuring that those with latent infection receive treatment before progressing to active disease. The third – arguably the most complex – is vaccination. However, access to diagnostics and preventive therapy remains uneven, making vaccination an especially critical pillar.

Recent findings from the BMJ-published PreVenTB trial conducted by the Indian Council of Medical Research (ICMR) provide such an opportunity. Conducted across 18 sites in India and involving more than 12,700 household contacts of TB patients, the trial evaluated VPM1002 developed by SIIPL and Immuvac developed by Cadila, in a real-world, high-risk population aged six years and above, including



Balram Bhargava

Former Director-General, Indian Council of Medical Research (ICMR)



Soumya Swaminathan

Former Chief Scientist of the World Health Organization (WHO)

individuals with comorbidities and varying infection status closely reflecting real life conditions.

The trial reported efficacy of VPM1002 and Immuvac as: 50.4% efficacy of VPM1002 against extrapulmonary TB (statistically significant); 64.6% efficacy of VPM1002 in children aged 6-14 years against all TB (PTB and EPTB); More than 60% efficacy of Immuvac against EPTB in children aged 6-10 years; more than 60% efficacy against progression to disease among those developing latent infection during follow-up and overall 21.4% efficacy of VPM1002 against all TB (Reference: Subho Sarkar, Consultant Intervention Pulmonologist; from LinkedIn). These are not trivial findings.

Extrapulmonary TB is the hidden burden of the epidemic, harder to diagnose, frequently missed, and associated with significant morbidity and mortality. A reduction of over 50% in such cases represents a meaningful clinical and public health impact, including reduced health-care costs and patient suffering.

The data also highlight a strong signal in school-age children and adolescents, where efficacy exceeded 60% which is an add-on benefit of vaccination in this age group. This is particularly relevant because India currently has no structured TB vaccination strategy beyond infancy. If confirmed, this could open the door to a booster-dose TB prevention strategy.

Need for nutritional support

Another important piece of evidence generated from study is the role of nutrition. Reduced efficacy was observed in individuals with low body mass index (BMI), underscoring the need for nutritional support for vaccines to work optimally in undernourished in context of broader health determinants.

From a programmatic standpoint, VPM1002 offers additional advantages. It is a single-dose vaccine based on a modified BCG platform, making it operationally simpler than multi-dose, adjuvanted vaccines in development. In a country of India's scale, logistical simplicity is a decisive advantage. The vaccine can be manufactured at large scale and cost effectively.

TB is largely a disease of low and middle income countries (LMIC) and their governments must act proactively. Waiting for expansive solutions developed elsewhere is neither practical nor sustainable. LMICs cannot afford to wait for a silver bullet, because there is no one-stop solution for TB, especially when there are results from a Phase III trial conducted in an Indian population across all age groups (six years and above) and against all forms of TB, including PTB and EPTB. It is to be noted that no other TB vaccine trial till date has studied efficacy against EPTB and none of the currently ongoing trials worldwide has included EPTB as the efficacy end-point.

India has navigated similar public health

decisions before. TrueNat was the first “make in India” Molecular test approved and adopted by the National TB Elimination Programme before its World Health Organization pre-qualification study.

During the COVID-19 pandemic, Bharat Biotech's Covaxin was initially approved in “clinical trial mode” to enable early access while additional data continued to accumulate. That decision was driven not by perfection, but by urgency and it helped accelerate protection at a critical time.

India has also demonstrated this approach with indigenous rotavirus vaccines, which were introduced despite modest efficacy and wide confidence intervals. Since then, they have helped reduce severe disease and child mortality and have been incorporated into the national immunisation programme (Bhandari *et al.*, *The Lancet*, 2014).

A smarter TB strategy

TB is, in many ways, a slow-moving pandemic. Yet, it has not always been met with the same urgency in policy action. The policy question, therefore, is how innovations, including moderately effective vaccines such as VPM1002 and Immuvac, can be intelligently integrated into the TB elimination programme. Targeted use among household contacts, deployment in school-age children, and alignment with nutrition and preventive therapy programmes could together lead to a more effective TB control framework. A combination of vaccines effective across different indications and age groups may be needed to have an impact.

India's TB challenge is unlikely to be solved by a single breakthrough. It will require a combination of early detection, preventive treatment, targeted vaccination against both pulmonary and extrapulmonary TB, case-based clinical management, nutritional supplementation, and sustained public health investment.

Waiting for a perfect vaccine may delay progress indefinitely, especially when no trial other than the PreVenTB trial has evaluated vaccine efficacy against both pulmonary and extrapulmonary TB in individuals aged six years and above. In contrast, deploying tools that reduce severe disease, particularly EPTB, can deliver immediate and tangible benefits.

The PreVenTB trial is comprehensive, well-designed and well conducted, offering a meaningful signal – perhaps a light at the end of the tunnel in TB vaccine development. Given the urgency of the challenge and the limited time to act, we must focus on solutions that are available today and supported by robust evidence of efficacy against both PTB and EPTB in individuals aged six years and above under real-world conditions, rather than wait indefinitely in the hope that better options may emerge in the future – an outcome that is far from certain.

New Indian vaccine trial data show meaningful protection against extrapulmonary TB, underscoring the need for targeted vaccination alongside stronger public health strategies

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MPC retains repo rate, lowers growth forecast

Repo rate unchanged at 5.25%; real GDP growth projected at 6.6%, down by 0.3% from the earlier projection of 6.9% for FY27; CPI inflation projected to be at 5.1% 50 bps more than the earlier one

Lalatendu Mishra
MUMBAI

The Monetary Policy Committee (MPC) of the Reserve Bank of India (RBI) on Friday voted unanimously to keep the policy repo rate under the liquidity adjustment facility (LAF) unchanged at 5.25%. Consequently, the standing deposit facility (SDF) rate remains at 5% and the marginal standing facility (MSF) rate and the bank rate at 5.50%.

The MPC also decided to continue with its neutral stance.

"The committee noted that the global environment has deteriorated since the last policy meeting with the conflict lingering amidst a fragile truce. The adverse implications of the extended disruption in supply chains and elevated energy prices are reflected in the moderation of growth and increase in inflation projections from the April policy," RBI Governor Sanjay Malhotra said in a statement.

Stating that CPI inflation remained below the target despite global shock as the pass through to domestic prices had been limited, he said baseline projections pointed towards headline inflation firming up towards the upper tolerance level in Q3 2026-27 and the impact of the supply shock would wane Q4 onwards.

"The underlying inflation pressures continue to remain benign at this juncture. However, generalisation of inflation through second-round effects on expectations and wages is a distinct possibility, warranting a close vigil. The outlook also remains clouded due to the sub-normal south-west monsoon forecast and El Niño risks," Mr. Malhotra said.

Gloomy outlook

Elevated energy prices coupled with global supply constraints are having adverse spillovers on economic activity, says MPC

- Domestic demand remains resilient, manufacturing and services sectors activity continue to expand
- Incipient signs of moderation in some sectors as suggested by high frequency indicators
- Considerable risks to baseline assessment of inflation and growth due to the uncertainty about the duration and intensity of West Asia conflict
- Food outlook uncertain on account of sub-normal south-west monsoon forecast and El Niño



Central bank announces host of measures to attract foreign capital

Lalatendu Mishra
MUMBAI

To attract foreign capital the RBI on Friday announced several measures. For government securities under the Fully Accessible Route (FAR), the RBI said it was expanding the universe of

'specified securities' by including all new issuances of 15, 30 and 40-year tenor G-secs.

Additionally, limits on short-term investments, concentration and individual securities on FPI investment under the General Route are being removed. "These

measures should help attract foreign capital for government borrowing," the RBI Governor said.

The RBI has also decided to increase the limits for investment by NRIs and OClIs in equity instruments traded on the stock market without SEBI registration.

As for growth, the MPC noted that elevated energy prices coupled with global supply constraints are having adverse spillovers on economic activity.

"While domestic demand remains resilient and manufacturing and services sectors activity continue to expand, there are incipient signs of moderation in some sectors as suggested by high frequency indicators," he stated.

He said the MPC was of the opinion that there were considerable risks to the baseline assessment of inflation and growth due to the uncertainty about the duration and intensity of the conflict, magnitude of its spillover effects, and the

pace of restoration of supply chains. "Additionally, the food outlook remains uncertain on account of the sub-normal south-west monsoon forecast and El Niño. Although risks of higher inflation have amplified, the MPC felt it would be prudent to wait for greater clarity to emerge," he said.

Stating that overall, the economic situation had broadly exhibited resilience and withstood the conflict spillovers, he said the impact of cost pressure was becoming visible.

"The rise in prices of energy and other inputs, coupled with supply disruptions, is likely to weigh on economic activity.

While import diversification in affected commodities is likely to improve supply, it would come at a higher cost," he said.

"The full impact, however, will depend on the duration of the conflict, time taken for normalisation of supply chains and the burden-sharing approach among the stakeholders," he added.

Real GDP growth for 2026-27 is projected at 6.6% down from earlier projection of 6.9% with Q1 at 6.6%; Q2 at 6.3%; Q3 at 6.5%; and Q4 at 6.8%.

CPI inflation for 2026-27 is projected to be at 5.1% which is 50 basis points more than the earlier projection.

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FIIs HOLD Rs 3.75 LAKH CRORE, OR 3.34%, OF Rs 112 LAKH CRORE GOVT DEBT

To draw funds, prop rupee, Govt scraps FII capital gains, withholding tax on bonds

Re under pressure, BoP deficit likely to be around \$50-60 bn, move expected to result in good foreign fund inflows

Siddharth Upasani
New Delhi, June 5

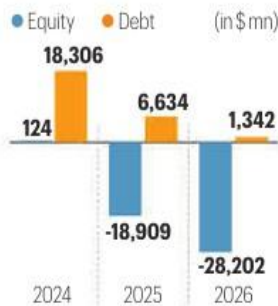
AMID PRESSURE to attract foreign funds and also stabilise the rupee, the Centre on Friday scrapped the capital gains tax, both long-term and short-term, on investment by Foreign Institutional Investors (FIIs) in government bonds as well as the withholding tax they must pay on their interest income from these debt instruments. At present, FIIs pay 12.5% tax on long-term capital gains, 30% on short-term capital gains, and around 20% withholding tax on interest income.

The decision, taken after at least two months of internal discussions, is expected to bring tens of billions of dollars in foreign fund into government debt over the coming years, and bridge to some extent the looming balance of payments (BoP) deficit that economists estimate could even touch \$60 billion in 2026-27.

In an ordinance promulgated to amend the Income Tax Act, 2025, after President

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Foreign investment in debt positive, but falling



NOTE: FPI INVESTMENT IN DEBT INCLUDES GENERAL, VOLUNTARY RETENTION, AND FULLY ACCESSIBLE ROUTES. SOURCE: NSDL

E. EXPLAINED

Addressing concerns

To assuage global investors, the government and the RBI have in unison announced a string of decisions to attract foreign money. In the last couple of years, heavy pull-out by FPIs from equities and poor net FDI inflows have exerted pressure on the rupee.

FY26 growth estimate raised to 7.7 per cent; momentum strong: PM

Siddharth Upasani
New Delhi, June 5

THE INDIAN economy ended 2025-26 on an unexpectedly strong note, with the GDP estimated to have grown 7.7% on the back of higher growth in investments, the Ministry of Statistics and Programme Implementation (MoSPI) said on Friday.

GDP growth in the last quarter of the year, or January-March 2026, declined slightly to 7.8% from 8% in October-December 2025 — revised upwards from 7.8% — despite the West Asia war overlapping with the final month.

Marginal revisions were also made to the GDP growth

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RBI eases norms for PSUs, banks to get foreign fund inflows

George Mathew
Mumbai, June 5

TO ENCOURAGE foreign capital inflows, the Reserve Bank of India on Friday eased norms for state-owned enterprises to borrow overseas and for banks to mobilise foreign current deposits. The move complements the government's decision to

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RBI Governor Sanjay Malhotra in Mumbai, Friday. PTI

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FII capital gains, withholding tax

Droupadi Murmu gave her assent, the government said the changes will come into effect from April 1, 2026. FII investment in government bonds stands at Rs 3.75 lakh crore, or just 3.34% of the available amount of Rs 112.42 lakh crore, under the so-called General Route and Fully Accessible Route (FAR). These are the two ways in which foreign investors invest in Indian government securities.

According to Axis Bank economists, no tax on FII investment in government debt could lead to \$45-50 billion inflows over two years.

A BoP deficit exerts pressure on the rupee to weaken. While the rupee has gained some ground since nearly breaching the 97-per-dollar mark last month, it is down 5% since the war began on February 27 and has slumped 10.3% in the last one year. After closing at 95.79 per dollar on Thursday, it ended sharply higher at 94.94 on Friday. Meanwhile, yields on government bonds declined.

The tax exemption on "any interest on Government security, and any capital gains arising

from the sale, exchange or transfer of such Government security" applies to FIIs as well as the Bank for International Settlements. The BIS is an organisation of central banks from around the world. It is yet to invest in India.

Until now, while foreign investors had to pay a long-term capital gains tax of 12.5% on listed stocks and bonds that they hold for more than 12 months, they also had to pay a withholding tax – akin to a tax deducted at source – on interest income from their holding of bonds. Non-residents paid a withholding tax of about 20% on their interest income from government bonds – one of the highest in the world – after a concessional rate of 5% ended in 2023. The tax on short-term capital gains was 30%.

Investors from countries with which India has double taxation avoidance agreements pay lower rates. Meanwhile, investors who don't have an Indian tax residency are at a further disadvantage because the withholding tax must be paid on the gross amount and losses can't be set off against past gains.

The Indian Express had reported on May 15 the government and the Reserve Bank of India were considering multiple measures to attract foreign investment inflows, including a cut in the withholding tax rate on government bonds, if not completely eliminating it.

Timing with tax elimination, the RBI too said Friday it was "expanding the universe" of government securities that fall in the so-called Fully Accessible Route (FAR) to include all new issuances of 15-, 30- and 40-year bonds.

"In addition, limits pertaining to short-term investment, concentration and individual securities on FPI investment under the General Route are being removed. These measures along with the tax benefits provided by the government this morning should help attract foreign capital for government borrowing," Governor Sanjay Malhotra said while announcing a raft of other measures to boost foreign inflows into the country. While he did not specify how much foreign money could come into India because of the steps that have been taken, he

said the hope was that a healthy amount would do so.

"The combined impact of these could help bridge the \$40-50 billion gap in the Balance of Payments that we had estimated for FY27. We see an appreciation bias likely for the rupee over the coming months as the actual flows on account of these measures start trickling in," Sakshi Gupta, Chief Economist at HDFC Bank, said.

Experts have long warned that the withholding tax is an obstacle to stronger foreign inflows, with Ananth Narayan, former Whole Time Member at the Securities and Exchange Board of India, saying last month the tax is the source of a lot of "friction". "I am not saying that if you solve this tomorrow, money will come in. But this is definitely a barrier for money to come into the country," he had said.

As such, the removal of the two taxes on Indian government bonds could boost inflows at a time when Foreign Portfolio Investors (FPIs) have pulled out \$28 billion from Indian stock markets so far in 2026.

"The whole world is fixated on foreign portfolio flows into equities, but FPI debt inflows are not insignificant," DSP Mutual Fund said on Thursday.

GS 3: SCIENCE AND TECHNOLOGY

INDIAN EXPRESS

• FIFA WORLD CUP 2026

AI-enabled ball for better decisions, fewer surprises



SHASHANK NAIR

EVERY FOUR years when the FIFA World Cup comes around, official sponsor Adidas creates a new iteration of the ball that will be used. This time, as the world further integrates artificial intelligence (AI) models into everyday use-case scenarios, the humble football now finds itself an AI-enabled entity, loaded with a sensor specifically built to track its movements.

But the Trionda, this edition's ball, is notable for more than its modern sensor. It has the lowest number of panels ever used to make a football. And, unlike the mercurial Jabulani ball used during the 2010 World Cup, it promises far fewer surprises than what many players had to contend with in South Africa.

The early World Cup football

The Telstar ball was created for the 1970 FIFA World Cup. Made of 32 panels, it was coloured black and white so that it would be more clearly visible to television audiences in a pre-colour TV era.

Its iconic design is what immediately comes to mind when you think of a football. It is from this foundation that the modern football has evolved.

How different is the Trionda from the Telstar?

A lot. For starters, this ball is like an electronic appliance — it needs to be charged for 90 minutes for six hours of play. This is because it contains a sensor inside — something Adidas first adopted with the Al Rihla ball used at the 2022 World Cup in Qatar.

This is how this "connected ball technology" works. The Trionda has a 500hz "inertial measurement unit" motion sensor inside one of its four panels, with counter-balances placed on all other panels as well to ensure that its flight remains true. An inertial measurement unit measures and reports an object's specific force, orientation, and how fast it rotates or revolves around an axis.

ICONIC TO INFAMOUS: BALLS OVER THE YEARS


1970: TELSTAR

The classic, with 32 black-and-white panels that would boost TV visibility. The iconic Telstar, named after a satellite, and its upgraded versions, were the Cup standard until 2002.




2006: TEAMGEIST

The Teamgeist was the first football to ditch the standard 32 panels and used 14 instead. Its unpredictable movement — especially with long-range shots — caused controversy.




2010: JABULANI

Jabulani means 'to rejoice'. But goalkeepers found little reason to. Adidas' smooth-surfaced ball had a life of its own, twisting and dipping at will. But this did lead to spectacular long-range goals.



THE TRIONDA'S colours and design reflect the three hosts: Canada, Mexico and the US



THE TRIONDA: TEXTURE, TECHNIQUE, TRAJECTORY

This is a tetrahedron: four triangles, three of which meet at every point. The panels are curved but have three points, like a typical triangle.

The ball has a rough surface with a host of microtextures. The physics is similar to golf balls that have dimples.

This ensures evenly distributed drag, which helps the ball go faster but doesn't necessarily compromise its path in the air.

What is the purpose of the chip?

Football authorities are attempting to cut down the often prolonged decision-making time that has followed the introduction of the virtual assistant referee (VAR) system. The sensor chip inside the Trionda sends razor-sharp ball-movement data to officials and hastens the process of making offside decisions.

"We can track every event, every interaction the player has with the ball. Every location at any given moment is being tracked by a local positioning system," said Hannes Schaefer, Football Innovation Lead for Adidas. "So this sensor essentially sends a signal 500 times per second, to anchor points around the stadium."

How will AI help in making quicker VAR calls?

The sensor will be complemented by pitchside sensors, which track player

Sensor check

The virtual assistant referee system has been criticised for slowing down decisions.

The Trionda's sensor will send data to officials and hasten the process of making offside decisions.

movements. FIFA has also chosen to scan each footballer at the tournament, and VAR will also use a 3D digital avatar of the player.

Combine all this information gathered — add AI to the mix — and FIFA and Adidas believe there lies a path to issuing lightning-fast offside calls and other VAR checks like accidental handballs and accurate player tracking.

Many countries have found themselves on the losing end of a match based on a decision that went against them. World Cups have famously amplified those calls — be it Diego Maradona's handball against England in 1986 or Frank Lampard's ghost goal against Germany in 2010. FIFA is hoping to minimise such incidents.

How will the Trionda perform?

The makeup of the Trionda is unlike any other football. While technology plays a big part, it is also a football that — just like

Over several World Cups, the ball has attracted more attention than the football. The Trionda promises to bring the focus back to the game

the Jabulani, or the Al-Rihla used in Qatar — has its own characteristics.

Chief among those are the Trionda's similarities to the Jabulani. Both balls are tetrahedrons: four triangles, three of which meet at every point. For the Trionda, the panels are curved but have three points, like a typical triangle.

The Jabulani, used in 2010, was notorious for its wild trajectories. Made of eight thermally bonded panels, the ball was the smoothest ever created by Adidas. The drag from that smoothness was what led to its unpredictability and unpopularity among footballers. But the Trionda is different and has a failsafe in place.

Adidas has deliberately made the Trionda's surface rough. It has added three deep grooves in each panel and a host of microtextures (microscopic, raised patterns engineered onto the upper surface). The physics is similar to golf balls that have dimples. The result should be evenly distributed drag that helps the ball go faster but doesn't necessarily compromise its trajectory through the air.

Does it come with complications?

A team of scientists led by Professor John Eric Goff used a wind tunnel and five World Cup balls: Jabulani (2010), Brazuca (2014), Telstar 18 (2018), Al Rihla (2022), and Trionda (2026). Their experiments showed that the Trionda "exhibited the smallest measured critical speed among the five balls in both tested orientations".

The researchers noted: "A long ball struck with great force may land several meters shorter than expected... Our experiment analyzed a no-spin state, so further research is needed that takes into account external variables in real matches such as spin, humidity and temperature." The results were published in the journal *Applied Sciences*.

What does its design denote?

The 2026 FIFA World Cup will be the first time three countries will host the tournament. Keeping that in mind, the Trionda is made on a white base, with red, blue, and green-coloured graphics across the four panels of the ball.

There is also the graphic of a maple leaf, an eagle and a star to denote the three hosts: Canada, Mexico, and the US.