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Editorial

# Beyond borders: Unleashing the potential of adult BCG vaccination for global public health

**Sankalp Yadav[1]***

[1]*Dept. of Medicine, Shri Madan Lal Khurana Chest Clinic, Moti Nagar, MCD,, New Delhi, India*

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In the realm of public health, vaccination has been a cornerstone in preventing and controlling infectious diseases.[1] While childhood vaccinations are widely acknowledged and implemented, there is a significant gap when it comes to adult immunization.[2] One such vaccine that has traditionally been associated with childhood is the Bacillus Calmette-Guérin (BCG) vaccine, primarily known for its role in protecting against tuberculosis.[3] However, the focus on BCG vaccination has predominantly centered around infants, overshadowing its potential benefits for adults. In this editorial, the importance of adult BCG vaccination and the argument for a paradigm shift in public health strategies to include and prioritize this intervention in adults are explored.

The BCG vaccine, developed in the early $20^{th}$ century, has long been a key player in the global effort to combat tuberculosis.[4] Initially intended for infants and children, the vaccine has proven effective in reducing the severity of tuberculosis and preventing severe forms of the disease, such as miliary and meningeal tuberculosis.[5] It is compulsory in 64 countries and recommended in others.[6] Over the years, numerous studies have indicated that BCG may offer broader protection beyond tuberculosis, including against respiratory infections and certain non-specific immune responses.[7] Despite these findings, adult BCG vaccination has received limited attention in the public health discourse.

Tuberculosis remains a global health challenge, with millions of new cases reported each year.[8] The conventional approach to tuberculosis control involves early detection and treatment of active cases, coupled with preventive measures such as BCG vaccination in childhood. However, the efficacy of this vaccine, i.e., the immunity developed, is widely reported to wane with age. A few recent research studies suggest that revaccinating adults with BCG could confer additional benefits. Studies have demonstrated that adult BCG vaccination can enhance the immune system's ability to respond to a variety of infections, providing a broader spectrum of protection beyond tuberculosis. Ahmed et al. reported that BCG revaccination in adults enhanced pro-inflammatory markers of trained immunity along with anti-inflammatory pathways.[9]

BCG is known for its immunomodulatory effects, influencing the innate and adaptive arms of the immune system. This modulation is not limited to specific pathogens but extends to a more generalized enhancement of the immune response. By stimulating the production of various cytokines and activating immune cells, BCG creates a heightened state of alertness within the immune system. This enhanced immune readiness has been associated with a reduction in the incidence and severity of infections, including those caused by viruses and bacteria unrelated to *Mycobacterium tuberculosis*.[10]

* *Corresponding author*.
*E-mail address*: drsankalpyadav@gmail.com (S. Yadav).

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In the era of emerging respiratory infections and pandemics, the need for interventions that bolster respiratory immunity is more pronounced than ever. Adult BCG vaccination has shown promise in conferring protection against respiratory infections, including influenza and other viral respiratory illnesses. The vaccine's ability to induce a trained immune response, a phenomenon where the immune system 'remembers' previous encounters and responds more robustly to subsequent challenges, makes it a valuable tool in the fight against infectious diseases.[11]

The term 'non-specific effects' refers to the vaccine's ability to provide protection beyond its intended target. Adult BCG vaccination has been associated with a reduction in overall mortality, even in populations where tuberculosis is not prevalent. This non-specific protection is particularly relevant in regions with high burdens of infectious diseases, as it contributes to a general improvement in health outcomes.[12]

The inclusion of adult BCG vaccination in public health programs carries several implications. First and foremost is the potential to reduce the burden of infectious diseases, both respiratory and non-respiratory, at the population level. This not only has direct benefits for individuals but also alleviates the strain on healthcare systems grappling with the challenges posed by infectious outbreaks.

Furthermore, the economic impact of preventing infectious diseases cannot be understated. Vaccination programs, when effectively implemented, result in decreased healthcare expenditures associated with the treatment of infectious diseases and the indirect costs related to productivity losses.[13] Adult BCG vaccination, by reducing the incidence and severity of a range of infections, can contribute to the overall economic well-being of communities and nations.

While the potential benefits of adult BCG vaccination are compelling, several challenges and considerations need to be addressed. One key challenge is the variability in vaccine efficacy across different populations. Genetic, environmental, and socio-economic factors can influence the vaccine's effectiveness, emphasizing the importance of tailored approaches in implementation.[14]

Ethical considerations surrounding the prioritization of resources also come into play. As with any public health intervention, decisions regarding vaccine distribution and administration must be equitable and grounded in principles of justice.[15] Balancing the benefits of adult BCG vaccination with other pressing healthcare needs requires careful planning and resource allocation.

In conclusion, adult BCG vaccination represents a promising avenue for enhancing public health outcomes. Beyond its established role in preventing tuberculosis, BCG has the potential to provide broad-spectrum protection against a range of infectious diseases. As the world grapples with the ongoing challenges posed by infectious outbreaks, a paradigm shift in public health strategies is warranted. By recognizing and prioritizing adult BCG vaccination, we can empower individuals, strengthen community resilience, and move closer to a future where preventable infectious diseases are relegated to the pages of history. It is time to embrace the full potential of the BCG vaccine and harness its non-specific effects for the greater good of global public health.

## Conflicts of Interest

None declared.

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