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Vaccine Hesitancy: Determinants, Public Health Consequences and Strategies for Rebuilding Confidence

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Abstract: Vaccine hesitancy refers to delay in acceptance or refusal of vaccination despite the availability of vaccination services. It exists on a continuum between complete acceptance and complete refusal and is influenced by vaccine confidence, perceived disease risk, social norms, practical constraints and trust in health systems. Hesitancy is vaccine-specific, population-specific and responsive to changes in disease epidemiology, political discourse, media coverage and personal experience. It should therefore not be treated as a fixed personality trait or equated automatically with non-vaccination. Globally, routine immunization has prevented millions of deaths, yet 13.5 million children remained completely unvaccinated in 2025, and many more started but did not complete recommended schedules. Access barriers, conflict and service disruption account for a large share of under-vaccination, but misinformation, distrust and weakening vaccine confidence increasingly complicate programme recovery. Evidence indicates that no single communication message reliably resolves hesitancy. Effective strategies combine convenient and reliable services, strong healthcare-provider recommendations, community engagement, reminders, transparent risk communication and interventions tailored to locally measured behavioural and social drivers. In India, vaccination coverage has improved through the Universal Immunization Programme and Mission Indradhanush, but migrant populations, urban informal settlements, remote communities and socially disadvantaged groups remain vulnerable to missed doses. Recent Indian research highlights the importance of interpersonal communication, supportive social norms and confidence in vaccine safety and effectiveness. Future policy should institutionalize vaccine-confidence monitoring, strengthen adverse-event communication, improve digital and community-based outreach and evaluate actual vaccine uptake rather than intention alone.

Keywords: vaccine hesitancy; vaccine confidence; immunization; misinformation; behavioural science; India

INTRODUCTION

Vaccination is among the most effective public health interventions, preventing an estimated 3.5–5 million deaths each year from diseases including diphtheria, tetanus, pertussis, influenza and measles.[1,2] Its success, however, depends not only on vaccine availability and biological efficacy but also on acceptance, accessibility and completion of recommended schedules.

The World Health Organization's Strategic Advisory Group of Experts defined vaccine hesitancy as a delay in acceptance or refusal of vaccination despite the availability of vaccination services.[3] This definition places hesitancy between full acceptance and outright refusal. A hesitant individual may accept some vaccines, delay others, seek repeated reassurance or vaccinate despite substantial concern.

Vaccine hesitancy should be distinguished from **under-vaccination**. A child may remain unvaccinated because services are distant, sessions are cancelled, vaccines are unavailable or caregivers cannot leave

work. Conversely, a person may express doubts but still receive vaccination. Conflating practical barriers with psychological resistance can lead to ineffective and stigmatizing interventions.
The concept is also context-specific. A person may accept long-established childhood vaccines but hesitate about a newly introduced vaccine. Confidence may change after an outbreak, an adverse-event report, a political controversy or a trusted clinician's recommendation. The central public health challenge is therefore to understand why vaccination is delayed in a particular population, for a particular vaccine, at a particular time.

Conceptual Frameworks
Early frameworks emphasized confidence, complacency and convenience. Confidence concerns trust in vaccine safety and effectiveness, the health professionals delivering vaccination and the institutions authorizing it. Complacency arises when the perceived risk of the disease is low. Convenience includes availability, affordability, geographical access and the ability to understand and navigate services.
More recent frameworks have expanded these concepts. The five-C model includes confidence, complacency, constraints, calculation and collective responsibility. "Calculation" describes extensive information searching and individual weighing of risks and benefits, while collective responsibility reflects willingness to vaccinate partly to protect others.
WHO's Behavioural and Social Drivers of Vaccination framework organizes determinants into four domains: **thinking and feeling**, **social processes**, **motivation** and **practical issues**.[4] Thinking and feeling includes perceived disease risk, confidence in vaccine benefits and safety concerns. Social processes include recommendations, norms, rumours and trust. Motivation reflects intention or willingness, while practical issues determine whether motivation becomes actual uptake. This framework is valuable because it prevents programmes from assuming that every missed dose is caused by misinformation.

Determinants of Vaccine Hesitancy

Confidence and institutional trust
Confidence is shaped by perceptions of vaccine effectiveness, safety, necessity and the trustworthiness of institutions. Trust is relational rather than purely informational. Communities assess whether authorities communicate honestly, acknowledge uncertainty, investigate adverse events and treat people respectfully.
Historical experiences influence current decisions. Discriminatory healthcare, coercive population policies, poor-quality services and lack of accountability may create distrust that persists across generations. Repeating scientific facts without addressing these experiences is unlikely to restore confidence.
Healthcare workers remain among the most influential sources of vaccine information. A clear, respectful recommendation from a trusted clinician can increase uptake. Conversely, dismissive communication or visible uncertainty among health professionals can reinforce doubts.

Perceived safety and adverse events
Safety concerns are among the most frequently reported reasons for hesitancy. Vaccines, like other medical interventions, can cause adverse effects, most of which are mild and transient. Rare serious events require robust surveillance and transparent investigation.
Risk communication becomes difficult because vaccine-associated risks are often highly visible while the diseases prevented by successful vaccination become less familiar. When disease incidence declines, the risk of vaccination may appear more immediate than the risk of infection.
Authorities should distinguish events occurring **after** vaccination from events caused **by** vaccination. Premature reassurance can be as damaging as exaggerated alarm. Communication should explain what is known, what remains uncertain, how causality is assessed and what support is available to affected individuals.

Complacency and declining disease visibility
Vaccination programmes can become victims of their own success. Younger parents and even health professionals may have little direct experience of polio, diphtheria or severe measles. When disease is perceived as rare or mild, motivation declines.

Outbreaks may temporarily increase acceptance, but relying on outbreaks to correct complacency is ethically unacceptable. Communication should retain the public memory of disease without using fear or exaggeration.

Misinformation and the digital information environment

False or misleading claims can spread rapidly through social media, video platforms and private messaging groups. Emotional personal stories often travel more easily than statistical explanations. Algorithms that prioritize engagement may amplify controversial or alarming content.

Not every unanswered question should be labelled misinformation. Questions about safety, eligibility, fertility, pregnancy or dosing may reflect legitimate uncertainty. Treating concerned individuals as irrational can drive them towards less reliable sources.

"Debunking" after misinformation has spread has limited reach. **Prebunking**, media literacy and rapid filling of information voids may be more effective. Public health agencies need continuous social listening to identify emerging concerns before they become established narratives.

Social norms and interpersonal influence

Vaccination decisions are embedded in families, peer groups, workplaces, religious communities and neighbourhoods. Individuals often use the behaviour of trusted others as evidence of safety and social acceptance.

A 2024 study involving 2,058 caregivers in six informal settlements in Varanasi found that vaccine confidence, interpersonal communication and descriptive social norms were strongly associated with vaccination intentions.[5] The findings suggest that trusted conversations and visible community acceptance may be more influential than impersonal mass messaging.

Practical constraints

Distance, transport, wage loss, inconvenient session timing, long waiting periods, incomplete records, stock-outs and disrespectful treatment can all reduce uptake. These barriers may be misclassified as hesitancy when caregivers are willing but unable to complete vaccination.

Practical failure can subsequently reduce confidence. A caregiver who repeatedly attends a cancelled session may begin to question whether vaccination is truly important to the health system. Service quality and confidence are therefore interdependent.

Global Trends and Public Health Consequences

Global vaccine confidence varies across countries and over time. A major analysis of 290 surveys from 149 countries showed substantial temporal and geographical changes in perceptions of vaccine safety, importance and effectiveness. Confidence in the importance of vaccines was particularly associated with uptake.[6] These findings show why periodic monitoring is preferable to assuming stable national attitudes.

The latest WHO–UNICEF estimates indicate that 90% of infants received at least one dose of a diphtheria–tetanus–pertussis-containing vaccine in 2025, while 85% completed the three-dose series. Nevertheless, 13.5 million children remained zero-dose.[1] These children are concentrated in communities affected by poverty, conflict, displacement, weak primary healthcare and marginalization. Hesitancy contributes to some gaps, but access and health-system fragility remain major causes.

The public health consequences include outbreaks of measles, diphtheria, pertussis and other preventable diseases; increased treatment expenditure; avoidable disability and mortality; and loss of community protection for infants and immunocompromised people.

Vaccine hesitancy can also affect health-system trust more broadly. Controversies involving one vaccine may spill over into routine childhood immunization, maternal vaccination and future emergency responses.

Evidence on Interventions

No single intervention is effective across all populations. Strategies work best when selected after identifying the dominant local barrier.

A 2022 systematic review of strategies to overcome vaccine hesitancy found that multicomponent, dialogue-based and community-engaged approaches were generally more promising than passive

Table 1. Vaccine-hesitancy determinants and evidence-informed responses

Domain	Typical manifestation	Common programme error	Evidence-informed response	Suggested indicator
Confidence	Concern about safety, effectiveness or institutional motives	Repeating generic facts without addressing the specific concern	Transparent dialogue, trusted healthcare-provider recommendation and adverse-event communication	Proportion reporting confidence in vaccine safety and benefit
Complacency	Belief that disease is rare, mild or personally irrelevant	Using exaggerated fear-based messaging	Communicate realistic disease risk and consequences using locally relevant evidence	Perceived disease susceptibility and severity
Social norms	Family, peer or community opposition or uncertainty	Treating decisions as purely individual	Engage trusted community figures, parents and vaccinated peers	Perceived proportion of trusted others supporting vaccination
Information environment	Rumours, misleading videos and conspiracy narratives	Responding only after content becomes widespread	Social listening, rapid response, prebunking and media literacy	Time from emerging concern to authoritative response
Healthcare-provider factors	Weak, hesitant or inconsistent recommendation	Assuming technical knowledge guarantees communication skill	Train providers in presumptive recommendation, listening and risk communication	Proportion receiving a clear provider recommendation
Practical constraints	Distance, wage loss, cancelled sessions and stock-outs	Labelling missed appointments as refusal	Extended hours, mobile sessions, reliable supply, reminders and outreach	Missed opportunities and session-cancellation rates
Previous adverse experience	Fever, pain or perceived injury after a prior dose	Dismissing symptoms as irrelevant	Acknowledge the experience, assess clinically and provide anticipatory guidance	Proportion receiving counselling after adverse events
Marginalization and distrust	Greater hesitancy among migrant, minority or historically excluded groups	One-way messaging without participation	Co-design services and communication with affected communities	Coverage gap between disadvantaged and reference populations
Vaccine-specific uncertainty	Acceptance of routine vaccines but concern about a new vaccine	Assuming attitudes transfer across vaccines	Conduct vaccine-specific assessment and communication	Acceptance and uptake by vaccine
Motivation–behaviour gap	Positive intention but failure to vaccinate	Measuring intention as programme success	Use reminders, appointments, transport and convenient delivery	Verified vaccination uptake

information alone.[7] Interventions included reminders, educational initiatives, healthcare-worker communication and community participation, but the diversity of study designs limited certainty.

A 2025 meta-analysis of randomized studies of COVID-19 vaccine communication found that educational and information interventions increased actual uptake by approximately 23%, while social-norm strategies increased uptake by approximately 28% compared with no intervention. Effects on self-reported intention and confidence were smaller or inconsistent.[8] This difference is important: intervention studies should prioritize verified vaccination rather than changes in stated willingness.

Personalized reminders can reduce forgetfulness and practical barriers but will not resolve deep mistrust. Community dialogue can improve understanding but may fail if vaccines are unavailable. Financial or non-financial incentives may increase uptake in some settings, yet they can raise ethical concerns or reinforce suspicion if communities believe authorities are "paying people to take a dangerous product."

Mandates can achieve high coverage where legal authority and public trust are strong, but they may produce resistance, inequity or exclusion when exemptions, access and compensation are poorly designed. Mandates should therefore be proportionate, legally justified and accompanied by accessible vaccination and transparent accountability.

Public Health Significance

Vaccine hesitancy is not simply a problem of individual ignorance. It is a property of relationships among people, vaccines, institutions, information systems and service environments. A technically accurate vaccine programme can still fail when communities experience disrespect, exclusion or inconsistent access.

The issue also has an equity dimension. Affluent groups may delay vaccination because of ideological beliefs or online misinformation, while poor or migrant households may appear hesitant because of transport, work and documentation barriers. Using a single national message for both groups is unlikely to succeed.

Primary healthcare is central to sustained confidence. Trust is built through repeated respectful encounters, reliable services, accurate records and visible response to concerns—not only through campaigns during outbreaks.

Indian Perspective

India's Universal Immunization Programme is among the largest in the world. Mission Indradhanush and its intensified rounds have sought to identify zero-dose and partially immunized children, particularly in low-coverage districts, urban slums, remote settlements and migrant communities.

India's overall progress conceals substantial geographical and socioeconomic inequalities. Urban averages can be misleading because children living in informal settlements may have poorer access than more affluent urban populations. Migration, absence of documentation, irregular employment and mobility between states complicate completion of multidose schedules.

A Mumbai investigation of zero-dose children after the COVID-19 disruption found that most identified children lived in migrant slums or pavement settlements. Awareness gaps, hesitancy and operational failures all contributed, demonstrating that confidence-building must occur alongside improved service delivery.[9]

A recent systematic review of non-COVID vaccine hesitancy in South Asia identified confidence, miscommunication, limited knowledge and broader contextual constraints as recurring themes. The authors emphasized that hesitancy was vaccine- and setting-specific and recommended community co-creation rather than imported, uniform messaging.[10]

India's frontline workers—ASHAs, auxiliary nurse midwives and anganwadi workers—are essential because they combine service delivery with interpersonal trust. Their effectiveness depends on adequate training, supportive supervision, timely payment and access to accurate answers about new vaccines and adverse events.

The U-WIN digital platform offers opportunities for individual tracking, reminders and portability of records. Digital systems, however, should complement rather than replace household outreach. People without smartphones, stable numbers or digital literacy are often those at greatest risk of being missed.

Recent Advances

Behavioural diagnosis before intervention

The BeSD approach represents an important shift from generic awareness campaigns towards systematic assessment. Short standardized tools can measure confidence, norms, motivation and practical barriers before selecting interventions.

Social listening and infodemic management
Public health agencies increasingly monitor online and offline conversations to detect information voids and emerging safety concerns. Ethical social listening should use aggregate data, avoid intrusive surveillance and lead to timely public response.

Prebunking and misinformation resilience
Prebunking exposes people to common manipulation techniques before misinformation is encountered. Early studies suggest it can improve recognition of misleading content, although durability and effects on actual vaccine uptake remain uncertain.

Digital reminders and interoperable records
Electronic registries can identify missed doses, generate reminders and support vaccination across locations. Their effectiveness depends on accurate data entry, portability and protection against exclusion caused by authentication failures.

Vaccine-confidence surveillance
Countries are beginning to monitor confidence alongside coverage. This allows programmes to identify declining trust before it becomes visible through large coverage reductions or outbreaks.

Challenges and Limitations
Vaccine hesitancy is measured inconsistently. Studies use different questionnaires, definitions and thresholds, producing widely varying prevalence estimates. Intention is often treated as equivalent to uptake even though many willing individuals remain unvaccinated because of practical constraints.
Cross-sectional studies cannot determine whether mistrust caused non-vaccination or arose after a negative service experience. Online surveys frequently overrepresent educated, digitally connected respondents.
The COVID-19 literature dominates recent research but may not generalize to established childhood vaccines. Rapid development, emergency authorization and political polarization created a distinct context.
There is also a risk of stigmatizing communities. Labelling an ethnic, religious or geographical group as "vaccine hesitant" can conceal structural barriers and reinforce discrimination. Results should be interpreted within specific social and service contexts.
Finally, interventions are often evaluated over short periods. Trust is cumulative and may require years of consistent service quality. Immediate uptake is important, but durability, completion of multidose schedules and confidence in future vaccines also matter.

Future Directions and Policy Priorities
Vaccine programmes should routinely measure behavioural and social drivers at local level and connect findings with microplanning. Coverage data should be disaggregated by geography, migration status, sex, socioeconomic position and social group.
Healthcare workers require communication training that includes listening, acknowledging uncertainty, explaining relative risks and responding to misinformation without confrontation. Provider confidence should be assessed before introducing new vaccines.
Adverse-event surveillance must be visible and credible. Communities should know how events are reported, investigated and compensated where applicable. Silence or delayed communication creates information voids.
India should strengthen vaccination services for migrants through portable digital and paper records, flexible session timings, vaccination at transit and work sites and coordination across districts and states.
Research should prioritize pragmatic trials comparing locally tailored packages, measure verified uptake and completion, and include cost-effectiveness and equity outcomes. More evidence is needed on adolescent, adult, maternal and HPV vaccination, as hesitancy research remains disproportionately focused on childhood and COVID-19 vaccines.

CONCLUSION

Vaccine hesitancy is a dynamic and context-specific phenomenon located between unquestioning acceptance and complete refusal. It reflects confidence, perceived disease risk, social influence, practical access and trust in the institutions delivering vaccination.

The evidence does not support treating hesitancy as a simple knowledge deficit. Information is necessary but rarely sufficient. Effective programmes combine reliable services, strong provider recommendations, transparent communication, community participation, reminders and rapid responses to emerging concerns.

India has developed extensive immunization infrastructure and has made substantial progress in reaching previously missed populations. Persistent zero-dose and partially vaccinated groups, however, demonstrate that coverage depends on both trust and access. Migrants, urban informal settlements and remote communities require tailored service delivery rather than blame.

The most effective response to vaccine hesitancy is not persuasion at any cost. It is the creation of a trustworthy vaccination system: one that listens, communicates honestly, investigates safety concerns, makes vaccination convenient and treats every individual with dignity.

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