AN OVERVIEW OF VACCINE DEVELOPMENT AGAINST EPIDEMIC INFECTIOUS DISEASES

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ABSTRACT:

People can now defend against scenarios of pandemics through vaccinations thanks to advances in biotech and the introduction of new ideas in this scientific community. The immunity of humans is greatly influenced by vaccines in their many forms. The evolution of vaccines has advanced significantly since the nineteenth century, and both government and non-governmental vaccination centres have increased in number in facilities. The recommended immunization schedule has also been modified and made more recent for infants, kids, adults, and the elderly. The confidence of the public in government and non-government hospitals differs despite the fact that both administer the identical vaccine. Currently, non-governmental vaccinations contribute significantly to people's immunization rates thanks to their extra benefits. This review discusses the differences in added ambience provided by independent hospitals, the juxtaposition of the vaccinations provided by these Governmental and Non-governmental hospitals, people's opinions about Governmental vaccination, and suggestions for tactics to enhance Governmental vaccination.

Keywords: pandemics, governmental and non-governmental vaccination centers, immunization, ambience, independent hospitals.

1. INTRODUCTION

We owe a lot of our overall well-being to vaccinations and immunization. Contrarily, there is a relationship between the phrase's immunization and vaccination. The term "vaccination" refers to receiving a dosage of a vaccine. It is possible to administer the vaccination orally or as an injection. The process of receiving a vaccination is referred to as immunization. Due to the body developing an immunity to the disease after vaccination, it aids in disease prevention [1].

1.1 IMMUNITY

The capacity of the body for immunity is its capacity to identify pathogens and thwart their ability to make you sick. Before harmful microbes may infect the body and create disease or damage, the immune system's role is to assist in identifying and getting rid of them. Adaptive and innate immunity are the two different categories.

1.1.1TYPES OF IMMUNITY

In accordance with how it develops, immunity can be either active or passive:

- **ACTIVE IMMUNITY**

The creation of memory cells follows the body's own generation of antibodies, which constitutes active immunity.

Examples:

Natural-When exposed to a pathogenic infection, the body naturally produces antibodies in response (also known as the threat and reaction model).

Artificial-A regulated exposure to an attenuated pathogen that results in the production of antibodies (i.e., vaccination) is referred to as artificial.

- **PASSIVE IMMUNITY**

Memory cells do not develop as a result of passive immunity, which is caused by the acquisition of antibodies from another source.

Examples:

Natural- Receiving antibodies from another creature naturally, such as when a neonate is given breastfeeding milk or colostrum during pregnancy.

Artificial -Getting produced antibodies from outside sources, such as blood transfusions of antibody monoclonal.

Due to the existence or absence of memory cells, passive immunity will not produce long-term immunity while active immunity will. Any number of natural or synthetic methods can produce both active and passive immunity [2].

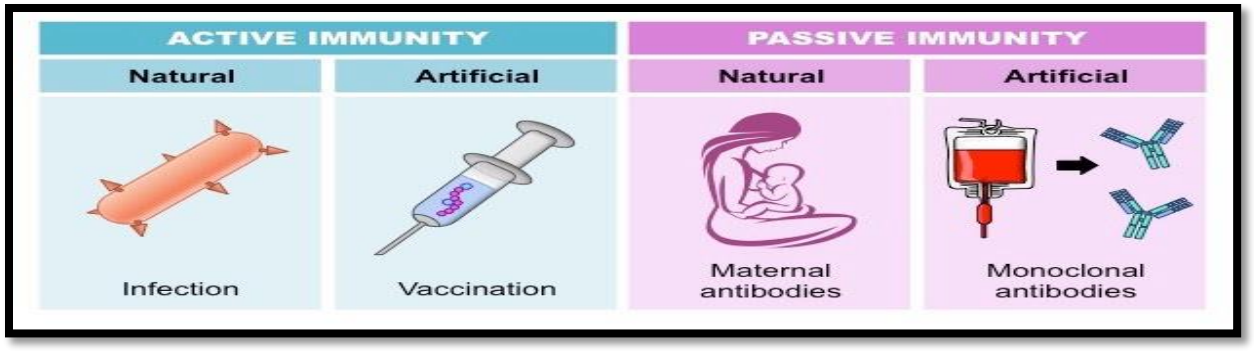


Figure 1: Types of immunity

2. WHY VACCINATION IS COMPULSORY

Reasons to Get Vaccinated

Vaccine-preventable diseases have not gone away. The viruses and bacteria that cause illness and death still exist and can be passed on to those who are unvaccinated and not protected. While many diseases are no longer common in the US, global travel makes it easy for diseases to spread. Vaccines will help keep you healthy. The Centers for Disease Control and Prevention (CDC) recommends vaccinations throughout your life to protect against many infections. When you skip vaccines, you leave yourself vulnerable to illnesses such as shingles, flu, and HPV and hepatitis B–both leading causes of cancer.

Vaccines are as important to your overall health as diet and exercise. Like eating healthy foods, exercising, and getting regular check-ups, vaccines can play a vital role in keeping you healthy. Vaccines are one of the safest preventive care measures available.

Vaccination can mean the difference between life and death. Vaccine-preventable infections can be deadly. Prior to the COVID-19 pandemic, approximately 50,000 adults died from vaccine-preventable diseases in the US each year.

Vaccines are safe. The US has a robust approval process in place to ensure that all licensed vaccines are safe. Potential side effects associated with vaccines are uncommon and much less severe than the diseases they prevent.

Vaccines cannot cause the diseases they are designed to prevent. Vaccines contain either killed or weakened viruses, making it impossible to get the disease from the vaccine.

Infants and older adults are at increased risk for serious infections and complications, but vaccine-preventable diseases can strike anyone, at any time. If you are young and healthy, getting vaccinated can help you stay that way.

Vaccine-preventable diseases are expensive. Diseases have a direct impact on individuals and their families, and also carry a high price tag for society as a whole, exceeding $10 billion per year. An average flu illness can last up to 2 weeks, typically with 5 or 6 missed work or school days. Adults who get hepatitis A lose an average of one month of work.

When you get sick, your children, grandchildren, and parents may also be at risk. Adults are the most common source of pertussis (whooping cough) infection in infants which can be deadly. When you get vaccinated, you help protect yourself and your family as well as those in your community who may not be able to be vaccinated.

In the US, millions of adults get sick from vaccine-preventable diseases each year, causing them to miss work and leaving them unable to care for those who depend on them, including children and/or aging parents.

VACCINATION

According to the WHO (World Health Organization), immunization is the process by which a person is given a vaccine and is subsequently made resistive to or immunity to a condition. Two to three million fatalities are currently prevented annually through vaccinations [3]. But diseases that can be prevented by vaccination claim the lives of over 1.5 million individuals each year. To maintain immunity and keep a person safe from further illnesses or diseases, the vaccination boosts the body's defense mechanisms [4][5]. A vaccination is the biologic approach which confers actively acquired defense against a specific contagious or cancerous malady [6][7].

2.1 COMPOSITION OF VACCINE

The ingredients in the vaccination include

- The body learns how to detect and combat infections if we come into contact with them later in life through exposure to the antigens, a weaker or destroyed version of the bacteria or virus.
- Immune-mediated response-boosting adjuvants.
- The use of chemicals to prolong the effectiveness of a vaccine.
- Vaccine stabilizing agents that safeguard them while they are moving or stored.

2.2 MILESTONES IN VACCINE[8]

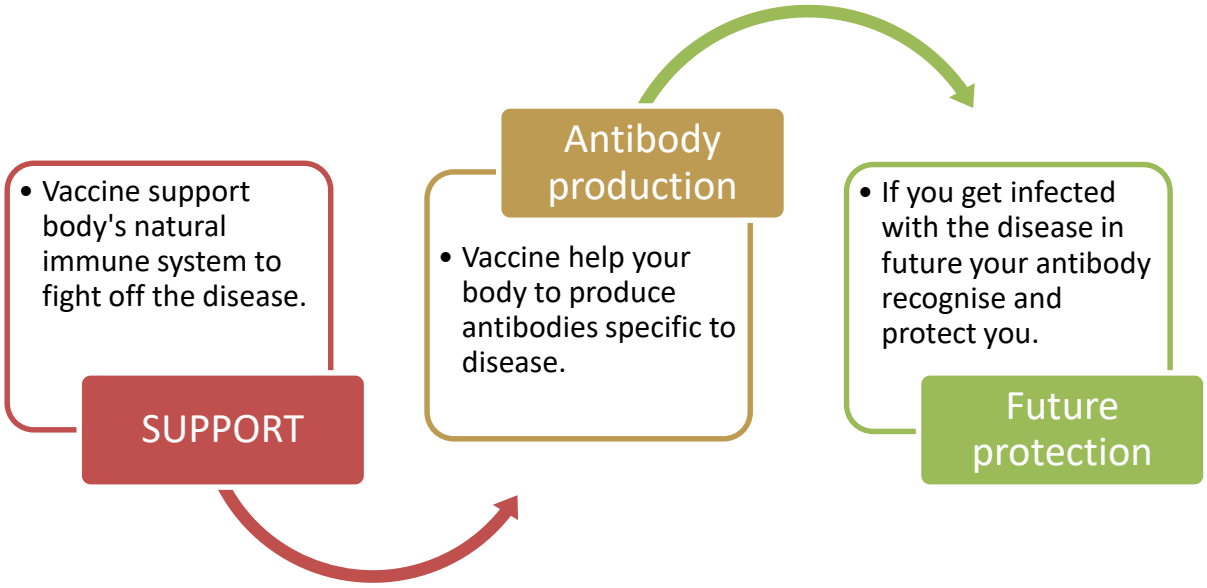
Table 1: Milestones of vaccine

CENTUARY	VACCINE FOR DISEASES (Year)
18th	Small pox (1796)
19th	Cholera (1880), Rabies (1885), Tetanus (serum antitoxin) (1890), Typhoid fever (1896), Bubonic fever (1897)
20th	Tuberculosis(1921), Diphtheria(1923), Scarlet fever(1924)0, Tetanus(tetanus toxoid)(1924), Pertussis(1926), Yellow fever(1932), Typhus(1937), Influenza(1937), Tick-borne encephalitis(1941), Polio(salk vaccine)(1952), Japanese encephalitis(1954), Anthrax(1954), Adeno virus-4 and 7(1957) oral polio(sabin vaccine)(1962), Measles(1963), Mumps(1967), Rubella(1970), Pneumonia(1977), Meningitis(1978), Hepatitis B(1981), Chicken pox(1984), Hemophilus Influenzae type B(1985), Q fever(1989), Hantavirus hemorrhagic fever with renal syndrome(1990), Hepatitis A(1991), Lyme disease(1998),

	Rotavirus(1998)
21st	Pneumococcal conjugate vaccine(2000), Nasal influenza vaccine(2003), Argentine hemorrhagic fever(2003), Human papillomavirus(2006) , Herpes zoster vaccine(2006), Hepatitis E(2012), Quadrivalent (4-strain) influenza vaccine(2012), Enterovirus 71(2013), Malaria(2015), Dengue fever(2015), Ebola(2019), COVID-19(2020), Respiratory syncytial virus vaccine(2023)

Figure 2: Vaccination.

2.3 WORKS OF VACCINATION [9]



3. AVAILABLE VACCINE TECHNOLOGIES

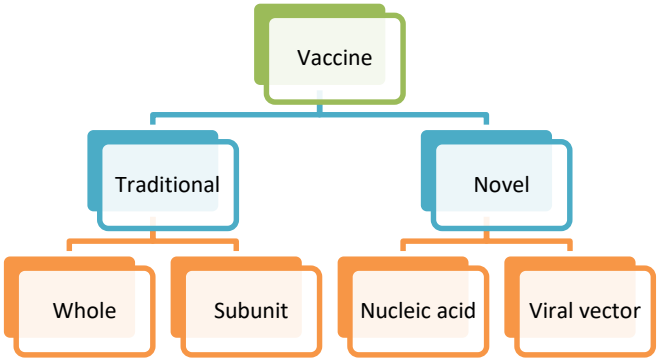
Vaccines come in a wide variety of forms. Each type is intended to instruct the body's immune system how to combat particular bacteria and the deadly illnesses they bring about [10][11].

3.1 CONDITIONS OF DESIGNING VACCINE [12]

Vaccines are developed by experts who take into account:

- The way the pathogen affects your immune system.
- Who should get the disease vaccine.
- The most effective method or technique for developing the vaccination.

3.2 VACCINE TECHNOLOGIES



- The earliest vaccines to be created were the traditional ones. They typically comprise whole infections or pathogenic components that are immediately recognised by the body's defence cell. The oldest vaccinations are against whole pathogens, and several studies have proven their effectiveness.
- For more recent or chronic illnesses that need for an even more targeted attack on certain antigens, traditional methods of establishing immunity may be inadequate. As a result, novel techniques for administering pathogenic antigens have been created.
- In place of the targeted pathogen, novel vaccines recently developed depend on pathogenic nucleic material or other alternative vector delivery mechanisms. Structure-based immunogen design, gene-based vaccine platforms, and the integration of recombinant antigens with powerful adjuvants are examples of novel approaches to vaccine development [13].

3.3 VACCINES TYPES [14][15][16]

There are numerous vaccination varieties, including:

- Vaccines that are inactive
- Vaccines made using live virus
- Vaccines using messenger RNA (mRNA)
- Vaccinations that are subunit, recombinant, polysaccharide, and conjugate
- Vaccinations for toxins
- Vaccinations for viral vectors

3.3.1 DEAD OR INACTIVATED VACCINATIONS

Typically, a thermal (application of high temperature) or chemical (formalin, etc.) treatment is used to destroy or inactivate the disease-causing bacteria. When these vaccines are given, the body responds with a strong immune response that resembles the majority of the reactions that occur during an illness.

Composition: Killed or non-replicating bacteria/ viruses

Examples: Typhoid vaccine, Influenza vaccine, Salk polio vaccine, Hepatitis A vaccine.

3.3.2 VACCINES MADE USING LIVE VIRUS

Vaccines that are live but have been weakened. Genetic engineering is used to weaken pathogens like viruses and bacteria, which limits their ability to multiply and prevents the host from becoming ill.

A pathogen-related organism that grows unfavorably in humans is employed in some modified live vaccination formulations. Similar to when a person is infected by a naturally occurring disease, the pathogen that has been weakened causes the host to respond broadly to the immune system.

Composition: Live weakened bacteria/ viruses

Examples: Oral Sabin polio vaccine, MRV Vaccine (Measles, Mumps, Rubella, and Varicella), Nasal influenza vaccine, Bacille Calmette-Guerin (BCG) vaccine, Varicella vaccine, Rotavirus vaccine.

3.3.3VACCINES USING MESSENGER RNA (mRNA) [17][18]

For the reason to elicit an immunological response, mRNA vaccines produce proteins. In comparison to other vaccinations, mRNA vaccines provide a number of advantages, such as quicker production times and no chance of infection in the person receiving the vaccine because they don't contain live viruses.

Composition: mRNA encoding a specific bacterial/ viral protein

Example: COVID-19.

3.3.4 SUBUNIT VACCINE

Specific parts of the germ, like its protein, sugar, or capsid (the covering that surrounds the germ), are used in subunit, recombinant, polysaccharide, and conjugate vaccines [19].

These vaccines produce a very potent immune response that is specifically directed at important germ components since they only use particular portions of the germ. Additionally, they can be administered to practically anyone who requires them, including those with compromised immune systems and ongoing medical conditions.

You could require booster shots to maintain your immunity to infections, which is one drawback of these vaccines.

- **Conjugate Vaccine:**

Polysaccharide vaccines, which were previously manufactured utilizing sugar molecules that are found on the bacteria's surface, were discovered to be less effective in infants and young children. Scientists found that chemical linking or conjugating the bacterial polysaccharide molecules to a carrier protein can improve the efficacy of these vaccinations [20].
The incorporation of additional proteins gives the antigen the immunological characteristics of the carrier, resulting in a greater immune response that is also suitable for smaller kids.
Composition: Bacterial/ viral polysaccharide antigen conjugated to toxoids
Example: Haemophilus influenza type b (Hib) conjugate vaccine, Pneumococcal conjugate vaccine, Meningococcal C conjugate vaccine.

- **Recombinant vaccine:**

A small amount of the disease-causing bacterium's or virus's DNA is extracted to create a recombinant vaccine. The specific gene is placed onto a plasmid or another vehicle that acts as a carrier, allowing for the creation of copious amounts of precisely defined proteins that are later used to create vaccines.
Composition: Bacterial/ viral protein fragments
Example: Hepatitis B vaccine, Human papillomavirus (HPV) vaccine.

3.3.5 VACCINE AGAINST TOXOIDS:

Some harmful bacteria attack the body and release toxin or deadly proteins. Toxoids, which resemble toxins but are not toxic, are the name given to some vaccinations created by chemically inactivating these toxins. A powerful immunological reaction is brought on by them [21].
Composition: Inactivated bacterial/ viral toxin.
Example: Diphtheria vaccine, Tetanus vaccine, Pertussis vaccine

3.3.6 VIRAL VECTOR VACCINES

Viral vector vaccines give immunity by using an altered version of another virus as a vector. The influenza virus, the vesicular stomatitis virus (VSV), the measles virus, and the adenovirus that causes the common cold have all been utilized as vectors. One of the viral vectors employed in various COVID-19 vaccines being tested in clinical studies is adenovirus.
Composition: Non-pathogenic viruses with genes encoding specific viral/ bacterial antigen
Example: COVID 19 vaccine.

3.3.7 DNA/RNA VACCINES

The pathogenic bacteria, virus, or genetic material—DNA or RNA—is delivered into the human cells, where the cell system then works to generate the protein that has been encoded by the pathogen's insertion gene(s). Such a protein is recognized as a foreign substance by our immune system, which then mounts an attack on the entire infection [22].
Composition: DNA encoding a specific bacterial viral protein

Example: Various nucleic-acid vaccines, such as the HIV vaccine, are now in the development, pre-clinical, and clinical evaluation phases.

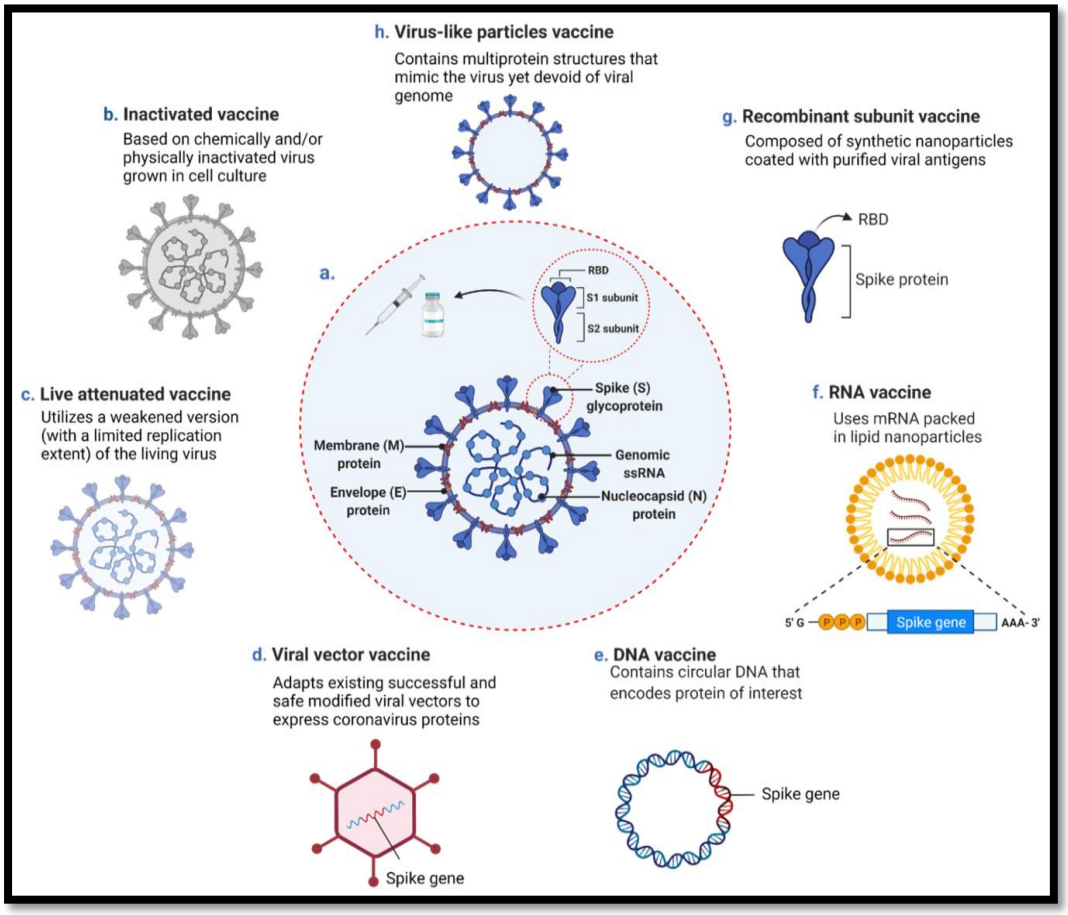


Figure 3: Types of vaccine

4. IMPORTANCE OF VACCINATION

- Diseases that used to regularly damage or kill infants, toddlers, and adults have been considerably reduced by vaccinations. Your child can now be protected against a wider range of diseases thanks to advancements in medical science. Since safe and effective vaccines have been developed, many diseases that once sickened or killed millions of children have been fully eradicated, and others are almost extinct[23][24].
- Kids is protected by vaccinations from deadly diseases including polio, which can paralyze victims, measles, which can result in brain enlargement and blindness, and tetanus, which can cause severe muscle contractions, difficulties breathing and eating, especially in infants.
- **Difficulties** include, there are very few major negative effects associated with vaccinations. Nearly all illnesses or discomfort that follow vaccinations are small and transient, such as a sore injection site or a low-grade fever. These are frequently manageable by taking over-the-counter painkillers as prescribed by a doctor, or by applying a cold compress to the injection site

4.1 VACCINATION CHART FOR INFANT AND CHILDREN [25][26][27][28][29]

- **AT BIRTH**

AGE	VACCINES	NO. OF DOSES	ABBREVIATION
Birth	Bacillius Calmette – Guerin (BCG)	1	BCG
	Oral polio vaccine (OPV O)	1	OPV
	Hepatitis B (Help – B1)	1	Hep-B

- **AT 6 WEEKS**

AGE	VACCINES	NO. OF DOSES	ABBREVIATION
6 Weeks	Oral polio vaccine (OPV 1)	1	OPV 1
	Pentavalent vaccine -1 (Penta 1) – Diphtheria, Pertussis, Tetanus, Hepatitis B, HiB	1	Penta 1 (DPT-HepB-HiB)
	Rotavirus 1	1	Rotavirus
	Pneumococcal conjugate vaccine (PCV 2)	1	PCV

- **AT 10 WEEKS**

AGE	VACCINES	NO. OF DOSES	ABBREVIATION
10 Weeks	Oral polio vaccine (OPV 2)	1	OPV 2
	Pentavalent vaccine -2 (Penta 2) – Diphtheria, Pertussis, Tetanus, Hepatitis B, HiB	1	Penta 2 (DPT-HepB-HiB)
	Rotavirus 2	1	Rotavirus
	Pneumococcal conjugate vaccine (PCV 2)	1	PCV

- **AT 14 WEEKS**

AGE	VACCINES	NO. OF DOSES	ABBREVIATION
14 Weeks	Oral polio vaccine (OPV 3)	1	OPV 3
	Pentavalent vaccine -3 (Penta 3) – Diphtheria, Pertussis, Tetanus, Hepatitis B, HiB	1	Penta 3 (DPT-HepB-HiB)
	Rotavirus 3	1	Rotavirus
	Pneumococcal conjugate vaccine (PCV 3)	1	PCV
	Inactivated Polio Vaccine (IPV)	1	IPV

- **AT 9 MONTHS**

AGE	VACCINES	NO. OF DOSES	ABBREVIATION
9 months	Measles, Mumps, and Rubella (MMR – 1)	1	MMR
	Japanese Encephalitis 1 (JE – 1)	1	JE

- **AT 9 TO 12 MONTHS**

AGE	VACCINES	NO. OF DOSES	ABBREVIATION
9 to 12 Months	Typhoid Conjugate Vaccine	1	Typhoid Conjugate Vaccine

- **AT 12 MONTHS**

AGE	VACCINES	NO. OF DOSES	ABBREVIATION
12 Months	Hepatitis – A (Hep – A1)	1	Hep – A

- **AT 15 MONTHS**

AGE	VACCINES	NO. OF DOSES	ABBREVIATION
15 Months	Measles, Mumps and Rubella (MMR – 2)	1	MMR
	Varicella 1	1	Varicella
	PCV Booster	1	PCV

- **AT 16 TO 18 MONTHS**

AGE	VACCINES	NO. OF DOSES	ABBREVIATION
16 to 18 months	Inactivated polio vaccine (IPV B1)	1	IPV
	Haemophilus influenza type B (Hib B1)	1	Hib

- **AT 18 MONTHS**

AGE	VACCINES	NO. OF DOSES	ABBREVIATION
18 months	Hepatitis A (Hep – A2)	1	Hep – A
	OPV Booster	1	OPV

- **AT 2 YEARS**

AGE	VACCINES	NO. OF DOSES	ABBREVIATION
2 years	Booster of Typhoid Conjugate Vaccine	1	Typhoid Conjugate Vaccine
	DPT 1st booster	1	DPT
	Japanese Encephalitis 2 (JE -2)	1	JE

- **AT 4 TO 6 YEARS**

AGE	VACCINES	NO. OF DOSES	ABBREVIATION
4–6 years	Varicella 2	1	Varicella
	Measles, Mumps, and Rubella (MMR – 3)	1	MMR
	DPT 2nd booster	1	DPT

- **AT 10 TO 12 YEARS**

AGE	VACCINES	NO. OF DOSES	ABBREVIATION
10 – 12 years	Tdap/Td	1	Tdap
	Human Papilloma Virus (HPV)	1	HPV
	Tetanus Toxoid – 1 (TT-1)	1	TT

- **AT 16 YEARS**

AGE	VACCINES	NO. OF DOSES	ABBREVIATION
16 years	Tetanus Toxoid – 2 (TT-2)	1	TT

4.2 VACCINATION CHART FOR PREGNANT WOMEN

In order to protect women's health and the health of their unborn children, several vaccinations are secure and advised for use before, during, and after pregnancy. The antibodies that mothers produce in response to these vaccinations not only shield them, but also cross the placenta and assist in shielding their unborn children from deadly infections in infancy. A mother's risk of contracting a serious illness and passing it on to her unborn child is reduced by vaccination during pregnancy [30][31].

- **FOR PREGNANT WOMEN**

Vaccines	Dose	Route	Site
TT1 Early in pregnancy	0.5 ml	Intra muscular	Upper arm
TT2 Four weeks after TT1	0.5 ml	Intra muscular	Upper arm
TT Booster If received 2 TT doses in a pregnancy within the last 3 years	0.5 ml	Intra muscular	Upper arm

5. VACCINATION SITE AND THEIR DIFFERENCES

The vaccination offered by the government and non-governmental entities today is the same, but their levels of trust are different. Because it is incorrect for governmental agencies to believe in parents or humanity. Perhaps the private groups' modern facilities are at fault for this[32].

5.1 GOVERNMENTAL VACCINATION

- In the past, many from wealthy households had the misconception that government hospitals were overcrowded, unhygienic, and doubtful of the efficacy of vaccine**s.**
- Government hospitals do not offer options like the possibility of a combination of two vaccines, a painless or feverless injection technique, or the capacity to administer an injection at the ideal moment.
- The benefits of this vaccination include its affordability and the fact that many private doctors recommend government vaccination for most parents to provide their children as the primary vaccination is carried out in these public institutions [33].
- **THE COST-FREE VACCINE:** As the world commemorates World Vaccination Day, India's Universal Immunization Programme (UIP) continues to be crucial in preventing serious illnesses in infants and young children. The government is offering free vaccinations to babies as part of mission Indradhanush to ensure their protection against illnesses including tuberculosis, hepatitis B, polio, and pneumococcal disease, among others [34].
- Starting at birth and continuing through age five, these vaccinations are given to children at distinct developmental stages.
- You can sign up your kid for the UIP using the following procedure:

  1. Register the child for the UIP at the local Primary Health Center (PHC) or government hospital. The program registration form asks for your child's name, birthdate, and other personal information.

  2. smartphone application: To register your child under UIP, the Indian government has released the "Immunization" smartphone application. The Google Play Store and Apple App Store both offer downloads for the program.

  3. Anganwadi Centers: These government-run child development centers offer a variety of services, including immunization, and you can register your child for the UIP there as well.

5.2 PRIVATE VACCINATION

People prefer private vaccination for

- Painless injection,
- Feverless injection and
- Self convinient like no need of waiting in queue for vaccine.
- Parents can select the combination vaccine needed for their child in convinient way.

5.2.1 Painless injection-

- Seeing the babies we love scream while getting their shots can be difficult. We don't want to see children in pain, but we do want a solution that shields them from illnesses for a very long period[35].
- The term "painless vaccination" refers to the injection of a vaccine without significantly hurting or upsetting the recipient. The DaPT vaccine is another name for the painless immunization. In one dose, this combination vaccination provides protection against tetanus, diphtheria, and acellular pertussis (whooping cough).
- Because it contains less antigen than conventional immunizations, it can be administered in more manageable dosages with little to no discomfort[36][37].

Figure 4: Painless vaccination

S. NO	DaPT Vaccine	DPT Vaccine
1.	It is painless	It is painful
2.	Usually, Needle-free, delivered through a jet injector	Administered with a needle
3.	Fewer side effects reported	More common side effects reported, such as fever, pain, and swelling at the injection site

5.2.2 PRICES OF VACCINE IN PRIVATE HOSPITALS

Private hospitals provide extra services including painless, feverless injections; the cost depends on the patient's needs. When consulting the websites and papers, some vaccine costs are put down; these costs may vary depending on the year. [38][39].

AGE	Vaccine	Price
Birth	BCG OPV Hepatitis B (1st)	BCG - Rs.60 OPV - Rs.230 Hepatitis B - Rs.175
6 weeks/ 2 Months	OPV/IPV (1st) Hepatitis B (2nd) DTwP/DTaP (1st)	IPV - Rs.700 Hepatitis B - Rs.175 DTaP - Rs.800

	Rotavirus (1st) HiB (1st) PCV (1st)	DTwP - Rs.50 DPT + HiB - Rs.600 Rotavirus - Rs.1500 PREVANAR-13 (PCV) - Rs.3800 Synflorix (PCV) - Rs.1800
10 weeks/ 4 Months	OPV/IPV (2nd) DTwP/DTaP (2nd) HiB (2nd) PCV (2nd) Rotavirus (2nd)	IPV - Rs.700 DTwP + HiB - Rs.600 DTaP - Rs.800 DTwP - Rs.50 Rotavirus - Rs.1500 PREVANAR-13 (PCV) - Rs.3800 Synflorix (PCV) - Rs.1800 DPT + HIB (EASY FOUR) - Rs.575 DPT + HiB + HepB (PENTAVAC) - Rs.550 DTaP + HIB + IPV (PENTAXIM) - Rs.2495
14 weeks/ 6 Months	OPV/IPV (3rd) Hepatitis B (3rd) HiB (3rd) DTwP/DTaP (3rd) PCV (3rd) Rotavirus (3rd)	IPV - Rs.700 Hepatitis B - Rs.175 DTwP + HiB - Rs.600 Rotavirus - Rs.1500 PREVANAR-13 (PCV) - Rs.3800 Synflorix (PCV) - Rs.1800 DPT + HIB (EASY FOUR) - Rs.575 DTwP + HiB + HepB (PENTAVAC) - Rs.550 DTaP + HIB + IPV (PENTAXIM) - Rs.2495
9 Months	MMR (1st)	MMR - Rs.500
12 Months	Hepatitis A (1st)	Hepatitis A - Rs.1400
15 Months	MMR (2nd) Varicella (Chickenpox) PCV (Booster)	MMR - Rs.500 Varicella - Rs.1900 PREVANAR-13 (PCV) - Rs.3800 Synflorix (PCV) - Rs.1800
18 Months	DTwP/DTaP (1st Booster) OPV/IPV (1st Booster) Hepatitis A (2nd)	DTaP - Rs.800 DTwP - Rs.50 IPV - Rs.700 Hepatitis A - Rs.1400
2 Years and then 3 Years	Typhoid Booster Typhoid Booster	Typhoid - Rs.300
5 Years	DTwP/DTaP (2nd Booster) OPV/IPV (2nd	DTaP - Rs.800 DTwP - Rs.50 IPV - Rs.700

	Booster) MMR (Booster) Varicella (Chickenpox) (Booster)	MMR - Rs.500 Varicella - Rs.1900
10 Years	Td/Tdap	Tdap - Rs.1100
10-12 Years	Human Papilloma Virus (HPV)	Cervarix - Rs.2200 Gerdasil - Rs.3200

5.2.3 AVAILABLE COMBINATION VACCINES [39]

Vaccine Name	Combines	Protection from
Pediarix	DTaP + Hep B + IPV	**5diseases** (Diphtheria, tetanus, pertussis, hepatitis B, and polio)
Pentacel	DTaP + IPV + Hib	**5diseases** (Diphtheria, tetanus, pertussis, polio, and Hib (*Haemophilus influenzae* type b))
Kinrix Quadracel	DTaP + IPV	**4diseases** (Diphtheria, tetanus, pertussis, and polio)
Vaxelis	DTaP + IPV + Hib + HepB	**6diseases** (Diphtheria, tetanus, pertussis, polio, hepatitis B, and Hib (*Haemophilus influenzae* type b))
ProQuad	MMR + varicella (chickenpox)	**4diseases** (measles, mumps, rubella, and varicella)

6. DISCUSSION

Early childhood immunization is crucial because it helps build immunity before kids are exposed to illnesses that could be fatal. Vaccines are examined to make sure that giving them to kids at the suggested ages is both safe and effective. Each day, many pathogens are exposed to children. This occurs as a result of the things that people put in their mouths, breathe in, and eat. Although babies are born with immune systems that can combat the majority of germs, some bacteria can cause serious or even fatal diseases that a baby cannot control. Babies require vaccination assistance for those reasons. Even while children receive multiple vaccinations up until their second birthday, and occasionally multiple vaccinations during a single office visit,

the immune system is not overloaded by these vaccinations. Antigens in vaccines are used in very little quantities to train your child's immune system to recognize and combat dangerous infections. The components of a germ known as antigens activate the immune system by exposing the body to them. It is crucial to ensure that children receive the appropriate immunizations and well-child visits in order to keep them healthy. Vaccine-unprotected children are more susceptible to illnesses like measles and whooping cough. Particularly for infants and young children, these illnesses can be exceedingly dangerous and are highly contagious. There have been outbreaks of these illnesses in recent years, particularly in areas where vaccination rates are low. Children who qualify for the immunizations for Children (VFC) program receive immunizations at no cost. 3,000 antigens were employed in vaccines thirty years ago to protect children against eight diseases by the age of two. By the time a child is two years old, 305 antigens are used in immunizations to protect against 14 diseases. Each vaccine aids in the body's immune system's development of its ability to combat pathogens in a different way. Following vaccination, immunity usually takes a few weeks to develop, but that immunity can last a lifetime. Occasionally administering booster doses of some vaccines, such those for the seasonal flu or tetanus, is necessary to keep the body's defenses in place. Vaccines are being given out by both governmental and non-governmental organizations, although the results are different in each case. For the comfort of themselves and their children, many parents favor mostly private areas. It's crucial for parents to consider advice for their children, such as a course of immunizations. Although there aren't any significant adverse reactions from immunizations, individuals nonetheless view pain and fever as significant ones. Private sector vaccinations that are painless and feverless could potentially be considered. Perhaps state-of-the-art equipment and environment will affect private immunizations. In contrast to private clinics, the government uses a lot more vaccines when there is a pandemic. Government immunization programs for children have not been expanded, though. Seminars and advertisements should be conducted to increase public knowledge of vaccination initiatives.

7. CONCLUSION

Population health makes for a healthier country. Vaccination help make humans more immune to outbreaks of disease. Vaccines instruct your body's defenses on how to produce antibodies that shield you from disease. Although there are differences between government and non-governmental organizations, improvements in facilities, diagnoses, treatments, and prevention are updated annually. Despite concentrating on their convenience, people may consider how to care for their children and forget their false beliefs, which may strengthen confidence in government immunization. This review's resolution calls for different initiatives, including holding talks, implementing updated policies, publicity, and educating patients about the similarities between privately and publicly funded immunization programs.

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