

Vaccines; What to do and what not to do

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Abstract

As vaccines have saved millions of lives, these are considered among the greatest advancements of current era. They are widely used in humans and animals. Vaccines are also responsible for decreasing the antimicrobial resistance. However, misinformation regarding vaccines leads to a problem known as vaccine hesitancy. Vaccine hesitancy causes people to avoid vaccinations which can lead to the outbreak of different diseases. So in order to prevent the development of misinformation regarding vaccinations, other steps should be taken. A person should be informed about the side effects of a vaccine and necessary steps should be taken to avoid the appearance of side effects of vaccine such as the use of steroids, epinephrine, or antihistaminic agents in order to prevent hypersensitivity induced by vaccines. Furthermore, vaccines should not be administered to diseased persons or immunocompromised persons as their immune competency regarding vaccines will not be the same as immunocompetent people. In this way, effective vaccinations can be administered.

Keywords: Vaccines, Hesitancy, Vaccinations, Prevent, Misinformation

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Introduction

Vaccine is an important part of modern healthcare systems in combating various diseases (Kayser & Ramzan, 2021). Vaccines have saved millions of lives (Orenstein & Ahmed, 2017). More than 10 million lives have been protected because of vaccines in the past 50 years (Olshansky & Hayflick, 2017). Vaccines have an extraordinary effect on health (Rappuoli et al., 2019) and have much lower chances of developing resistance as compared to antimicrobial agents (Kennedy & Read, 2018; Micoli et al., 2021). Vaccines are considered among the greatest developments of the last decade (Vetter et al., 2018). Other than the health benefits of vaccines, vaccines also have economic and social benefits (Rodrigues & Plotkin, 2020). Vaccines have remained among the most effective and reliable means to prevent several diseases which ensures the benefits for mankind (Hajj Hussein et al., 2015). Vaccines also decrease the disease's burden on animal populations (Jorge & Dellagostin, 2017). Vaccines are also alternatives to the use of antimicrobial agents in food-producing animals, thus eliminating the presence of antimicrobial residues in animal products (Hoelzer et al., 2018).

However, vaccine hesitancy has been developed due to the misinformation as a result of which some individuals reject or question vaccines, leading to the outbreak of diseases which is a major concern. Although vaccines have got major advancements, still the public confidence in vaccines has declined, as a result of a lacking trust (Bezbaruah et al., 2024). Some people believe that vaccines have severe side effects, some think that vaccines have not been through sufficient clinical trials and some think that vaccines have a chance to cause infection (Kreps et al., 2021). In the past time, uptake of vaccination was low because of dependency upon the global supply now vaccine hesitancy has been developed which is a cause for lack of uptake of vaccination (MacDonald, 2015; Zhang et al., 2022). Vaccines are targeted even though they have safeguarded and will keep saving millions of lives. Critiques are primarily directed at vaccine safety. Vaccine reluctance has been greatly aided by the quick spread of misleading information and even conspiracy theories online. One of the top 10 dangers to world health in 2019, according to the World Health Organization, is vaccination hesitancy. Inactivating agents, adjuvants, preservatives, and novel technologies like genetic vaccines are among the most prevalent concerns that parents and patients have regarding the safety of vaccines. There have generally been growing concerns about side effects, which could contribute to a growing distrust of scientific findings and, consequently, the scientific method (Löffler, 2021). This chapter emphasizes the importance of precautions before vaccination, during vaccination, and after vaccination.

1. Vaccines, what to do

Before the administration of vaccines, health personnel must identify the presence of diseases that may promote severe harmful events

present in the vaccines. Conditions which may reduce vaccine efficacy should also be identified (Opri et al., 2018). Immune competence should be checked before vaccination and be ensured by a pre-vaccination checklist (Speth et al., 2018). Hospitals should be used as places to administrate the vaccines. Healthcare institutions should have such facilities (Kroger et al., 2023). To make immunization programs successful, the public should participate in these programs efficiently because the efficacy of vaccines depends upon the trust of people in vaccination programs along with the quality of vaccines (Pierik, 2020). Before the vaccination, there should be a decision on whether a patient receives a vaccine according to the guidelines. Before the vaccination, the route of administration of the vaccine should be decided. Furthermore, comfortable levels of both the vaccinator and the patient should also be accessed (Charles et al., 2016). Before the administration of the vaccine, a vaccinator should use a mask and hand sanitizer to prevent the spread of diseases as the asymptomatic patients may be present in the healthcare facilities to receive a vaccine (Mohammadi et al., 2022). Before vaccinating people against diseases, people should be given information about the vaccines so that the adaption of preventive measures and vaccination could be possible against that disease (Wang et al., 2023). Similarly, before the administration of vaccines, the efficacy of a certain type of vaccine against a specific disease should be considered (Grohskopf et al., 2015). Before vaccine administration, the public health professionals should communicate effectively with the patients so that misconceptions regarding the vaccine can be minimized (Ward et al., 2019). Before the availability of vaccines on a larger scale, there should be some agreement between the vaccine sources and patients to receive the vaccine first as it will increase the interest of the general public regarding the vaccines (Volpp et al., 2021). Many people reject childhood vaccination programs because of a lack of communication with healthcare professionals and they consider that effective communication by healthcare professionals can make them receive childhood vaccines (Rumetta et al., 2020). Some people ignore the importance of vaccines because of the complementary and alternative medicine so healthcare professionals should communicate with the public regarding it (Attwell et al., 2018). Vaccine scheduling also depends upon the time required for drug clearance (Papp et al., 2019). Evidence-based interventions should be considered to increase timely immunization (Kempe et al., 2015).

Vaccines are different from other medicines as they are administered to healthy population. As a result, there is a low tolerance for potential side effects. The safety evaluation of vaccines is a long process starting from the non-clinical assessment of its components in terms of purity and stability to the clinical assessment of vaccines. So the vaccines should have minimum side effects (Di Pasquale et al., 2016). Hypersensitivity can occur because of vaccination either due to the active component of the vaccine, antigen, or because of other components (McNeil & DeStefano, 2018). Rarely, hypersensitivity reactions occur after immunizations, and they are categorized as immediate if they happen within the first four hours of injection and non-immediate if they happen later. The most frequent side effect after vaccination injection is a local response, which typically doesn't need an allergy test. However, immediate reactions necessitate an allergy workup and may be IgE-mediated. Generally speaking, a known food allergy such as to milk or eggs does not exclude receiving a vaccination. Patients with a known sensitivity to gelatin, yeast, latex, antibiotics, or other specific components of vaccinations require an allergy workup before delivery of the vaccine (Sarti et al., 2020). Vaccine-induced hypersensitivity can be managed in three steps. The first step is to identify any possible risk of hypersensitivity based on previous clinical findings of a patient. The second step is the identification of a systemic response to the vaccine and the third and last step comprises medical management (Hung et al., 2022). Vaccine-induced hypersensitivity can be minimized through the use of antihistaminic agents which relieve itching (Sokolowska et al., 2021; Zuberbier et al., 2022). Epinephrine and corticosteroids also beneficial for the management of vaccine-induced hypersensitivity (Liyanage et al., 2017). However, corticosteroids are not recommended for use at all (Muraro et al., 2022).

Currently, the growing numbers of vaccination administrations are related to higher reports of adverse vaccine reactions. Although allergic responses and other general adverse responses brought on by the vaccination or its ingredients are uncommon, they can occasionally be extremely dangerous and even lethal. Proteins are the main allergens in many IgE-mediated reactions including immediate-type allergic reactions. In patients with immediate-type vaccine reactions, a precise examination followed by algorithms is essential for the proper diagnosis, treatment, and choice about re-vaccination if an allergy is suspected. In any place where vaccines are given, facilities and medical personnel should be on hand to manage acute hypersensitivity reactions or anaphylaxis (Chung, 2014). A complete workup is required for patients with a history indicative of an immediate IgE-mediated hypersensitivity. In nearly all cases, the vaccines can be administered using modified protocols, even if the allergy tests are positive. Overdiagnosis of vaccine allergy is frequent and is regarded as a major public health issue. The diagnosis of vaccine allergy is complex and is frequently retained due to fear of severe anaphylactic reactions. This is especially true for patients who develop localized reactions or delayed benign skin rashes (Caubet & Ponvert, 2014).

To provide life-saving defenses against infectious diseases globally, it is crucial to maintain ideal conditions for the transportation and storage of vaccines. Monitoring temperatures across the cold chain and collecting evidence that standards have been met to protect the products' quality and integrity are crucial for guaranteeing vaccine potency. Documented proof that is necessary to confirm vaccine quality from the manufacturer's place of origin to the immunization site is provided by tracking, documenting, and reporting vaccine temperatures across the supply chain (Kartoglu & Ames, 2022). To produce stable, effective vaccine dosage forms for human use, effective formulation strategies must address several interrelated topics, such as stabilization of antigens, selection of suitable adjuvants, and development of stability-indicating analytical methods. Vaccine instability frequently arises as a major challenge during clinical development as well as commercial distribution (Kumru et al., 2014). Although healthcare systems have included cold chain management, which has made it possible to administer vaccinations effectively in both urban and rural locations, the COVID-19 virus has presented completely new difficulties for vaccine distribution. Since almost everyone on the planet is affected, methods are required to create optimal vaccine delivery scenarios, taking into account cost, storage, and transportation. The extent of the distribution efforts required in a pandemic, particularly the goal of vaccinating whole populations, is not taken into account by current models (Manupati et al., 2021). Maintaining the cold chain for vaccine storage is crucial to preventing changes in the composition, potency, and effectiveness of immunobiological products, which are temperature-sensitive products (Albano de Azevedo Guimarães et al., 2018). The cold chain is maintained for immunobiological conservation to shield vaccines from exposure to low or high temperatures, which can cause power losses and compromise the vaccine's ultimate immunological effect in addition to raising the risk of adverse events after vaccination (Lloyd et al., 2015; Pursell, 2015). Vaccines, what to do have been summarized in table 1.

2. Vaccines, what not to do

Seroprotection provided by vaccines is considerably lower in immunocompromised people as compared to immunocompetent people (Beck et al., 2012; Lopez et al., 2017; Ryan, 2021; Balcells et al., 2022a; Balcells et al., 2022b). A population is heterogeneous regarding vaccination as different immunocompromised people have different levels of immunosuppression and their response to infection varies (Martire et al., 2018). Immunocompromised patients do not respond to vaccination in a manner the immunocompetent people. As a result, vaccines should not be administered in immunocompromised people (See, 2022). In immunocompromised people, live-attenuated vaccinations should be inhibited specifically (Mohme et al., 2020). As the immune response in immunocompromised people is inadequate, it is not preferable to administer vaccines to these people (Alnaimat et al., 2023). Seroconversion rates are significantly lower in immunocompromised patients (Lee et al., 2022).

Table 1: Vaccines, what to do

Vaccines, what to do	References
Events responsible for reducing efficacy of vaccines should be identified	Opri et al., 2018
Immune competence should be accessed	Speth et al., 2018
Vaccines should be administered at hospitals	Kroger et al., 2023
Participation of public in immunization programs	Pierik, 2020
Decision of route of administration	Charles et al., 2016
Adaptation of personal protection equipments at time of administration of vaccines	Mohammadi et al., 2022
Information to public regarding vaccination	Wang et al., 2023
Consideration of efficacy of vaccine	Grohskopf et al., 2015
Communication between public health professionals and patients	Ward et al., 2019
Agreement between vaccine sources and patients	Volpp et al., 2021
Communication about childhood vaccination	Rumetta et al., 2020
Communication of relation of vaccines with complementary and alternative medicine	Attwell et al., 2018
Vaccine scheduling	Papp et al., 2019
Evidence-based interventions to promote timely immunizations	Kempe et al., 2015
Side effects of vaccines should be minimum	Di Pasquale et al., 2016
Management of vaccine-induced hypersensitivity	Hung et al., 2022
Administration of antihistaminic agents along with vaccine	Sokolowska et al., 2021; Zuberbier et al., 2022
Administration of corticosteroids and epinephrine	Liyanage et al., 2017
Through examination to check vaccine allergy	Chung, 2014
Administration of vaccine through modified ways	Caubet & Ponvert, 2014
Ideal conditions for the transportation and storage of vaccines	Kartoglu & Ames, 2022
Stabilization of antigens, selection of suitable adjuvants, and development of stability-indicating analytical methods	Kumru et al., 2014
Cold chain maintenance of vaccines	Lloyd et al., 2015; Purssell, 2015; Albano de Azevedo Guimarães et al., 2018; Manupati et al., 2021

Live-attenuated vaccines should be inhibited during pregnancy especially during the first trimester of pregnancy (Silva et al., 2010; Torresi et al., 2017). For example, live-attenuated influenza vaccine is contraindicated during pregnancy (Fiore et al., 2009; Moro et al., 2011; Moro et al., 2013). Viable vaccines are also contraindicated in pregnancy (Kurasawa, 2023).

The decision to administer or postpone vaccination due to a recent or current serious disease is based on the severity of symptoms and the etiology of the condition. The safety and effectiveness of vaccinating individuals with mild diseases have been established, and vaccination should be postponed for individuals with moderate or severe acute disease. This prevents the possibility of confusion between symptoms of the underlying illness and potential vaccine side effects (Kroger et al., 2023). Vaccines, what not to do have been summarized in table 2.

Table 2: Vaccines, what not to do

Vaccines, what not to do	References
Administration of vaccines in immunocompromised people	See, 2022; Alnaimat et al., 2023
Administration of live-attenuated vaccines in immunocompromised people	Mohme et al., 2020
Administration of live-attenuated vaccines in pregnancy	Silva et al., 2010; Torresi et al., 2017
Administration of live-attenuated influenza vaccines in pregnancy	Fiore et al., 2009; Moro et al., 2011; Moro et al., 2013
Administration of viable vaccines in pregnancy	Kurasawa, 2023
Administration of vaccines in a diseased person	Kroger et al., 2023

Conclusion

Vaccines have become a source of peace for mankind. Vaccines are responsible for protecting millions of lives from harmful agents. They are one of the greatest developments in the history of mankind. However, there is significant communication between the healthcare professionals and the people, which leads to vaccine hesitancy. Different steps have to be taken to minimize this hesitancy. These steps include effective communication between the healthcare professionals, publication of information regarding a vaccine, and facility of vaccine at

healthcare institutions. Furthermore, vaccine-induced hypersensitivity should be minimized along with cold chain maintenance. Also, vaccines should not be administered in immunocompromised persons, pregnant women, and diseased persons.

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