

Viewpoint

Young adult immunization initiative (YUVA/YAII): A policy framework for India's life-course vaccination strategy

India's Universal Immunization Program (UIP) has achieved success in childhood vaccination, yet millions of young adults remain outside its protective reach. They remain largely unprotected against infections such as human papillomavirus (HPV), hepatitis B (HBV), and hepatitis A (HAV) among other vaccine-preventable diseases¹. This gap is critical, as young adulthood (18-35 yr) is a period of both opportunity and vulnerability, when sexual debut, migration, and substance-use risks often converge². Despite effective vaccines, coverage in this age group remains negligible. Beyond HPV, HBV, and HAV, young adults also face risks from measles, varicella, influenza, typhoid, and Japanese encephalitis.

Despite the success of India's Universal Immunization Programme (UIP) in reducing childhood morbidity and mortality, a persistent blind spot remains: as children transition into adolescence, many fall off the immunization radar³. This gap is most evident for young adults - critical to India's demographic dividend but excluded from both the UIP and the Adolescent Health Program (RKSK). Defined here as ages 18-35 yr (adaptable to 39 for pilot initiatives), this vaccination group remains largely unprotected: HPV vaccination coverage is below one per cent⁴ and HBV under five per cent⁵ nationally, leaving preventable cancers and liver disease unaddressed and perpetuating inequities in sexual and reproductive health and slowing progress toward Sustainable Development Goal (SDG) 3.3⁶.

Young adulthood is marked by workforce entry, mobility, and family formation, but also heightened exposure to infections, migration, and substance-use risks. Leaving this group unprotected risks reversing gains in communicable disease control and exposes a major gap in national health priorities.

International usage distinguishes adolescents (10-19) and youth (10-24), while India's National Youth Policy defines youth as 15-29 yr. We propose an operational age band of 18-35 yr, reflecting the window

where HPV, HBV catch-up and HAV prevention, offer maximum benefit. Older adults require a different portfolio (influenza, pneumococcal, zoster), addressed under API guidelines⁷ and programmes such as National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke (NPCDCS) (≥ 30 yr) and National Programme for the Health Care of the Elderly (NPHCE) (≥ 60 yr). This approach aligns with WHO's Immunization Agenda 2030⁸ while allowing for national tailoring.

The epidemiological case for young adult immunization: HPV prevalence among women aged 18-25 yr reached 19 per cent, with over 65 per cent carrying high-risk types such as HPV 16 in a 2012 survey of tribal women.⁶ Urban studies report prevalence around 13 per cent in women aged 16-26 yr, and acquisition rates remain high among sexually active young women^{9,10}. Cervical cancer caused ~77,000 deaths annually in the year and contributed to anal, penile, and oropharyngeal cancers in men¹¹. The disease burden exceeds 1.5 million disability-adjusted life years (DALYs) annually as of year 2025, with 10 per cent of cases diagnosed under the age of 35 yr, underscoring early infection risk and the need for timely prevention¹².

HBV also imposes a significant burden. India harbours an estimated 37-40 million carriers¹¹ and studies show high HBsAg prevalence in the 21-40 yr age group¹³. Despite routine childhood vaccination, coverage gaps persist - only 22.7 per cent of surveyed adults reportedly completing the HBV series, leaving young adults vulnerable to acute infection and long-term complications such as cirrhosis and liver cancer¹⁴. Low awareness and incomplete coverage heighten HBV risk, with liver disease costing India tens of billions annually in treatment and lost productivity¹⁵.

Hepatitis A virus (HAV), once a childhood infection, now increasingly affects adolescents and young adults, causing more severe illness and economic disruption¹⁶.

HPV, HBV, and HAV remain key burdens, while outbreaks of measles, varicella, influenza, typhoid, and JE underscore the need for a bundled approach. These preventable infections drive cancer, liver disease, and acute hepatitis in India's most productive age group, making young adult immunization a public health and economic priority.

Social and economic rationale: India's demographic dividend depends on young adults, whose health is vital for sustaining productivity and resilience. Cervical cancer treatment costs reportedly range from INR 19,494 to INR 41,388 per patient, with catastrophic health expenditure affecting over 60 per cent of households as of yr 2020¹⁷, while HBV-related liver disease imposes a substantial national economic burden. Cost-effectiveness modeling from Tamil Nadu demonstrates that early HBV diagnosis and vaccination can save approximately INR 180,000 per 1,000 population and gain 505 quality-adjusted life years (QALYs)¹⁸ as of yr 2020. Preventing HPV-related cancers and hepatitis-driven liver disease can avert catastrophic costs, safeguard earning potential, and ease long-term pressure on insurance systems. Chronic illness also drives productivity losses: 6.9 per cent of adults aged 45-64 report completely stopping work, while 22.7 per cent report limiting paid work due to health problems¹⁹ as of yr 2017-2018, underscoring the economic imperative for preventive immunization.

Adult immunization is concentrated in private urban markets, rationed by ability to pay, leaving rural and marginalised groups excluded. Expanding publicly financed, accessible vaccination for young adults is both an equity obligation and an economic efficiency measure that aligns household welfare with national growth.

Policy gaps and missed opportunities: India lacks a coherent framework for young adult immunization; programmes end at adolescence with no mechanism to provide catch-up or vaccines relevant to sexually active and mobile populations. The 2024 Routine Immunization Manual (MoHFW) focuses on childhood immunization and provides no framework for adults²⁰. Previously published reports, noting the policy vacuum, have called for a structured approach to adult immunization^{7,21}.

Western models highlight contrasts: the UK achieves high HPV coverage through school programmes at ages 12-13 yr²², while the USA enforces college-entry vaccine mandates and workplace flu campaigns²³, relying on compliance and insurance incentives absent in India. School-based delivery is impractical for India's

18-35 yr age group due to high dropout rates (14% at secondary, retention to higher secondary ~45%)²⁴, low tertiary enrolment (GER ~28%)²⁵, and youth mobility (migration rate ~29%, ~5% employment-related)²⁶. Instead, feasible platforms include colleges, workplaces, PHCs, and harm-reduction hubs, supported by Covid Vaccine Intelligence Network (CoWIN) and *Ayushman Bharat* Digital Mission (ABDM) for portability and equity dashboards. Rather than replicating Western mandates, India can adapt their intent - routine access and cohort reach, through opt-in consent, public financing, and interoperable registries.

Regulatory and ethical considerations are critical in these settings. Informed consent must be voluntary, informed, and documented, with disclosure of benefits, risks, and alternatives. Digital platforms can operationalize consent management through secure, opt-in mechanisms, ensuring privacy and compliance with India's Health Data Management Policy. These safeguards are essential to maintain trust and uphold ethical standards.

Stigma and misinformation deepen these gaps: HPV is miscast as a "girls' vaccine," and hepatitis vaccines are poorly understood. Overcoming these barriers is vital for equitable uptake and a stronger young adult immunization framework. This paper envisions a mission-driven policy framework for the young adult populations of India (Box).

Integration with Harm Reduction

A distinctive feature of YUVA is its integration with harm-reduction services. According to the 2019 'Magnitude of Substance Use in India' report, ~2.8 per cent of Indians aged 10-75 yr were cannabis users while 2.1 per cent used opioids and an estimated 850,000 people were injecting drug users (PWIDs)²⁷. NACO through NACP-V (2021-2026)²⁸, designates NSPs and OST as core prevention services for PWIDs. Operational guidelines for bridging populations²⁹ and the Link Worker Scheme 2.0³⁰ emphasize community-based outreach and referral pathways, creating a strong foundation for embedding vaccination within these hubs.

Financing and affordability

The economic burden of HPV-related cancers, hepatitis-driven liver disease, and STI complications far exceeds prevention costs, positioning immunization as an investment. YUVA is feasible due to low-cost indigenous vaccines, minimal marginal costs through existing infrastructure, and blended financing *via*

Box. YUVA/YAII: A framework for young adult immunization

The Young Adult Immunization Initiative (YAII), branded as YUVA (*Yuva Unmukh Vaccine Abhiyan*), is proposed as a mission-mode framework to address immunization attrition beyond childhood in India.

YUVA is anchored in a tiered vaccine bundle (ages 18-35 yr):

- Tier 1 (universal): gender-neutral HPV catch-up, Hepatitis B completion or catch-up, and Td/Tdap (one-time Tdap followed by decennial boosters);
- Tier 2 (catch-up if non-immune): MMR, Varicella, and Influenza (annual for high-risk groups); and
- Tier 3 (indication-based): Hepatitis A, Meningococcal, Pneumococcal, and context-specific vaccines including Typhoid, Japanese Encephalitis, Rabies (pre-exposure), and COVID-19 boosters, aligned with national guidance.

Delivery leverages existing platforms such as colleges, workplaces, community health centres, and harm-reduction sites under the National AIDS Control Organization, avoiding parallel systems. A proposed *SANKALP* digital registry, linked to CoWIN and the *Ayushman Bharat* Digital Mission, enables record portability and equity monitoring. Messaging normalizes vaccination as routine adult health care, frames vaccines as empowerment tools, ensures gender neutrality, and amplifies youth voices. Implementation follows a *phased pathway* from district pilots to State-level scale-up and national integration under the National Health Mission (Supplementary Table).

NHM, CSR, and philanthropy, aligning with SDG 17's shared-responsibility framework.

Risks and mitigation

YUVA faces predictable challenges, including HPV vaccine hesitancy if framed as gender-specific, mitigated through gender-neutral messaging, youth-led campaigns, and routine adult health delivery. Supply and logistics risks including cold-chain gaps beyond paediatric systems are addressed through phased rollout and indigenous production. Digital exclusion is mitigated *via* dual paper-digital records. Political contestation and programme fatigue are reduced by aligning YUVA with national missions, piloting through state programmes, integrating delivery into colleges, workplaces, and harm-reduction clinics, and sustaining transparency through external evaluations and public dashboards.

Overall, young adult immunization is a critical but overlooked component of India's life-course vaccination strategy. The YUVA framework offers a pathway to close this gap by leveraging existing infrastructure, digital platforms, and youth-centred

delivery points. The benefits are clear: protecting young adults against HPV-related cancers, hepatitis-driven liver disease, and other vaccine-preventable infections can reduce catastrophic health costs and strengthen workforce productivity. Pilot implementation in two to three states, supported by cost-effectiveness modelling and stakeholder consultation, is essential for policy translation. Investing in young adult immunisation is a strategic choice for equity, economic resilience, and future vaccine preparedness. YUVA represents India's first integrated immunization platform for young adults. Implemented effectively, it can protect the demographic dividend and strengthen public health resilience over the coming decades.

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Laxit K. Bhatt

Department of Pharmacology and Toxicology, Zydus Research Centre, Moraiya, Sarkhej-Bavla NH 8A, Ahmedabad 382 213, India

laxitk.bhatt@zyduslife.com; bkltox@gmail.com

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