EDITORIAL HIGHLIGHTS

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GS 3: SCIENCE AND TECHNOLOGY THE HINDU PAGE: 08

Salmonella infections: why India needs to look beyond typhoid and diarrhoea

Athira Elssa Johnson

Salmonella is often linked to food poisoning, diarrhoea and typhoid. But the infection can range from mild gastroenteritis that gets better on its own to a serious bloodstream infection, and therefore, say experts, deserves more attention than it is currently being given.

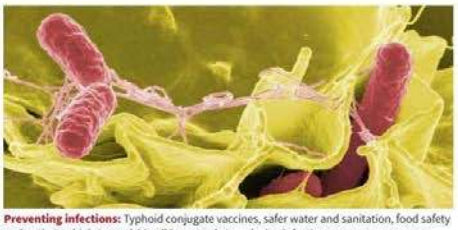
Salmonella is a group of bacteria that can cause different infections. Typhoid and paratyphoid or enteric fever, are caused by Salmonella Typhi and Salmonella Paratyphi. The problem, however, is broader than typhoid. Non-typhoidal Salmonella infections, which often cause gastroenteritis, may go undiagnosed because many people recover without testing. At the same time, antibiotic resistance is making serious infections harder to treat.

Why infections turn serious

Non-typhoidal Salmonella commonly causes gastroenteritis, with diarrhoea, stomach cramps, fever and sometimes vomiting. It is often linked to poultry, eggs and other animal-based foods. Most healthy people recover with supportive care, but the infection can become serious and spread to the bloodstream. "Salmonella should not be seen as only a cause of diarrhoea," said Sweatha Kumar, associate consultant, infectious diseases, Rela Hospital, Chennai. "In some patients, especially young children, older adults and those living with other illnesses or weakened immunity, it can become invasive and life-threatening."

Suresh Kumar D., senior specialist in infectious diseases, Apollo Speciality Hospitals, Vanagaram, Chennai, said the actual burden of non-typhoidal Salmonella is difficult to estimate as many mild infections are never diagnosed.

Both typhoid and non-typhoidal Salmonella infections spread through the faecal-oral route, but their sources are different. For typhoid, humans are the reservoir. Non-typhoidal Salmonella has a wider ecology, involving animals, food and the environment. Poultry, eggs, meat and other animal-derived foods can be sources. Transmission can also occur when raw meat contaminates ready-to-eat food during preparation.



Preventing infections: Typhoid conjugate vaccines, safer water and sanitation, food safety and antimicrobial stewardship all have a role in reducing infections. WIKIMEDIA COMMONS

"Contamination can occur at multiple points, from farms, slaughterhouses and food processing to transportation, storage, restaurants and finally the household kitchen," Dr. Sweatha said. "That is why Salmonella is very much a One Health problem involving humans, animals, food and the environment."

Food handlers can play an important role in transmission, as those carrying the infection can contaminate food and potentially expose many people to the bacteria. But food safety cannot depend only on individual food handlers. The wider system needs better training, sanitation, refrigeration, monitoring and enforcement. While the Food Safety and Standards Authority of India has surveillance and testing systems, gaps remain, particularly in the large informal food sector.

At the household level, it is important follow: washing hands, using safe water, cooking poultry and eggs thoroughly, refrigerating perishable foods appropriately and keeping raw meat separate from ready-to-eat food.

Challenges and way forward

The major concern is the growing antimicrobial resistance in Salmonella. India has seen a major shift in the resistance pattern of S. Typhi. A recent study in *PLOS Neglected Tropical Diseases* said, culture-confirmed isolates from 1977 to 2024 found that fluoroquinolone resistance rose sharply, reaching 85% in 2015-19, and remains high despite a subsequent decline.

"The emergence and spread of extensively drug resistant typhoid shows what can happen when resistance accumulates across multiple antibiotic classes," Dr. Sweatha said, "It can leave clinicians with very limited treatment options."

Experts say the answer is not to simply use stronger antibiotics. Blood culture is the main test for suspected typhoid and should ideally be done before antibiotics are started. The Widal test has limitations and should not be used alone to diagnose typhoid. For uncomplicated non-typhoidal Salmonella gastroenteritis, treatment mainly involves adequate fluids and electrolyte replacement. Antibiotics are usually reserved for severe or invasive infections and people at higher risk of complications.

Prevention remains as important as treatment. The World Health Organization recommends typhoid conjugate vaccines for children from six months of age; however, this not yet part of India's universal immunisation programme.

The challenge is to treat the infections that genuinely require antibiotics while preventing the infections that can be prevented in the first place.

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GS 2: POLITY

THE HINDU PAGE: 08

Why 543 should remain 543

S.Y. Quraishi

Former Chief Election Commissioner of India and the author of 'An Undocumented Wonder – The Making of the Great Indian Election'

Delimitation, federal fairness and women's representation can all be achieved without enlarging the Lok Sabha

Days after both Houses of Parliament were adjourned *sine die* on August 13, 2026, the monsoon session has yet to be formally prorogued. The delay has prompted speculation that Parliament could be reconvened for another attempt at the constitutional amendment linked to delimitation and women's reservation. Whether or not that happens, it gives urgency to a question Parliament must confront: must delimitation necessarily mean an enlargement of the Lok Sabha?

Numbers alone cannot decide

At first glance, the issue looks like arithmetic. India's population has grown enormously since Lok Sabha seats were frozen half a century ago, so it seems natural to argue that representation must now expand correspondingly. But, constitutional design is not arithmetic alone.

Article 81 requires representation broadly to correspond to population, "so far as practicable", while Article 82 provides for readjustment after every Census. Yet, Parliament has twice modified the mechanical application of this principle when another compelling national objective was at stake. In 1976, through the 42nd Constitutional Amendment, the inter-State allocation of seats was frozen on the basis of the 1971 Census so that States successful in family planning were not politically penalised for reducing population growth. The freeze was later extended by the 84th Amendment until the publication of figures from the first Census conducted after 2026. Parliament thus recognised that population matters, but it is not the only constitutional value at stake.

The government has reportedly suggested increasing every State's representation by roughly 50%, arguing that this would leave each with the same 'proportion' of Lok Sabha seats that it has today. On the face of it, that appears to answer the fear of the southern States of losing their relative position. But 'proportion' tells only half the story.

Suppose Uttar Pradesh rises from 80 seats to 120, while Tamil Nadu rises from 39 to about 59. Their proportional relationship remains unchanged. Yet, the absolute gap in voting strength rises from 41 Members of Parliament (MP) to around 61. Parliament does not vote in proportions; it votes in absolute numbers. Governments are formed by numbers, and confidence motions, legislation, and constitutional amendments are decided by numbers. A 50% pro-rata increase may preserve the ratio while widening the numerical gap.

The 1976 freeze therefore embodied a federal compact: States that succeeded in population stabilisation would not see their political voice diminished for doing what national policy encouraged. That understanding should not now be thoughtlessly discarded.

There is also a misconception that delimitation and enlargement are inseparable. They are not. India has already shown that constituency boundaries can be redrawn without changing the number of seats allocated to each State. The delimitation after the 2001 Census reorganised constituencies within States while maintaining the existing inter-State allocation.

That principle can be adopted again. The 2027 Census can provide the basis for redrawing constituencies within each State so that populations are more evenly distributed. Boundaries can reflect demographic movement and urbanisation. None of this requires increasing the Lok Sabha beyond 543 or disturbing the present federal balance.

A continuously expanding legislature is also not an inevitable consequence of population growth. The United States House of Representatives has remained at 435 voting members (there were some temporary exceptions) for more than a century despite enormous population growth. Switzerland's National Council has remained at 200 members since 1963. Going a step further, Hungary reduced its Parliament from 386 members to 199, while Italy reduced its Chamber of Deputies from 630 to 400. There is no democratic law requiring legislatures to grow whenever population grows.

Bigger House, weaker deliberation

There is another serious concern: what a larger House does to Parliament's own functioning. Parliamentary time does not expand with the number of MPs. Even with 543 members, many MPs hardly get opportunities to speak, ask questions or raise matters of public importance. A Lok Sabha enlarged by 50%, to more than 800 members, would reduce those opportunities further. It may increase representation numerically while weakening the quality of deliberation, one of Parliament's most important functions. Indian MPs already represent the largest average constituencies among the world's major democracies – several times the size of a U.S. congressional district or a U.K. constituency. Freezing the House at 543 while the population keeps growing means that burden only increases after delimitation, and the case for more representatives to improve accessibility is a real one. But it does not follow that the additional representatives must sit in Parliament. Most citizens approach elected representatives over roads, schools, hospitals, local services and State administration - matters substantially within the State sphere. If population growth has made constituencies unwieldy, strengthening representation at the State level is, therefore, a more sensible solution. More MLAs and smaller Assembly constituencies can bring representatives closer to citizens without continuously enlarging the national legislature.

That expansion faces none of the federal-arithmetic constraint that makes Lok Sabha expansion fraught. A larger Assembly shifts no balance between States – each answers only to its own population. Vidhan Sabhas can therefore grow to meet accessibility needs without disturbing the inter-State balance in Parliament that the 1976 freeze was designed to protect. Then comes women's reservation. One-third reservation for women is now being connected with delimitation, and enlargement of the Lok Sabha is presented partly as a way of accommodating women without disturbing existing political interests.

But women's representation should not become a constitutional justification for enlarging the House. One-third of the present Lok Sabha is approximately 181 seats. Women can receive their constitutionally promised representation within the existing House of 543. The purpose of reservation is to alter who occupies parliamentary seats, not necessarily to create hundreds of additional ones.

A 50% expansion could produce a curious result: the number of women MPs would rise, which is desirable, but so would the numerical dominance of the already larger States. A reform intended to correct one representational imbalance could deepen another. Women's representation and federal fairness are both legitimate constitutional objectives. India need not choose between them.

Preserve 543, undertake reforms

The solution is simple: retain the Lok Sabha at 543; preserve the present inter-State distribution of seats; undertake delimitation within States on updated population figures; implement women's reservation within that structure; and expand the Vidhan Sabhas to absorb the accessibility pressure that population growth has created.

For half a century, States have pursued demographic policies knowing that successful population stabilisation would not reduce their parliamentary influence. Southern States in particular invested heavily in education, health care and family welfare and achieved fertility levels that national policy itself encouraged. To reward that success with a larger political advantage for States where population grew faster would invert the incentive the Union deliberately created.

The question, therefore, is not whether population should matter. Of course it should. The question is whether it should now mechanically rearrange the federal political balance that India consciously preserved for five decades. Twice before, Parliament amended the constitutional framework to preserve the existing inter-State allocation despite population changes. There is no reason it cannot do so a third time. The uncertainty over whether Parliament may be recalled makes this more than an academic debate. Decisions taken now could shape the federal balance of the Republic for decades.

Delimitation is necessary. Women's representation is overdue. Updated constituency boundaries are desirable. But none of these objectives requires an 800-plus-member Lok Sabha.

Sometimes constitutional wisdom lies not in making institutions larger, but in preserving the balance that has allowed them to endure; 543 has served India for more than half a century. There is a strong constitutional, federal and democratic case for letting this number remain 543.

GS 2: INTERNATIONAL RELATIONS THE HINDU PAGE: 08

India's return to its Central Asian neighbourhood

Pankaj Saran

Former Deputy National Security Adviser, Ambassador and Convenor, NatStrat

Prime Minister Narendra Modi is set to travel to Central Asia in the next few days, the first port of call being a state visit to Uzbekistan, followed by participation in the meeting of Heads of State of the Shanghai Cooperation Organization (SCO) in the Kyrgyz capital, Bishkek, called Frunze in Soviet times. The change of names is not just symbolic. It represents the birth of a new region.

Central Asia is an evocative moniker. The region lies landlocked, situated between two giants, Russia and China. In most of its countries, the post 1991 generation has largely taken over, engaged in finding a new internal equilibrium. Islam is the main religion, but does not define identity and is therefore not a political project. The fight against radicalisation and terrorism is uncompromising. Occasional catastrophes such as the devastating Crocus City Hall terror attack in Moscow in 2024, China's constant fear of spread of radicalisation in the border regions and export of instability and extremist ideology from Afghanistan are everyday reminders of the challenges.

In Central Asia, there are a multitude of ethnicities, languages, geographies and resource endowments. These influence domestic and foreign policy choices, with Turkmenistan practising rigorous neutrality. Relations among countries are complicated by legacy disputes over borders, water resources and overlapping ethnicities. Türkiye and Iran are dominant influences, while the United States and the European Union are working their way in as Russia's hold weakens and China's grows.

Mr. Modi's 2015 visit to all five Central Asian countries was historic. It marked the end of an unstated Indian policy of deferring to Russia in its periphery – politely keeping away. In 2017, India was welcomed into the SCO as a full member by Russia, as Pakistan was, by China. To mark the 30 years of their independence/diplomatic ties, India made an unprecedented gesture of inviting all Central Asian leaders as chief guests for the Republic Day in 2022. The COVID-19 pandemic forced the event to be held only virtually, but not without it leading to the creation of high-level mechanisms for cooperation, including the India-Central Asia Dialogue.

The Prime Minister's visit is an opportunity for India to deepen its strategic presence, expand economic ties and strengthen its diplomatic influence

Beyond geography

If South Asia and West Asia, not to speak of East Asia and the Indian Ocean Region are India's neighbourhoods, Central Asia is no less. A lack of overland connectivity does not take away from the civilisational links India has with the region – in culture, religion, language and architecture. Geographically, India and Tajikistan are separated only by the narrow Wakhan corridor that lies in Afghanistan. India is part of the continuum that is the Eurasian landmass.

Pakistan, a historically new piece in the equation, seeks to usurp the historical lineage based on religious affinity. Its tactic to cut India off, physically and otherwise, from these historical connections, like its other India-centric gambits, is, as anecdotal evidence shows, doomed to failure. Yet, India must not allow this to succeed. Countries of the region are today looking beyond Russia and China for partners in their socio-economic development. India's lived experience as a plural, moderate and democratic society is admired not feared in the region.

It is against this background that Mr. Modi's decision to go back to the region must be welcomed. India should build upon the foundations to consolidate its rightful place in the region, whether in the economic, trade, defence, natural resources, technology spheres or in softer areas such as cultural, educational, health and tourism exchanges. The choice of a state visit to Uzbekistan is consistent with the steady improvement of relations under President Mirziyoyev since 2016. It is among the most dynamic countries of the region, and most forward in the diversification of its foreign policy. Any Indian visitor to Tashkent, Samarkand or Bukhara will vouch for the empathy and resonance between the two peoples.

There are also hardnosed reasons – Uzbekistan has been uncompromising in its fight against terrorism and extremism. Its intimate knowledge of Afghanistan, and pragmatic approach towards the Taliban, are of key importance to India. India has had detailed discussions with it on alternative rail and road connectivity routes through Iran and Afghanistan which need to be revisited in the light of recent developments in these countries.

India and the SCO

Starting from the small beginnings of the "Shanghai Five" in 1996, the SCO, in its 25th anniversary, has grown to 10 members, 15 dialogue partners and two observers. With the exception of 2024, Mr. Modi has been a regular participant in SCO Heads of States meetings. India's SCO engagement is driven by geography, not ideology. Within the SCO chambers, negotiating against a China-Pakistan dyad is demanding but essential. India has kept its head above the swamp by suggesting several ideas to enhance cooperation in the economic, technological and civilisational fields. In Tianjin last year, Mr. Modi put forward the vision of security, connectivity, and opportunity for the SCO. In the instant case, for a country as overwhelmingly dependent on China as Kyrgyzstan, the SCO, and India in particular, offers a valuable geopolitical lifeline.

Taken together with his visits to the Indian Ocean Region last month, Mr. Modi would have traversed far-flung corners of India's maritime and continental neighbourhood in quick succession reflecting India's geostrategic imperatives and opportunities.

GS 3: ECONOMICS AND ENERGY THE HINDU PAGE: 10

Can India build a strategic fuel system?

India's proposed strategic-fuel programme would expand crude, LNG and LPG storage, but building reserves alone will not guarantee energy security; the system will work only if India can move the fuel through ships, pipelines and distribution networks, while having clear rules on ownership, financing, and replenishment

EXPLAINER

Kalyan Mangalapalli

The story so far:

West Asia-related disruptions have exposed a vulnerability in India's energy-security system. India can import large quantities of crude oil, LNG and LPG, but its ability to store, transport and release these fuels during a prolonged disruption differs sharply by fuel. India already operates underground strategic crude-oil storage and two underground LPG caverns, but has no operating underground natural-gas storage facility.

Against this background, the government is considering a decade-long strategic-fuel programme that would add about 28 MT of crude-oil storage, 9 MT of LNG storage and 4 MT of LPG storage. Reuters reports that the proposed reserves are intended to provide nearly two months of crude and LNG demand and about six weeks of LPG demand. The programme remains under consideration and should therefore be treated as a proposed target, not committed capacity.

India already operates underground strategic crude-oil storage and two underground LPG caverns, but has no operating underground natural-gas storage facility. GETTY IMAGES

How much storage does India have today?

India's position varies considerably by fuel. For crude oil, Phase I of the Strategic Petroleum Reserve provides 5.33 MT of underground capacity, with actual storage of about 3.37 MT, or roughly 63-64% utilisation, across Visakhapatnam, Mangaluru and Padur. A further 6.5 MT has been approved under Phase II at Chandikhol and Padur.

However, execution on the Chandikhol project remains protracted amid ongoing land acquisition requirements and finalisation of commercial PPP frameworks.

LPG has a much smaller underground footprint. The Visakhapatnam and Mangaluru caverns together provide about 0.14 MT of capacity. A proposed 4 MT strategic reserve would therefore represent roughly a 30-fold increase in underground LPG capacity.

Natural gas presents the largest storage gap. India currently has no operational underground gas-storage facility. Its gas-security system instead depends on domestic production, LNG imports, import terminals, commercial inventories and pipelines.

These figures also highlight an important distinction between storage capacity and inventory. A facility has a physical capacity, but the fuel it holds can vary. Not all inventory is necessarily immediately accessible either. During a crisis, the critical measure is therefore not simply how many tonnes can be stored, but how much fuel is available and at what withdrawal rate it can reach consumers.

What does the proposed 9 MT of LNG storage mean?

LNG is particularly prone to confusion because India already has substantial LNG import and regasification infrastructure. A regasification terminal can receive LNG and convert it into natural gas, but its regasification capacity does not constitute strategic inventory.

LNG is stored as a cryogenic liquid at around -162°C, requiring specialised insulated tanks and boil-off gas management. Underground gas storage is different: LNG is first regasified and the resulting natural gas is injected into a depleted reservoir or cavern.

The PNGRB-ICF study provides a useful but narrowly defined stress test. Its 2030 scenario examined how much additional LNG infrastructure would be required to supply priority consumers for 20 days under stress conditions. It estimated a requirement of about 0.56-0.6 MT of LNG equivalent, achievable with roughly eight additional LNG tanks. The combined cost of the tanks and the associated strategic inventory was estimated at around $1 billion. This was a scenario-specific estimate, not an assessment of India's overall strategic LNG requirement.

The proposed 9 MT strategic inventory is an order of magnitude larger. Against the ICF projection of roughly 58 MT of annual LNG imports, 9 MT represents about 56 days of imports – hence the description of approximately two months of LNG import cover. It does not mean two months of India's total gas consumption.

The difference is important. A 0.6 MT requirement addresses a 20-day priority-sector stress scenario; 9 MT represents a much broader strategic objective of buffering India against prolonged LNG import disruption. The associated investment would therefore be substantially larger.

Does all the gas have to be stored as LNG?

No. India could eventually use a portfolio of surface LNG tanks and underground natural-gas storage.

Additional LNG tanks would hold inventory directly at import terminals. A separate proposal from the Ministry of Petroleum and Natural Gas would require LNG import terminals to maintain storage capacity 10% above their normal operating requirement, with the additional capacity available to the government during supply or price disruptions.

For longer-duration requirements, depleted oil and gas reservoirs, which account for 74% of global working gas volume, could provide much larger volumes of underground gas storage. Salt caverns offer different advantages: faster injection and withdrawal and the ability to cycle inventory more frequently, potentially making them useful for shorter-duration balancing.

But a depleted field cannot simply become a storage site because production has ended. Reservoir characteristics, cap-rock integrity, pressure behaviour, existing wells, cushion-gas requirements and pipeline connectivity must all be assessed. India's sedimentary basins – including Krishna, Godavari, Cambay, Mumbai Offshore and Rajasthan – offer potential locations, but moving from geological potential to usable storage requires subsurface investigation, site selection, engineering, construction, testing, filling and pipeline integration.

Salt caverns face a similar qualification process. Rajasthan's salt-bearing formations have been investigated for solution-mined caverns, but suitability depends on depth, thickness, purity, geometry, groundwater and mechanical properties.

Can India scale its crude and LPG experience?

Crude is the most mature component. India already operates underground crude caverns and has developed the associated engineering capabilities. The U.S. Strategic Petroleum Reserve illustrates the scale possible with salt caverns, with authorised capacity of 714 million barrels across 60 caverns. But the U.S. system works as an integrated network of caverns, pipelines, marine terminals and refineries. Storage is therefore fundamentally an infrastructure system, not simply an underground space.

LPG is technically proven in India but presents a much larger scaling challenge. A proposed 4 MT reserve would require a substantial network of new caverns or other storage facilities, together with import terminals, pipelines, pumping systems and bottling infrastructure.

The Mangaluru cavern illustrates the complexity. Underground construction requires geological and hydrogeological investigation, rock mechanics analysis and groundwater management, particularly where work takes place alongside operating surface facilities. Scaling the system would require sustained capabilities in geophysics, geomechanics, tunnelling, reservoir engineering and project execution.

What happens if the fuel cannot reach India?

Because energy security relies heavily on maritime logistics, including vulnerable chokepoints such as the Strait of Hormuz and long distance routes from the U.S., India is proactively diversifying both its import sources and shipping capabilities. To reduce reliance on foreign vessels, State-run oil refiners and the Shipping Corporation of India plan to invest $1.5 to $2 billion in a joint venture to acquire 59 ships. Simultaneously, Indian Oil is expanding sourcing through new 2027 agreements with Algeria and increased U.S. purchases, while exploring direct stakes in Very Large Gas Carriers to secure greater control over its supply chain.

What about pipelines?

Pipelines provide the final link between imported or stored fuel and inland consumers. PNGRB has recently authorised approximately 1,800 km of new LPG pipelines across six States, involving investment of around $0.7 billion. These pipelines improve connections between supply sources and inland markets and reduce dependence on road movement, but they do not themselves add strategic storage. Their value lies in improving deliverability.

The same principle applies to natural gas. Underground storage is useful only if it can inject into and withdraw from the gas grid at the required rate. LNG tanks are useful only when regasification and downstream pipelines can move the gas. LPG caverns require connections to bottling and distribution systems.

Who pays for the strategic reserves?

The reported $42 billion programme, which has yet to be confirmed by the government, combines infrastructure CAPEX with the cost of purchasing and maintaining strategic fuel inventories. Reuters reported that more than half could go towards storage infrastructure, with the balance used to purchase and fill the reserves. Financing would be a challenge and the government shot down reports that a cess would be charged to pay for the reserves.

The financial obligation does not end with construction. Billions of dollars of fuel would need to be purchased, financed and maintained. Stocks released during a crisis would then have to be replenished, potentially when commodity and freight prices are higher. The policy therefore needs to establish who owns and finances the inventory, minimum stock obligations, emergency-release authority, and who bears replenishment and price risk. A commercial-cum-strategic model could reduce the public burden, provided commercially used capacity remains available during emergencies.

Is storage enough to make India energy-secure?

Building 41 MT of combined storage is only part of the equation. A strategic reserve is effective only if India can seamlessly access fuel, transport it inland, and replenish stocks after a release.

Ultimately, energy security relies on an integrated framework: reserves buy time, shipping brings the next cargo, pipelines deliver fuel inland, and governance dictates emergency execution. The ultimate test of India's strategic fuel programme will be its ability to coordinate all these elements simultaneously when a crisis hits.

(The author is an Energy and Emerging Technologies expert)

THE GIST

- India's existing strategic storage differs sharply by fuel, with crude having the most developed system, LPG a limited underground footprint and natural gas no operational underground storage facility.
- The proposed 28 MT of crude, 9 MT of LNG and 4 MT of LPG reserves would represent a major expansion, but the LNG requirement should not be confused with existing regasification capacity or narrower 20-day stress scenarios.
- Geological suitability, infrastructure and project execution will determine how quickly storage can scale, while shipping and pipelines remain critical to ensuring fuel reaches consumers during prolonged disruptions.

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Nepal flash flood highlights growing glacier risks in warming Himalayas

Scientists are investigating whether a glacier collapse triggered the flood, as the rapidly warming Himalayas raise the disaster risk; the catastrophe, which killed 389 people and left over 900 missing, has renewed concerns over melting glaciers, unstable slopes and inadequate warning systems

NEWS ANALYSIS

Associated Press
BENGALURU

The deadly flash flood in Nepal on Wednesday was likely caused by a huge chunk of a glacier that broke off and temporarily dammed a river, according to preliminary investigations by scientists. That may have led to the backed-up water surging downstream with enormous force a few hours later, they suggested.

Scientists are still piecing together information from satellite and ground-level data to figure out exactly what happened to cause the flood, which killed at least 389 people and left more than 900 missing, including foreigners and pilgrims.

The U.S. Geological Survey on Wednesday reported a magnitude 5.2 glacier collapse that sent debris flowing downstream with catastrophic impact on communities. It said its determination was based on data from nearby seismic stations, long period seismic waves and satellite imagery.

"A lower part of a glacier has really come off," said Jakob Steiner, a geoscientist at the University of Graz in Austria who is currently based in Bangladesh. "If you look at the imagery it's like someone cut with a huge knife through the whole lower part and it fell off."

Mr. Steiner said a mass of glacial ice dropping from a great height could have felt like a bomb exploding, resulting in the chaos that followed.

Scientists said it is too early to draw a direct connection between global warming and Wednesday's catastrophe. However, they said that as Earth's temperature rises because of human activities such as burning oil, gas and coal, the chances of such disasters increase, especially in the Himalayan mountains, which are warming considerably faster than many other parts of the world.

"We have to be cautious and not draw a connection yet. However, rising temperatures are changing the Hindu Kush Himalaya region and melting glaciers," said Saswat Sanyal, a disaster risk reduction specialist at the Kathmandu-based climate research group International Centre for Integrated Mountain Development.

Hundreds have lost their homes across the Himalayan region, and officials reported large-scale damage to critical infrastructure, including hydropower dams, roads, buildings and bridges in the region. Water levels in rivers across the flood-affected region rose by as much as 9 metres (29.5 feet) in 30 minutes as a result of the surge from the glacial detachment upstream, researchers at the Kathmandu-based climate research group said. "It was a huge rise, a huge surge of water that happened suddenly," said Mr. Sanyal.

A drone view of the devastation following a flash flood in the Bhotekoshi River in Bangladesh, on Thursday. ANI

Preliminary evidence suggests a large volume of ice and rock may have plunged into the Lhende Khola, a tributary of the Bhotekoshi river. Researchers said the collapse could have displaced water and picked up loose sediment and boulders, producing a powerful surge downstream. Researchers are also examining whether debris temporarily dammed the river before the impounded water burst through, magnifying the flood.

New normal

Mr. Steiner said the area has a history of destructive mountain hazards. Floods originating from a glacial lake struck the same valley in 2025, while an ice and rock avalanche occurred elsewhere in the area in 2024. The broader Langtang region was also hit by devastating avalanches during Nepal's 2015 earthquake.

The Hindu Kush Himalaya is warming rapidly, driving major changes in glaciers, snow cover, permafrost and mountain slopes, according to climate scientists.

The mountains contain the largest volume of snow and ice outside the polar regions. More than 63,000 glaciers in the area feed at least 10 major Asian river systems and support the food, water, energy and livelihood security of billions of people. However, around 78% of the glacier area, located between 4,500 and 6,000 metres above sea level, is highly exposed to warming.

"What happened yesterday is unfortunately the new normal. It's going to get worse from here onwards," Mr. Steiner said.

The last decade was the hottest multi-year period globally since records began, and 2024 was the warmest year ever recorded. United Nations reports have found that between 2000 and 2019, glaciers lost 267 gigatons of ice per year, roughly equivalent to the mass of 46,500 Great Pyramids of Giza.

In a warming world, the reports project the loss of up to 50% of all glaciers – excluding those in Greenland and Antarctica – by 2100, even if global warming can be limited to 1.5 degrees Celsius (2.7 degrees Fahrenheit.)

Current global policies put Earth on a trajectory to warm by about 2.8 degrees Celsius (5 degrees Fahrenheit) above pre-industrial levels by the end of the century. Research by the Kathmandu-based group has found that glaciers across these mountains are melting at an accelerating rate, with ice-loss rates doubling since 2000.

Melting glaciers can feed and enlarge glacial lakes, increasing the potential for sudden floods.

As glaciers retreat, mountain rock that was previously insulated and supported by ice becomes exposed to warmer temperatures, rain and repeated freezing and thawing. Permafrost – ground that has remained frozen for years – can also thaw, weakening rock faces and slopes. "The chances that material starts to move down from mountains increase," Mr. Steiner said.

A Himalayan task

Mr. Sanyal said that may be the kind of cascading hazard behind what happened Wednesday in Nepal – an avalanche or glacier collapse that turns into a debris flow, river blockage and devastating flash flood.

Mr. Steiner said about 10% of Nepal's power production was located in the valley affected by the latest disaster. He said the repeated losses raise questions about whether enough has been done to install warning systems for residents and visitors alike after previous floods and avalanches.

The country's landscape has long been a draw for tourists, with more than a million people visiting the country annually in recent years.

Scientists say stronger early warning systems, better monitoring and faster cross-border information sharing will be increasingly important as temperatures rise and mountain landscapes become less stable.

But monitoring thousands of glaciers, steep slopes and river valleys across the Himalayan arc is extremely difficult.

GS 2: INTERNATIONAL RELATIONS

INDIAN EXPRESS PAGE: 12

• DIPLOMACY

India-China boundary talks: Some progress, but a long road ahead

EXPERT EXPLAINS

SUJAN CHINOY

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THE EIGHT-POINT consensus reached at the 25th round of talks between Special Representatives (SRs) Ajit Doval and his Chinese counterpart Wang Yi in Beijing is a welcome step ahead of the expected visit of President Xi Jinping to India for the BRICS Summit.

Some of the outcomes concern the maintenance of peace and tranquility in the border areas, and advancing negotiations on a framework for the settlement of the boundary question in accordance with previous agreements. There is a specific reference to advancing discussions through an Expert Group and Working Group respectively, to explore an "early harvest" of boundary delimitation in appropriate sectors, and effective border management.

Last year, there was agreement in principle on working towards setting up additional General-Level Mechanisms/Senior Highest Military Commander (SHMC) meetings in the Eastern and Middle sectors akin to the existing mechanism in the Western sector at Chushul/Moldo.

This time, the two sides agreed to implement that understanding along with establishing two hotlines in the Eastern and Middle Sectors. Going forward, the implementation will have to be handled carefully.

The past as prologue

In 1992, the Joint Working Group (JWG) on the Boundary Question decided on confidence building measures (CBMs) such as border personnel meetings (BPMs), complementing forward movement on border trade.

A sub-group of the JWG was created following the border peace and tranquillity agreement (BPTA) of 1993 — the India-China Expert Group of Diplomatic and Military Officials (EG), a precursor to the Working Mechanism for Consultation and Coordination on India-China Border Affairs (WMCC), an institutional mechanism for border management set up in 2012.

After the success achieved in 1995 on disengagement at Sumdorong Chu (along the India-China Line of Actual Control in Arunachal Pradesh), Lipulekh (Middle Sector) and Dichu (Eastern Sector) were subsequently identified as additional military meeting points. The plan for BPMs at Lipulekh was abandoned due to lack of infrastructure and adverse weather conditions. A trial meeting at Dichu in the Kibithu sector in Arunachal Pradesh was finalised. Dichu is a sensitive area in Anjaw district, and the site of a famous battle in 1962 at Hill 100, in which the Kumaon Regiment did the Indian Army proud. The site chosen for the BPM on Madan Ridge proved contentious. No further meetings could take place.

It was not until 2014 that the proposal for additional points for BPMs was revived. Eventually, it was decided to have regular BPMs at Wacha/Kibithu in the same sector opposite Damai on the Chinese side, in addition to existing venues across Bum La in Arunachal Pradesh and Nathu La in Sikkim.

Together with BPMs across the Lungnak Lungpa stream at Daulat Beg Oldie (DBO) and Tianwendian (TWD) in the Chip Chap valley, and at the Chushul–Moldo meeting point in the Spanggur Gap, these have contributed to the two militaries maintaining direct contact.

Additional meetings would further the cause of peace.

Existing hotlines at DBO and Chushul, some informal communication at Demchok in the Western Sector, and similar hotlines at Nathu La (Sikkim) and Bum La and Kibithu in the Eastern Sector have provided the two militaries with channels for direct contact. The two additional hotline channels agreed to for the Eastern and Middle sectors could strengthen this capacity and help defuse local tensions.

NSA Ajit Doval and Chinese Foreign Minister Wang Yi at the 25th Meeting of Special Representatives in Beijing on Tuesday. ANI

• The LAC's sectors

THE LINE OF ACTUAL CONTROL separates Indian-controlled territory from Chinese-controlled territory.

IT IS DIVIDED INTO into three sectors: the Eastern Sector (Arunachal Pradesh and Sikkim), Middle Sector (Uttarakhand and Himachal Pradesh) and Western Sector (Ladakh).

The road ahead

The SRs are working to realise the consensus reached between Prime Minister Narendra Modi and President Xi at Kazan in October 2024 and at Tianjin in August 2025 on improving ties.

Recent developments such as the resumption of the Kailash Mansarovar Yatra, direct flights, and border trade are meaningful steps in the right direction.

However, the road ahead, especially on the task of "early and substantial harvest of boundary delimitation and border management" may be long and arduous, requiring patient negotiations. It would be premature to suggest that substantive boundary delimitation has already begun in earnest. After all, the Expert Group and Working Group under the WMCC are now explicitly tasked with finalising their respective Terms of Reference. That means the framework is being created and the process is being activated incrementally.

There is also the issue of making piecemeal progress as against a more holistic settlement of differences along the Line of Actual Control. Neither the Sikkim sub-sector nor the Middle Sector are free from the burden of differences. The negotiators must be empowered to engage in meaningful discussions. They must have sufficient experience in handling a matter that has proved vexatious for previous generations.

If taken in the right direction, the guidance provided by the political leadership can lead to lasting peace and offer a window for substantive cooperation between two large and populous neighbours in an era of global flux.

(The author was head of the Indian side in the Expert Group of Diplomatic and Military Officials negotiating with China between 1996 and 2000)