Addressing Vaccine Hesitancy: A Comprehensive Analysis of Factors

Manthan Prajapati [1], Madhav Oza [1], Mansi Bhagat [1], Mrudangsinh M Rathod [2].

[1] Student, Department of Pharmacy Practice, Parul Institute of Pharmacy, Parul University, Vadodara, Gujarat, India.
[*2] Assistant Professor, Department of Pharmacy practice, Parul Institute of Pharmacy, Parul University, Vadodara, Gujarat, India.

Corresponding Author: Dr. Mrudangsinh M Rathod, Assistant Professor, Department of Pharmacy practice, Parul Institute of Pharmacy, Parul University, Gujarat, India.
Mobile phone: (+91)9904883838
E-mail: mrudangsinh.rathod@yahoo.com

ABSTRACT:

Background: Vaccination has been instrumental in promoting global health and development, saving millions of lives annually by enhancing the immune system's ability to fight diseases. Vaccines play a crucial role in preventing and managing outbreaks of infectious diseases. However, despite significant progress, access to adequate immunization remains a challenge for many people worldwide, including nearly 20 million newborns each year. In some countries, progress has slowed or even reversed, and complacency threatens to undermine past successes.
Method: This review utilizes data from the National Family Health Survey (NFHS) carried out at three different intervals between 2005 and 2021. According to the survey, children between the ages of 12 to 23 months who received specific vaccinations at any point before to the survey were deemed to have received all necessary immunisations.
Findings: Global data indicate that India's immunization coverage has been increasing over time, as demonstrated by the results of surveys conducted in the country. Gender bias has declined, and birth order vaccination rates have improved. Immunization is influenced by factors such as parental education, financial circumstances, access to healthcare, safety concerns, and missing vaccinations. Despite the challenges, tremendous progress has been made and will continue to be made.
Conclusion: While challenges such as access to healthcare facilities and vaccine availability for indigenous communities, as well as people's safety education, remain significant issues, progress has been achieved since the last survey. The government must remain vigilant against anti-vaccine propaganda and work towards eliminating it.
KEYWORDS: Vaccination coverage, vaccination, religious beliefs, socio-economic scenarios, Vaccination Attitude, Survey Data, social media, Vaccine communication.

INTRODUCTION:

"Vaccine" is one of the greatest accomplishment mankind have ever achieved[1]. Vaccines had contributed significantly reduced the mortality and morbidity rates of many diseases. And it had been playing a major role in fulfilling successful public health to overcome communicable and non-communicable diseases[2,3]. However, there is a continuous rise in the cases of delayed vaccination or refusal of vaccine[2]. And this hesitancy contributes to the vaccine gaps and immunization coverage- these are the factors for the elimination of vaccine-preventable diseases (VPDs) and this may lead to the re-emergence of the diseases (e.g., measles, polio, etc.)[2].

From absolute acceptance to full rejection, vaccine response is shown along a continuum. However, vaccine-sceptical people constitute a diverse population[4]. The Strategic Advisory Group of Experts (SAGE) working group has defined vaccine hesitancy as the delay in accepting or refusing immunisations irrespective of the availability of vaccine facilities. Vaccine hesitancy is complex and context-specific, varying through time, space, and vaccines. It is impacted by elements like complacency, convenience, and confidence. [4]. There

are some factors that are universally consistent with vaccine refusal. As part of the immunisation programmes' implementation and educational efforts, these must be addressed by the WHO (World Health Organisation) and UNICEF (United Nations Children's Fund). The benefits of vaccines and the science behind immunisation must be highlighted by social media, blogs, newspapers, influential people, and celebrities. [5].

Immunization now avoids between 2 to 3 million fatalities from diphtheria, tetanus, pertussis, influenza, and measles each year[6]. The COVID-19 pandemic and related interruptions have stressed health services, with 23 million children missing in 2020, 3.7 million more than in 2019, and the most since 2009[7].

Vaccine Hesitancy: Vaccine hesitancy, on the contrary, has become a rising issue over the years[3]. As old as the vaccines themselves, there have always been questions surrounding vaccines, from safety to whether or not they are actually necessary[2]. Vaccine hesitancy is described by the WHO SAGE on immunization as " delay in accepting or refusing vaccination, regardless of the availability of vaccination services[4]." In 2018 an estimated 60% of total 19.7 million infants under 1year of age who were unable to obtain basic vaccines belonged to 10 countries, including Angola, Brazil, the Democratic Republic of the Congo (DRC), Ethiopia, India, Indonesia, Nigeria, Pakistan, The Philippines, and Vietnam[8]. In 2020, infant vaccination rates fell to 83%, leaving 3.7 million more children without or with insufficient vaccinations than in 2019. [9]. The Internet has increased the chances of anti-vaccine individuals connecting, coordinating, and increasing their voice share at a worldwide level. In consequence, the anti-vaccine group has managed to influence person's attitudes and to reduce vaccination trust despite its demonstrated effectiveness[2]. Figure 1 and Figure 2 show the immunization coverage of the polio vaccine in developed and developing countries respectively.

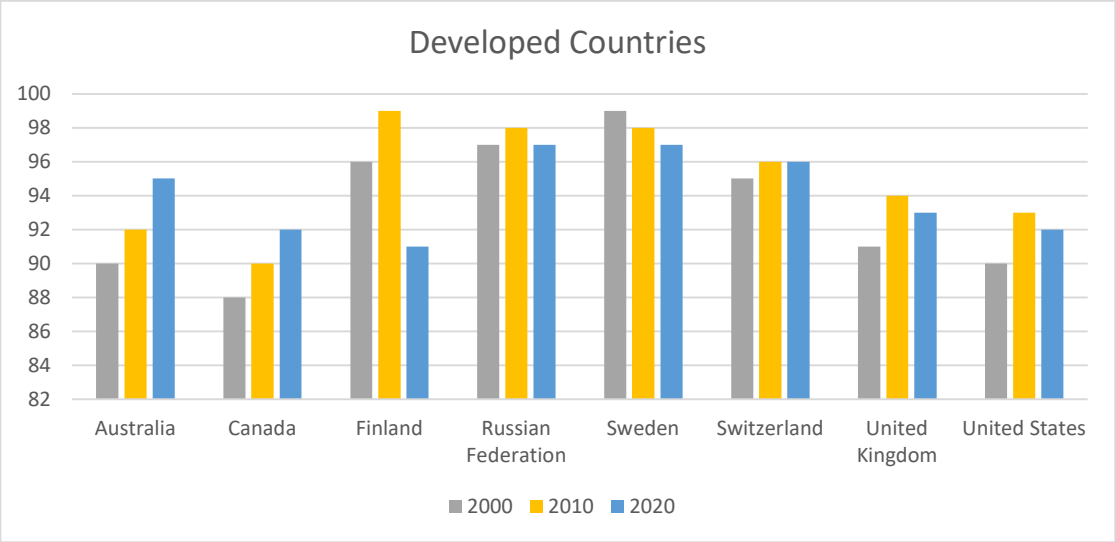

Figure 1 Polio immunization coverage in developed countries[10].

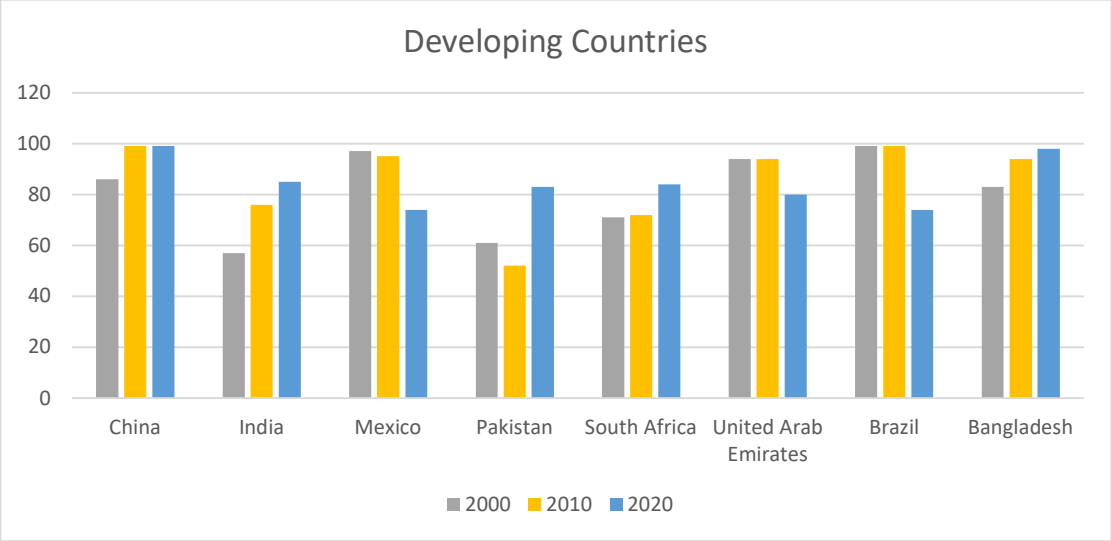

Figure 2 Polio immunization coverage in developing countries[10].

Children aged 12 to 23 months who received certain immunisations at any time before the survey (as shown by a vaccination card or a mother's recollection). A child must have received the following basic immunizations as listed in Table 1. All the data are from the National Family Health Survey 3 (2005-06) and 4 (2015-16) of India.

Table 1: All of the basic immunizations.

Vaccine	Dose
BCG (bacille Calmette-Guerin)	1
DPT (Diphtheria Pertussis Tetanus)	3
Polio	3
Measles	1

Factors Affecting Vaccination

Residence Type: In both urban and rural regions, the rates of completely vaccinated children were 66% and 54%. The DPT3 vaccination had the greatest disparity in coverage (59% vs. 70%) across rural and urban areas[11].

The NFHS-4 shows an increase in vaccination when compared to NFHS-3, but there is a minor increase in non-vaccinated individuals as shown in

Table ***2***. In NFHS – 4 Survey, they found that exposure to mass media in rural areas was lower than in urban which might be a reason for the less knowledge to the parents about the vaccination programs[12].

Table 2: Vaccination coverage % based on urban and rural living.

Residence	NFHS-3 (2005–06)		NFHS-4 (2015-16)	
	All basic vaccinations	No vaccinations	All basic vaccinations	No vaccinations
Urban	57.6	3.3	63.8	5.1

Rural	38.6	5.7	61.3	6.4

Child delivery site: Children who were partially or not at all immunised had a higher likelihood of giving birth outside of an institution than children who were fully immunised. Additionally, despite the fact that there was no conclusive evidence linking under-vaccinated kids to private institution births, children born there had a higher risk of not receiving vaccinations than children born in public institutions. [11].

Gender: Gender disparities in health-care access are thought to be a result of wider cultural factors in South Asia that benefit boys when compared to girls at an early age[14]. Female adolescent health in the south Asian region is harmed by early marriage, childbearing, anaemia, sexual abuse, and a lack of educational options[15]. In India, a girl under the age of five has mortality of 8.3% higher than boys. Poor nutrition, a lack of preventative treatment (particularly immunization), and delays in seeking health care for sickness are all examples of neglect[14]. When the background variable "sex of the kid" was considered for its effect on immunisation, the bias against a female child was at greater extent in Rajasthan and Uttar Pradesh. In Rajasthan, male youngsters were 46% more likely to get vaccinated than to females [12]. In Brazil and the USA, women were more inclined to adhere to their employers' recommendations regarding Covid-19 vaccination, while the opposite was observed in India and South Korea. In France, Germany, Russia, and Sweden, however, there was no significant difference in vaccine uptake between genders [16]. Table 3 shows an increase in vaccine coverage comparing NFHS-4 to NFHS-3 data[12,13].

Table 3: Vaccination coverage % Based on Gender.

	NFHS-3 (2005–06)		NFHS-4 (2015-16)	
Sex	All basic vaccinations	No vaccinations	All basic vaccinations	No vaccinations
Male	45.3	4.3	62.1	5.9
Female	41.5	6	61.9	6.2

Birth Order: Higher birth order is linked to a reduced likelihood of immunization[16]. In Northern India, mothers with higher birth orders, particularly those in the category of four and above, were less likely to vaccinate their children. [17]. Children with first birth order were more likely to get immunized than children with birth order 6 or more as shown in Table 4[12,13]. According to a survey conducted in Goa, the percentage of newborns who received all recommended vaccinations declined with higher birth order, with 86.6%, 88.8%, 69.2%, and 75.0%, respectively, for birth orders 1, 2, 3, and 4. Unvaccinated newborns made up 1.1%, 2.0%, 7.6%, and 25.0% of the population, respectively[18]. The gender disparity has not narrowed despite rising rates of age-appropriate vaccine coverage over time, unless a girl has an elder brother, the disparity widens with birth order. When compared to boys born third to families with two older girls, girls born third to families with two other girls have the greatest vaccination disadvantage[16].

Table 4: Vaccination coverage % based on Birth Order.

	NFHS-3 (2005–06)		NFHS-4 (2015-16)	
Birth order	All basic vaccinations	No vaccination	All basic vaccinations	No vaccination
1	54.6	3.7	67.3	4.7
2 to 3	45.3	4.7	61.4	5.7
4 to 5	29.9	7	51	9.5
>6	18.5	8.6	43.3	16.6

Religion: Caste and religion are strongly ingrained cultural divisions that influence parental beliefs about health-seeking behaviours, such as vaccination choices for their children, and have an effect on the accessibility of health care. In comparison to Hindus, Muslim children had 1.42 times the likelihood of being under-vaccinated vs fully-vaccinated and 2.2 times the likelihood of being unvaccinated. [11].

The non-vaccination rate was not considerably higher among Christian children than among Hindu youngsters. Other religions (Buddhism, Jainism, Zoroastrianism, and Judaism) have lower rates of under- and non-vaccination than fully vaccinated children[11]. Table 5 Shows NFHS-3 and NFHS–4 vaccine coverage % based on the Religion[12,13].

The NFHS – 3 Survey shows the rate of vaccinated infants was higher among Christians and Sikhs but the rate of non-vaccinated infants was also higher and that rate is increased in the NFHS – 4 Survey[12,13].

Table 5: vaccine coverage % based on the Religion.

Religion	NFHS-3 (2005–06)		NFHS-4 (2015-16)	
	All basic vaccinations	No vaccinations	All basic vaccinations	No vaccinations
Hindu	44.4	4.4	63	5.3
Muslim	36.3	7.3	55.4	9.8
Christian	56.3	9.4	61.7	7
Sikh	67.3	6.6	88.9	1.2
Buddhist/ Neo-Buddhist	50.9	0.7	55.9	9.7
Other	27.2	7.9	69.1	2.5

Parent Education: Children born to parents who are educated are twice as probable to receive vaccinations than children born to parents who are uneducated (in the case of Bihar, five times more probable). In the areas under consideration, parental education was therefore essential for child immunisation. [17].

Vaccination coverage rises as a mother's education level rises as shown in Table 6[12]. In a cross-sectional study conducted in Delhi, maternal education was found to have a substantial impact on the use of medical services as well as total vaccination[19]. The NFHS – 3 and NFHS – 4 Survey shows the high rate of no vaccinations in infants whose mothers had no schooling, the rate increases with the increase in mother's education(Table 6).

Table 6: Vaccine coverage % based on Mother's Schooling.

Mother's Schooling	NFHS – 3 (2005–06)		NFHS – 4 (2015-16)	
	All basic vaccinations	No vaccinations	All basic vaccinations	No vaccinations
No schooling	26.1	7.4	51.5	10.2
<5years Complete	46.1	7.6	63.2	5.8
5-7 years Complete	51.8	3.7	61.2	5.2
8-9 years Complete	59.7	2.3	65.9	4.6
10-11 years Complete	66.1	2	67.6	4.2
12 or more years Complete	75.2	0.3	69.7	3.5

Financial Factors: The cost of vaccines and vaccinations is an issue since a handful is provided for free or part of the national immunization program [20]. Table 7 shows vaccination coverage improves with rising wealth status [12]. The loss of daily income was found as one of the most often cited causes for skipping childhood immunization in slum regions in a community-based cross-sectional study done in Mumbai, one of the world's most populated cities [21].

It was expected that 87% of the 2.5 million deaths of youngsters below five years of age globally have happened in poor regions of the world. Thus country-stage economic elements have a large impact on the capacity to successfully immunize populations in low earnings countries [22].

In India, better earnings became mentioned as a promoter whilst in Bangladesh, each high and low earnings/Socioeconomic status (SES) have been determined to promote vaccination[23,24]. It was predicted that underprivileged parts of the globe will account for 87% of the 2.5 million deaths of children under the age of five. Thus, economic factors at the country level have a significant influence on the ability of low-income countries to successfully immunize their populations[22].

Table 7: Vaccine coverage % based on the wealth index.

Wealth Index	NFHS-3 (2005–06)		NFHS-4 (2015-16)	
	All basic vaccinations	No vaccinations	All basic vaccinations	No vaccinations
Lowest	24.4	9.1	52.8	10
Second	33.2	6.1	60.6	6.3
Middle	46.9	4.3	64.2	4.8
Fourth	55.3	2.9	66.9	3.7
Highest	71	0.9	70	3.7

Tribal Population: Nearly 90% of India's tribal people reside in rural regions and continue to dwell mostly in mountainous and wooded areas. Tribal peoples' health and socioeconomic indices are typically worse than the rest in most countries. Access to healthcare services is limited owing to inadequate road connection, a shortage of health workers, a lack of suitable equipment, language, and social obstacles, and poverty, all of which lead to reduced health-seeking tendencies among tribal populations and lower trust in the health care system. Some popular fallacies about vaccination include the following: vaccines induce impotency, vaccines make the kid sick, and vaccines are unnecessary. Because of family migration in quest of better career possibilities and greater income, children's vaccination remains incomplete. Dropouts and dropout rates are greater in places with a higher rate of migration[25].

Access to healthcare service: A study carried out in the Udaipur region of Rajasthan found a correlation among the vaccination status of 2365 children aged 5 years and the proximity of their families to the nearest primary healthcare center. Overall immunization rates were 55% for houses 1 km away, 47% for distances 1-2 km, 32% for distances 2-7 km, and 30% for households more than 7 km distant from healthcare centres. Low-Income families, by the way, resided further away from primary healthcare institutions than their wealthier counterparts[26].

In NFHS – 4 Survey when asked to women aged 15-49 about potential problems in accessing medical services one-fourth cited money as a problem. With an increase in the number of living children, the rate of distance to the health centre as a reason for not seeking assistance increased[12].

Safety Issues: The issue of vaccination side effects and contraindications is particularly significant because numerous of the research we evaluated found that not only parents but even physicians, were hesitant to vaccinate children with modest illnesses, such as moderate fever or diarrhoea[27]. Invalid contraindications, the physician's failure to question parents or review the child's vaccination record at every appointment, and failure to administer simultaneous vaccine doses were all causes for missed chances[27].

Vaccination schedules are structured in such a manner that numerous vaccinations are given at the same time to increase compliance and coverage. However, because immunization schedules are overcrowded, Healthcare professionals (HCPs) and parents are concerned about administering many vaccinations in a single visit. Furthermore, in the Indian community, there is a high level of scepticism regarding newly released vaccinations, as well as uncertainty about the necessity to vaccinate against unusual illnesses[2]. Women were more anxious about the possibility of major side effects and were also more prone to believe that some vaccinations cause autism and had denied a shot for their child in the past[28].

Negative experiences: Parental vaccination uptake might be influenced by their beliefs of the physical dangers involved with immunization [29]. The Measles, Mumps, and Rubella (MMR) vaccine was shown to be more controversial among parents of 4-5 year old children who had direct experience with autistic children. These parents anticipated that the long-term repercussions of autism were worse than measles, mumps, and rubella[30]. Unpleasant experiences with initial immunization, along with absence of any severe threat and severity of childhood illnesses, might explain the reasons why some parents decline or postpone bringing their children for additional doses in vaccine schedule[29].

Missed vaccinations: Missed vaccination chances don't always imply that parents have made the choice not to immunize their children. Despite the best of intentions, missing appointments, a shortage of time once the mother leaves for job, familial illness, and other childcare responsibilities can all conspire against attending vaccine appointments on time[30]. In Australia, the most common reasons given by parents for their children's partial immunization were a lack of understanding that booster doses were necessary and parental complacency[31]. Intercurrent sickness was the most common cause stated for missed or delayed immunization in Italy and was reported in Australia as well[32,33]. Parents with older children, on the other hand, may not be aware of when their child's shots are due if they are not reminded, and they might need additional freedom in appointment dates according to work and other childcare obligations[31,34].

Fake News: Fake News is regarded as a huge concern among 68% (65 and older) to 80% (18 to 29 years old) of US residents and as a threat to democracy by 88%[35].

There have already been several conspiracy theories and mis/disinformation regarding coronavirus. And now, inaccurate and confusing information about vaccinations is being disseminated on social media channels. With their far-fetched conspiracy ideas, anti-vaccine groups are attempting to create vaccination reluctance. For example, Pakistan failed to eradicate polio owing to anti-vaccine conspiracy beliefs[36].

Several conflicts and misleading information have undermined vaccination trust during the past 20 years. In poliomyelitis vaccination campaigns during the early 2000s, the culture of suspicion was established in specific areas by wrongly alleging that the vaccine contains pig's blood, among other things[2]. Recognizing the need for vaccination, religious leaders who were first mute, later with community activists, actively promoted the coordinated action that resulted in the effective eradication of poliomyelitis[37,26]. The spread of false news can have major ramifications for society and developments in smartphone technology with internet access are also contributing to the propagation of fake news[38]. As per studies, the degree of fake news distributed during crises such as natural calamities and terror attacks has increased rapidly over the last decade and is extremely deadly[39].

Anti-vaccine propaganda is widely circulated on social media and exposure to such information may have a direct impact on vaccination attitudes and generate downstream vaccine apprehension. Data suggest that even brief exposure to vaccine-critical websites – as little as five to ten minutes – enhanceds the total impression of vaccine risk when compared to control websites[40].

3.1 **Number of Vaccinations:** According to the NFHS – 4 Survey, there has been increase in vaccination coverage for BCG, DPT1, DPT2, DPT3 vaccines where as vaccination coverage slightly declined in case of POLIO vaccines

Figure *3*. The vaccines at birth and the first dose (as in polio and DPT) have a higher rate of vaccination than the further vaccinations. The BCG vaccination (92%) had the highest coverage, whereas the third dosage of polio vaccine had the lowest (73%). Even though more children got the initial doses of the DPT and polio vaccinations than the second or third doses, polio vaccination has a greater dropout rate than DPT. The first DPT dosage was given to 90% of children aged 12-23 months, while the final dose was given to 78%. For the polio vaccination, these numbers were 91% and 73%, respectively[12].

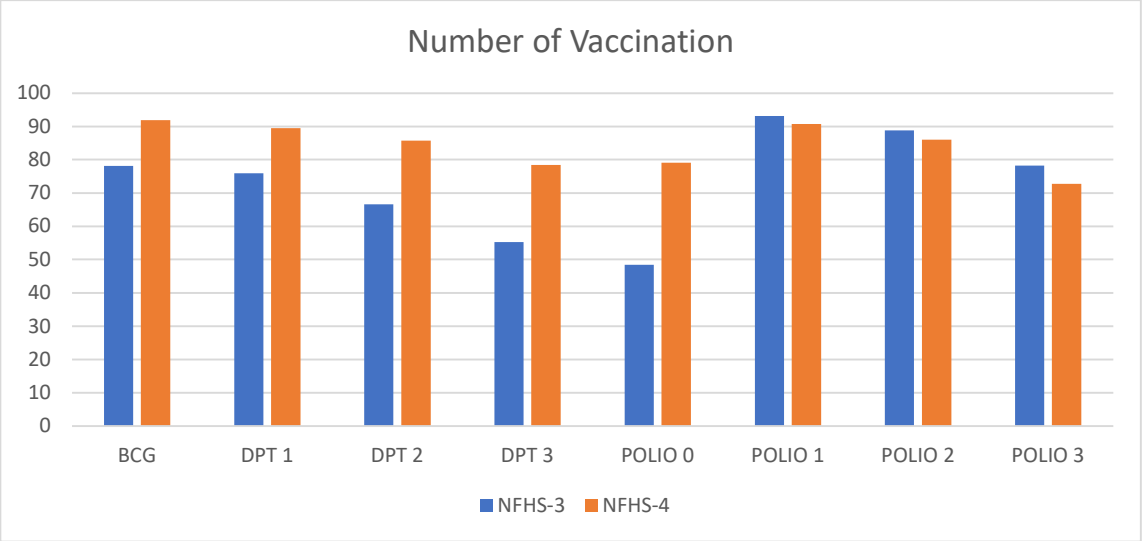

Figure 3: Vaccine coverage % based on the number of vaccination doses.

Overcoming the Vaccine Hesitancy: Several of the aforementioned difficulties also bring opportunities to combat vaccine hesitancy and improve vaccination and healthcare system confidence[2]. Vaccination uptake must be increased and maintained for vaccinations to be successful. WHO suggests that improving vaccination coverage requires understanding drivers of vaccination, improving and sustaining uptake and monitoring and evaluating interventions to improve uptake[41]. WHO suggest 3 categories to improve vaccination.

Understanding Drivers of Vaccination: A vast number of factors affect whether somebody is vaccinated or not. The concept of behavioural and social drivers (BeSD) of vaccination coverage highlights indicates the four categories that can be assessed to determine causes for under-vaccination(Fig. *4*)[41].

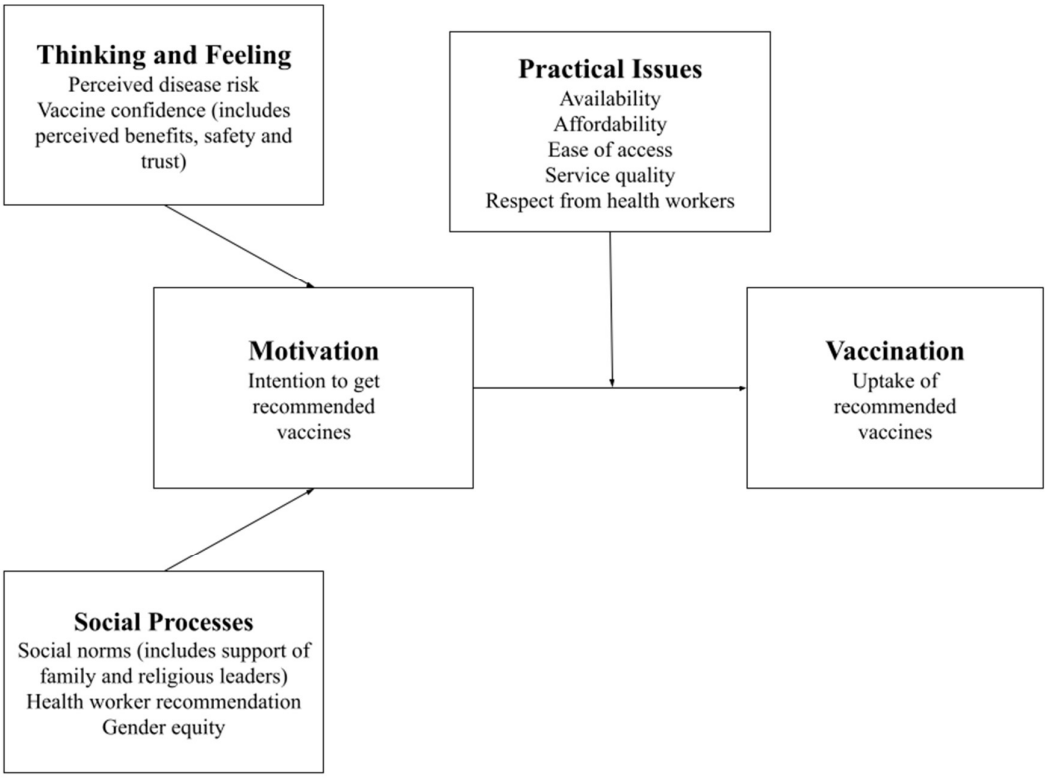

Fig. 4: The Behavioural and Social Drivers (BeSD)

Improving and sustaining uptake: Because a variety of factors influence vaccination rates, the most successful treatments are multi-faceted. Interventions should, in most situations, be focused on discourse and explicitly targeted at a specific under-vaccinated population group. Authorities can produce insights to create effective good health care, systems, policies, and methods of communication that support and enable suggested immunization behaviours by working together with health workers, caregivers/parents, and their families and communities[41].

Monitoring and evaluating interventions to improve uptake: Systematic monitoring and evaluation of efforts to improve acceptance and uptake to guide changes and broad application of successful stratergies[41].

Factors improving vaccine hesitancy

Communication: Children in Italy were almost certain to get pertussis and MMR vaccines if their mothers had acquired significant immunization information. Most parents would appreciate conversations regarding immunisation with medical practitioners yet some professionals may require assistance in developing an open relationship with the parents as well as upgrading their understanding so that they can answer correctly queries from parents[30].

Parental doubt regarding the necessity for immunisation must be addressed with crucial information on the safety of multiple and single-antigen vaccines, assurance that a minor illness is not an excuse for delaying immunisation, duration of protection, and reasons for booster injections [30,34,42,43]. Although, healthcare experts might require greater training in how to effectively explain vaccination-related dangers to parents because the communication style 'preferred' among parents might limit vaccination coverage [30,44]. The creation of a parent-centred strategy to promote decisions that are well informed, increases vaccination compliance among parents who prefer to immunize their children[30].

Sources of Information: It is essential to have reliable vaccination-related information to influence vaccine acceptability. The firmly held local views and disinformation about the vaccine are likely to prevail in India's strongly interconnected rural areas. More than health care experts or medical officers, parents who approved the vaccine trusted school teachers as a source of knowledge. So they should take a more active role in disseminating genuine, trustworthy immunization information[45]. They provide information to the public and have the ability to break down cultural obstacles to immunization [2].

Children's immunization status, parents' awareness, and desire to vaccinate may all increase or slightly increase with face-to-face information or teaching and it can be more effective [44]. Because it's difficult to manipulate and verify all of the numbers accessible on numerous platforms, it's critical to increase access to clear and scientifically confirmed information concerning vaccination benefits and risks, as well as to reply queries with fair and reliable facts[46].

Social Media: Numerous social media platforms have pledged to combat anti-vaccine propaganda as part of larger efforts to combat disinformation, in response to rising worries about the damaging impact of the online anti-vaccine message[40]. Media may have an exceptional effect on mass opinion, with enduring impacts. Nowadays, having access to social networking sites (72.9% of families use smartphones) is more in India than access to TV (45.0%) or cooking gas cylinders (21.6%)[47].

In the US, Twitter has teamed with the Department of Health & Human Services to link vaccine-associated terms to Vaccines.gov, like a pinned Tweet. In contrast to countering disinformation, platforms like YouTube, are cooperating with high-profile content producers to broadly mislead films in favour of physical separation alongwith isolation precautions for COVID-19 control straight to users as adverts. Facebook is seeking to counteract vaccination misinformation by decreasing its circulation and providing users access to trust information about the topic[40].

Reminder and recall systems: A recent analysis of patient-reminder studies conducted in the US, Australia, Canada, Denmark, New Zealand, and the UK found that using reminder and recall techniques like postcards, letters, and phone or auto-dialer calls increased the proportion of kids who were immunised or had their immunisations up to date. With all the reminder systems being effective, telephone reminder was the most effective and the most costly[30].

A reminder from a healthcare professional during a vaccine visit, on the other hand, is a cheap and successful approach to get parents to place their child at their next immunization appointment[48]. The mobile text message reminders were straightforward and intelligible to the mothers who got them. Literacy and language-related challenges, as well as information and communications technology (ICT) infrastructure (phone ownership, network, and energy), were significant obstacles to execution[49].

Policy and law:

Vaccine requirement for school attendance: In the United States, roughly 54.2% of teenagers have received the human papillomavirus (HPV) vaccine, which can prevent six forms of HPV-related diseases. It may be important to consider state policy methods, such as school-entry regulations, as part of the patchwork of provider, parent, and structural interventions, to increase HPV vaccination and prevention of HPV-related diseases. According to registry data, HPV vaccination rates increased significantly after the strategy was implemented[50].

The submission of a child's vaccinated status card should be mandatory for school enrollment. Inter-sectoral coordination with other ministries, mandatory vaccination certificates for school entry, and implementing various NHM (National Health Mission) programmes to improve Health Literacy (HL) are all potential alternatives[51].

In 2017, Pennsylvania updated its school-entry vaccination regulations, reducing the provisional period from eight months to the first five days of school and mandating children entering 12th grade to get the meningococcal conjugate vaccine (MCV4). Their results concluded a modest increase in the vaccination rates, and findings imply that these revised school-entry vaccination criteria could assist enhance timely immunization rates for both needed and non-necessary vaccines, boosting kid protection at the start of the school year[52].

Financing and reducing the cost of the vaccine: Vaccination of children has lagged in nations like India but several conditional cash transfer programmes, have proven to help improve health outcomes[53]. Special permissions should be given to parents who are taking their children for immunization to prevent a day's salary loss. All government and private sectors, along with small-scale companies and employers of the daily labourers, must legalize this issue. Introducing a financial bonus to such parents could exhibit some progress. However, rather than establishing a new cash assistance programme, it is simpler to include it into the current national programme and prolong the period during which recipients receive them. For example, financial help under the JSY (Janani Suraksha Yojana) which is granted post-delivery should be given to the beneficiary only after the newborn has been vaccinated against measles in the 9th month[51].

Community outreach and home visits: The child's MCP (Maternal Child Protection) card, which will be digitalized and linked with Aadhar or a BPL (Below Poverty Line) card, must automatically update the address when the family relocates. As a result, the duty for that child's care will be immediately moved to an Anganwadi in the new neighbourhood, and the Accredited Social Health Activist (ASHA) of that Anganwadi will pay a home visit to advise newcomers about the anganwadi's location, closest healthcare centre, and the following schedule [51].

CONCLUSION:

Vaccine hesitancy is an extremely crucial problem that cannot be overlooked, as the drivers of hesitancy are at different levels that may be personal, interpersonal, community-based, population-based and other vaccine-related factors like availability, etc. Biases connected to gender, wealth index, residence, and birth order are all declining. Both birth order and birth site show a considerable rise in immunization, and government hospitals and programs have consistently increased vaccine coverage, regardless of birth order or birth site. Preventing any disease with vaccination can be both cost-effective and beneficial to world wellness. Many organizations worldwide are working to improve vaccination rates, from vaccine availability to public education, which is why reluctance rates have been falling over time. Fact-checking is important in reducing hesitation because it inhibits the dissemination of false NEWS, misinformation about vaccines, and vaccination drivers. Access to healthcare facilities and vaccination availability, as well as people's education on safety, were key issues among the indigenous community. However, this has improved since the last survey. The government should maintain a close eye on anti-vaccine information and work to eliminate it. Government, policymakers, healthcare personnel, the media, and people working proactively can improve immunization and eliminate the hesitancy for vaccination.

ABBREVIATIONS

VPDs- Vaccine diseases
SAGE- Strategic Advisory Group of Experts
WHO- World Health Organization
UNICEF- United Nations Children's Fund
DRC- Democratic Republic of the Congo
BCG- Bacille Calmette-guerin
DPT- Diphtheria pertussia tetanus
NFHS- National Family Health Survey
SES- socioeconomic status
HCPs- Healthcare professionals
MMR- Measles, Mumps and Rubella
BeSD- Behavioural and social drivers
UK- United Kingdom
ICT- Information and communications technology
HPV- Human papilloma virus
NHM- National health mission
HL- Health literacy
MCV4- Meningococcal conjugate vaccine
JSY- Janani suraksha yojana
MCP- Maternal child protection
BPL- Below poverty level
ASHA- Accredited social health activist
MoHFW- Ministry of health and family welfare

Availability of data and materials: All the data used were obtained from the National Family and Health Survey 3 and 4. International Institute for Population Sciences (IIPS) and ICF. 2017. National Family Health Survey (NFHS-4), 2015-16: India. Mumbai: IIPS[12].
International Institute for Population Sciences (IIPS) and Macro International. 2007. National Family Health Survey (NFHS-3), 2005–06: India: Volume I. Mumbai: IIPS[13].

Competing interests: The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this article.

Funding: This study is not funded by any government or non-government organization.

Authors' contributions
All the authors have equal contributions to the literature review, drafting of the manuscript and edits.

REFERENCES

[1]. Dubé E, Laberge C, Guay M, Bramadat P, Roy R, Bettinger JA. Vaccine hesitancy: an overview. Human vaccines & immunotherapeutics. 2013 Aug 8;9(8):1763-73.
[2]. Agrawal A, Kolhapure S, Di Pasquale A, Rai J, Mathur A. Vaccine Hesitancy as a Challenge or Vaccine Confidence as an Opportunity for Childhood Immunisation in India. Infectious diseases and therapy. 2020 Sep;9:421-32.
[3]. Dasgupta P, Bhattacherjee S, Mukherjee A, Dasgupta S. Vaccine hesitancy for childhood vaccinations in slum areas of Siliguri, India. Indian journal of public health. 2018 Oct 1;62(4):253.
[4]. World Health Organization. Report of the SAGE Working Group on Vaccine Hesitancy. 2014. https://www.who.int/immunization/sage/meetings/2014/october/SAGE_working_group revised_report_vaccine_hesitancy.pdf?ua=1. Accessed 16 August 2021.
[5]. Aggarwal A. Childhood Vaccine Refusal and Hesitancy–Reasons. The Indian Journal of Pediatrics. 2019 Jan;86(1):5-6.
[6]. Vaccine and immunization [Internet] 2021 [cited 10 September 2021]. Available from https://www.who.int/health-topics/vaccines-and-immunization#tab=tab_1
[7]. Immunization coverage [Internet] 2021 [cited 10 September 2021]. Available from https://www.who.int/news-room/fact-sheets/detail/immunization-coverage.
[8]. Immunization [Internet] 2018 [cited 10 September 2021]. Available from https://www.who.int/news-room/facts-in-pictures/detail/immunization.
[9]. Progress and challenges with sustaining and advancing immunization coverage during the COVID-19 pandemic [Internet] 2021 [cited 10 September 2021]. Available from https://data.unicef.org/wp-content/uploads/2016/07/Progress-and-challenges-final-15-july-2021.pdf
[10]. Immunization data [Internet] 2021 [cited 10 September 2021]. Available from http://immunizationdata.who.int/listing.html?topic=&location=
[11]. Shrivastwa N, Gillespie BW, Kolenic GE, Lepkowski JM, Boulton ML. Predictors of vaccination in India for children aged 12–36 months. American journal of preventive medicine. 2015 Dec 1;49(6): S435-44.
[12]. International Institute for Population Sciences (IIPS) and ICF. 2017. National Family Health Survey (NFHS-4), 2015-16: India. Mumbai: IIPS.
[13]. International Institute for Population Sciences (IIPS) and Macro International. 2007. National Family Health Survey (NFHS-3), 2005–06: India: Volume I. Mumbai: IIPS.
[14]. Fikree FF, Pasha O. Role of gender in health disparity: the South Asian context. Bmj. 2004 Apr 1;328(7443):823-6.
[15]. Lazarus JV, Wyka K, Rauh L, Rabin K, Ratzan S, Gostin LO, Larson HJ, El-Mohandes A. Hesitant or not? The association of age, gender, and education with potential acceptance of a COVID-19 vaccine: A country-level analysis. Journal of Health Communication. 2020 Oct 2;25(10):799-807.
[16]. Corsi DJ, Bassani DG, Kumar R, Awasthi S, Jotkar R, Kaur N, Jha P. Gender inequity and age-appropriate immunization coverage in India from 1992 to 2006. BMC international health and human rights. 2009 Oct;9(1):1-2.
[17]. De P, Bhattacharya BN. Determinants of child immunization in flourless-developed states of North India. Journal of Child Health Care. 2002 Mar;6(1):34-50.
[18]. Order B. Immunization status of children in Goa. Birth. 2005 Apr 1;1(86.6):12-2.
[19]. Kusuma YS, Kumari R, Pandav CS, Gupta SK. Migration and immunization: determinants of childhood immunization uptake among socioeconomically disadvantaged migrants in Delhi, India. Tropical Medicine & International Health. 2010 Nov;15(11):1326-32.
[20]. Wiot F, Shirley J, Prugnola A, Di Pasquale A, Philip R. Challenges facing vaccinators in the 21st century: results from a focus group qualitative study. Human vaccines & immunotherapeutics. 2019 Dec 2;15(12):2806-15.
[21]. Singh S, Sahu D, Agrawal A, Vashi MD. Barriers and opportunities for improving childhood immunization coverage in slums: a qualitative study. Preventive medicine reports. 2019 Jun 1;14:100858.

[22]. Centers for Disease Control and Prevention (CDC) Vaccine-preventable deaths and the Global Immunization Vision and Strategy, 2006-2015. MMWR Morb Mortal Wkly Rep 2006; 55:511-5;
[23]. Patra N. A Probe into the Ways to Stimulate Childhood Immunisation in India: Findings from NFHS-III. Available at SSRN 1117614. 2009 Dec 10.
[24]. Rahman M, Obaida-Nasrin S. Factors affecting acceptance of complete immunization coverage of children under five years in rural Bangladesh. Salud pública de méxico. 2010;52:134-40.
[25]. Immunization among Tribal Population in India: A Need Assessment Report [Internet] 2021 [cited 10 November 2021]. Available from unicef.org/india/reports/immunization-among-tribal-population-india.
[26]. Siddique AR, Singh P, Trivedi G. Role of Social Mobilization (Network) in Polio Eradication in India. Indian pediatrics. 2016 Aug 7;53.
[27]. Falagas ME, Zarkadoulia E. Factors associated with suboptimal compliance to vaccinations in children in developed countries: a systematic review. Curr Med Res Opin. 2008 Jun;24(6):1719-41. doi: 10.1185/03007990802085692. Epub 2008 May 9. PMID: 18474148.
[28]. Freed GL, Clark SJ, Butchart AT, Singer DC, Davis MM. Parental vaccine safety concerns in 2009. Pediatrics. 2010 Apr 1;125(4):654-9.
[29]. May T. Public communication, risk perception, and the viability of preventive vaccination against communicable diseases. Bioethics. 2005 Aug;19(4):407-21.
[30]. Tickner S, Leman PJ, Woodcock A. Factors underlying suboptimal childhood immunisation. Vaccine. 2006 Nov 30;24(49-50):7030-6. doi: 10.1016/j.vaccine.2006.06.060. Epub 2006 Jul 13. PMID: 16890330.
[31]. Ferson MJ, Fitzsimmons G, Christie D, Woollett H. School health nurse interventions to increase immunization uptake in school entrants. Public Health. 1995 Jan 1;109(1):25-9.
[32]. Degli Atti MC, Rota MC, Bella A, Salmaso S, ICONA Study Group. Do changes in policy affect vaccine coverage levels? Results of a national study to evaluate childhood vaccination coverage and reasons for missed vaccination in Italy. Vaccine. 2004 Oct 22;22(31-32):4351-7.
[33]. Bond L, Nolan T, Pattison P, Carlin J. Vaccine-preventable diseases and immunisations: a qualitative study of mothers? Perceptions of severity, susceptibility, benefits and barriers. Australian and New Zealand journal of public health. 1998 Aug;22(4):441-6.
[34]. Mills E, Jadad AR, Ross C, Wilson K. Systematic review of qualitative studies exploring parental beliefs and attitudes toward childhood vaccination identifies common barriers to vaccination. Journal of clinical epidemiology. 2005 Nov 1;58(11):1081-8.
[35]. Marco-Franco JE, Pita-Barros P, Vivas-Orts D, González-de-Julián S, Vivas-Consuelo D. COVID-19, Fake News, and Vaccines: Should Regulation Be Implemented?. International Journal of Environmental Research and Public Health. 2021 Jan;18(2):744.
[36]. Kanozia R, Arya R. "Fake news", religion, and COVID-19 vaccine hesitancy in India, Pakistan, and Bangladesh. Media Asia. 2021 Apr 27:1-9.
[37]. Merten M. India, Pakistan, and polio. BMJ: British Medical Journal (Online). 2016 May 4;353.
[38]. Raj A, Goswami MP. Is fake news spreading more rapidly than COVID-19 in India Journal of Content, Community and Communication. 2020 Jun;11(10):208-20.
[39]. Hunt K, Agarwal P, Al Aziz R, Zhuang J. Fighting fake news during disasters. OR/MS Today. 2020;47(1):34-9.
[40]. Puri N, Coomes EA, Haghbayan H, Gunaratne K. Social media and vaccine hesitancy: new updates for the era of COVID-19 and globalized infectious diseases. Human vaccines & immunotherapeutics. 2020 Nov 1;16(11):2586-93.
[41]. Improving vaccination demand and addressing hesitancy [Internet] 2021 [cited 23 November 2021]. Available from https://www.who.int/teams/immunization-vaccines-and-biologicals/essential-programme-on-immunization/demand
[42]. Evans M, Stoddart H, Condon L, Freeman E, Grizzell M, Mullen R. Parents' perspectives on the MMR immunisation: a focus group study. British Journal of General Practice. 2001 Nov 1;51(472):904-10.
[43]. Impicciatore P, Bosetti C, Schiavio S, Pandolfini C, Bonati M. Mothers as active partners in the prevention of childhood diseases: maternal factors related to immunization status of preschool children in Italy. Preventive medicine. 2000 Jul 1;31(1):49-55.
[44]. Kaufman J, Ryan R, Walsh L, Horey D, Leask J, Robinson P, Hill S. Face-to-face interventions for informing or educating parents about early childhood vaccination. Cochrane Database of Systematic Reviews. 2018(5).
[45]. Social capital, trust in health information, and acceptance of Measles–Rubella vaccination campaign in Tamil Nadu: A case–control study
[46]. Vrdelja M, Kraigher A, Vercˇicˇ D, Kropivnik S. The growing vaccine hesitancy: exploring the influence of the internet. Eur J Public Health. 2018;28(5):934–9.
[47]. Onnela J-P, Landon BE, Kahn A-L, et al. Polio vaccine hesitancy in the networks and neighbourhoods of Malegaon. India Soc Sci Med. 2016;153:99–106.
[48]. Shaw KM, Barker LE. How do caregivers know when to take their child for immunizations?. BMC pediatrics. 2005 Dec;5(1):1-6.
[49]. Mekonnen ZA, Gelaye KA, Were MC, Tilahun B. Acceptability, Barriers and Facilitators of Mobile Text Message Reminder System Implementation in Improving Child Vaccination: A Qualitative Study in Northwest Ethiopia. Journal of Multidisciplinary Healthcare. 2021;14:605.

[50]. Thompson EL, Daley EM, Washburn T, Salisbury-Keith K, Saslow D, Fontenot HB, Zimet GD. School-entry requirements for HPV vaccination: part of the patchwork for HPV-related cancer prevention. Human Vaccines & Immunotherapeutics. 2021 Jul 3;17(7):1975-9.
[51]. Priya P K, Pathak VK, Giri AK. Vaccination coverage and vaccine hesitancy among a vulnerable population of India. Human vaccines & immunotherapeutics. 2020 Jul 2;16(7):1502-7.
[52]. Srivastava T, Emmer K, Feemster KA. Impact of school-entry vaccination requirement changes on clinical practice implementation and adolescent vaccination rates in metropolitan Philadelphia. Human vaccines & immunotherapeutics. 2020 May 3;16(5):1155-65.
[53]. De PK, Timilsina L. Cash-based maternal health interventions can improve childhood vaccination—Evidence from India. Health Economics. 2020 Oct;29(10):1202-19.
[54]. UNICEF. Key Data. UNICEF India. [cited 2023 Apr 8]. Available from: https://www.unicef.org/india/key-data.

Article information

Manuscript Submitted: 02-01-2023
Manuscript Revised: 16-03-2023
Manuscript Accepted: 22-04-2023
Manuscript published: 31-07-2023

Scan here to access this article online.