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RESEARCH ARTICLE

The Role of Vaccination and Immunization in Pandemic Diseases

Aqeel Abbas Kareem[1], Marwa Ibrahim Saihood kadim[2]

1Clinical and Laboratory Department University of AL-Qadisiyah- College of Pharmacy

2Graduated from department of chemistry-university of AL-Qadisiyah-college of science

Corresponding Email: aqeel. abbas @qu.edu.iq

Abstract:

This article is part of a series explainers on vaccine development and distribution. Throughout history, humans have successfully developed vaccines for a number of life-threatening diseases, including meningitis, tetanus, measles and wild poliovirus… Immunization is the process whereby a person is made resistant to a disease, typically by the administration of a vaccine. Vaccines stimulate the body's own .

Objective: Vaccines reduce risks of getting a disease by working with our body's natural defenses to build protection. When you get a vaccine, your immune system responds.

Methods: There are different delivery methods for immunizations, including oral, intranasal, subcutaneous, and intramuscular. Post-vaccination, there can be complications such as anaphylaxis. Epinephrine autoinjection is crucial in these settings.

Results: the result of vaccine in immunity introducing something called an antigen into the body, which imitates an infection and primes the immune system to respond . Vaccines protect against diseases

Conclusion: The introduction of new vaccines in the coming decades will impose additional and sometimes unexpected financial burdens on public and private health care plans, providers, and consumers. These burdens are offset by the value of these new vaccines, including financial savings that result from decreased medical expenditures, enhanced quality of life, reduced care-giving burdens, and gains in productivity associated with the prevention of infectious disease.

Kew word: Vaccines, toxoid vaccine , Diseases ,Immunization and Viruses

Introduction

A pandemic refers to the global dissemination of a novel illness, like a new strain of flu or the coronavirus responsible for COVID-19. The CDC advises a three-week interval for Pfizer shots and a four-week gap for Moderna doses, especially for older individuals and those with weakened immune systems. Many people experiencing myocarditis post-COVID vaccination typically show positive responses to medication. Contracting Guillain-Barré syndrome (GBS) is far more frequent through infection than through vaccination.

Immunization involves rendering your body immune or resistant to an infectious disease, often achieved through vaccination. Vaccination, meanwhile, utilizes vaccines to confer immunity against a particular disease. The process of immunization occurs within the body, primarily triggered by vaccination, but it can also stem from other encounters with pathogens. Over time, "inoculation" has taken on a synonymous meaning with immunization(1,2).

The administration of vaccinations in order to confer immunity against a disease is referred to as vaccination. Immunization is the process of your body protecting itself against disease. In most cases, this is because to vaccination, although it may also be the result of other kinds of pathogen exposure. Inoculation and vaccination are now used interchangeably in modern parlance. (3) So

The aim of this article is to study how Vaccines reduce risks of getting a disease by working with our body's natural defines to build protection. When we get a vaccine, your immune system responds.

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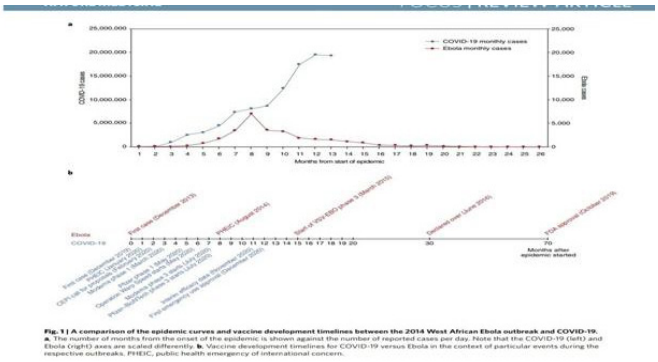

Figure 1. Reported cases of vaccine-preventable diseases (VPDs) global

Results and Discussion

Mechanism of action of vaccine

The comprehension of developing infectious sicknesses has undergone substantial evolution in the past two decades. Reflecting on the SARS-CoV outbreak in 2002, in spite of a relatively low numeral of deaths and infections, its considerable humanity rate and transmissibility led to important global disturbance, as indicated in Table 1. The epidemic concluded when efforts toward vaccine development commenced. Subsequently, with the closure of wet markets and the cessation of transmission to humans from civets, the disease did not resurface. Consequently[5], research into vaccines alongside SARS-CoV halted, and supporting for such initiatives was curtailed. Only a entire inactivated vaccine and a DNA vaccine underwent testing in phase 1 medical prosecutions [6].

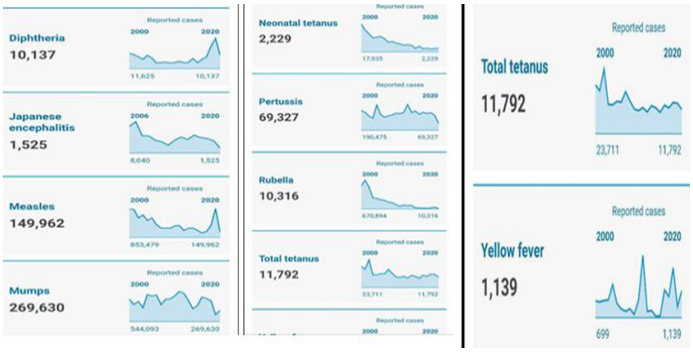

Figure 3. Estimations of National Vaccination Coverage (WUENIC) at the worldwide flat

Each of these components contributes significantly to the overall safety, efficacy, and longevity of vaccines, ensuring they remain potent and effective from production through to administration. [8]

The contents listed on vaccine labels may seem unfamiliar, yet numerous elements within vaccines exist naturally in the body, the environment, and our dietary intake. Extensive testing and ongoing monitoring are conducted for all vaccine ingredients and the vaccines as a whole to guarantee their safety. [10]

-Vaccines protect against Diseases

Vaccines offer protection alongside a wide array of diseases, encompassing: COVID-19, cervical cancer, cholera, Ebola virus illness, diphtheria, influenza, measles, Japanese encephalitis, meningitis, pertussis, mumps, pneumoniarabies, , polio, rotavirus, hepatitis B, rubella, tetanus, typhoid, varicella, and yellow fever. [10] Several vaccines are presently in the developmental or piloting stages, such as those targeting the Zika virus or malaria. However, these vaccines are not yet extensively accessible on a global scale. It's important to note that not all of these vaccinations might be necessary in every country. Some could be specifically recommended for individuals traveling to regions of heightened risk or for those engaged in high-risk occupations. To ascertain the vaccines essential for you and your family, it's advisable to engage in a discussion with your healthcare provider. They can offer guidance tailored to your specific needs, considering factors like travel plans, potential occupational hazards, and prevalent health risks in your region. [10]

- The rote of administration of vaccine

Immunization is generally safe, with common side effects of a vaccine being typically mild and transient, like temporary discomfort at the injection site or a slight elevation in body temperature. Although exceedingly rare, more severe adverse reactions are theoretically possible. However, any vaccine that receives licensure undergoes rigorous testing through various trial phases before authorization for administration. Moreover, continuous and thorough assessment occurs post-introduction. Scientists continually scrutinize diverse data sources for any potential indications of health risks associated with a vaccine. [11,12]. Keep in mind, the risk of severe harm from a vaccine-preventable disease far surpasses the risk associated with a vaccine itself. Consider tetanus, which can induce excruciating aching, muscle spasms (known as lockjaw), and measles, or blood clots, capable of causing encephalitis (brain infection) and vision impairment. Numerous diseases preventable by vaccines have the potential to lead to fatalities. Vaccination offers substantial benefits that outweigh the associated risks. Without vaccines, a significantly higher number of illnesses and deaths would be inevitable. [13.14,,15]

- Types of vaccines

Inactivated vaccines

This type employ a deactivated form of the disease-causing germ. Generally, these vaccines offer a fewer vigorous level of immunity paralleled to live vaccines. Hence, numerous dosages, known as promoter shots, might be essential over time to conserve continuous defense alongside diseases. Inactivated vaccines are specifically utilized for safeguarding against Hepatitis A, influenza (administered via a shot only), polio (administered via a shot merely), and rabies. [16-20]

Live-attenuated vaccines

This type utilizes a debilitated (or attenuated) usage of the

disease-causing germ. Due to their close similarity to the usual infection they protector alongside, these inoculations produce a potent and lasting immune reaction. Naturally, fair 1 or 2 dosages of most live vaccines provide a period of defense alongside together the germ and the related illness. However, live vaccines have certain limits. Since they comprise a small quantity of the weakened live virus, People with compromised immune systems, chronic health conditions, or individuals who've undergone organ transplants should seek advice from their healthcare provider before undergoing vaccination. Additionally, live vaccines necessitate refrigeration, which limits their suitability for use in nations with restricted entrance to refrigeration. Live vaccines are employed for immunization alongside mumps, measles, rubella (MMR collective vaccine), rotavirus, chickenpox, smallpox, yellow fever[21-25].

. Messenger RNA vaccines or mRNA vaccines

Indeed, investigators take delved into and engaged with mRNA preparations for many years, and this technology served as the foundation for crafting certain COVID-19 vaccines. mRNA vaccines function by generating proteins that stimulate an immune response within the body. These vaccines offer several advantages in contrast to other types: they boast shorter manufacturing durations and, due to their lack of live virus content, carry no danger of initiating illness in the immunized individual. mRNA vaccines stay specifically employed for safeguarding alongside COVID-19. [26-28]

. Subunit, recombinant, polysaccharide, and conjugate vaccines

Vaccines may be classified as subunit, recombinant, polysaccharide, or conjugate. Each of them uses a different component of the pathogen, such as sugar,the protein, or capsid (casing about the germ). These vaccines provoke a particularly robust immune reaction that is directed on critical components of the pathogen because they include just selected fragments of the infectious agent. They may also be used on practically anybody who has a need for them, including persons 13 who have immune systems that are compromised and people who have ongoing health issues. It is possible that you may need more vaccinations in order to maintain your level of protection against infections after receiving these vaccines. These vaccines are administered to guard against diseases triggered by Haemophilus influenzae type b, hepatitis B, human papillomavirus (HPV), pertussis (a component of the DTaP combination vaccine), pneumococcal disease, meningococcal disease, and shingles. [29-30] .

. Toxoid vaccines- Toxoid vaccines are those that include a toxin, which may be described as a harmful chemical that is produced by a bacteria that is responsible for causing a disease. Toxins are used to treat a variety of infectious diseases. They acquire immunity not against the germ itself but rather against the components of the pathogen that are responsible for causing sickness[31]. This provides evidence that the immune response is aimed at the poison rather than the germ in its whole. Toxoid immunizations are a common method for warding against infectious illnesses including diphtheria, tetanus, and whooping cough. Vaccines against viral vectors have been the subject of a significant amount of study as a possible therapy for a variety of infectious diseases, including HIV, Zika, and the common cold. The researchers also used this strategy while they were making vaccines against COVID-19. [32.33,34] Due to the fact that recombinant vector vaccines, which are also referred to as platform-based immunizations, are designed to simulate the typical immunological response that the body has to infections, they are especially efficient in teaching the immune system to fight off viruses. [35.36].

2. Vaccination

. Corona virus COVID-19: COVID-19 stems from the SARS-CoV-2 virus, a member of the coronavirus family. This family encompasses various viruses, ranging from typical ones causing mild colds to rarer, severe illnesses like (SARS) and (MERS). Similar to numerous respiratory viruses, coronaviruses propagate swiftly via droplets expelled during breathing, coughing, sneezing, or talking. [37]

The term "corona" originates from "crown" and depicts the appearance of coronaviruses due to their spike proteins. These proteins play a crucial role in the virus's biology by facilitating attachment to human cells, initiating infection, replication within the cell, and subsequent extent to additional cells. Certain antibodies can shield humans from SARS-CoV-2 via directing these spike proteins. Given the significance of this virus component, scientists conducting virus sequencing for research continually track mutations that alter the spike protein, a process known as genomic surveillance. [37]

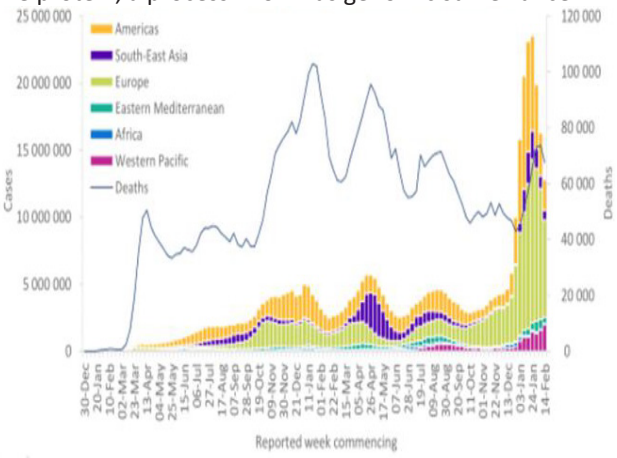

Figure-3 -Covid-19 cases reported weekly

. Avian influenza virus

Influenza pandemics represent epidemics that impact a substantial portion of the world owed to the emergence of a new virus strain. These events, changeable yet recurrent, carry significant health, economic, and social ramifications on a global scale. An influenza pandemic unfolds when a novel influenza virus appears, accomplished of consistent human-to-human communication, and encounters a human populace lacking sufficient immunity alongside it. As international travel continues to expand, a pandemic can swiftly disseminate worldwide, leaving minimal time for the development of a prepared communal health reaction. [22]

. Avian influenza (AI)

(AI) is a greatly transmissible viral illness that affects various species of birds used in food production (such as turkeys, chickens, guinea fowl quails,), in addition to pet birds and wild birds. On rare occasions, mammals, comprising individuals, can convention avian influenza. AI encompasses numerous virus strains, typically categorized as either low pathogenic (LPAI) strains, which tend to induce minimal or no medical symptoms in rooster, or greatly pathogenic (HPAI) strains, known for causing austere medical manifestations and possibly great humanity proportions in poultry. [23]

. H5N1 Influenza Virus Vaccine:

On April 17, 2007, the FDA granted approval for the initial vaccine in the U. S. designed to prevent H5N1 influenza, generally known as avian influenza or "bird flu." The vaccine inactivated influenza virus is intended for individuals aged 18 to 64 years who face an elevated danger of contact to the subtype of H5N1 influenza virus included in the vaccine. Derivative from the influenza virus A/Vietnam/1203/2004, the vaccine is synthetic via Sanofi Pasteur Inc. It stands prepared for potential use should the H5N1 avian influenza virus acquire the ability to professionally transmit from individual to individual, leading to quick global disease extent. [30]

. The Spanish flu virus

The Spanish flu was an influenza (flu) produced via an H1N1 virus originating from around form of avian source. It emerged as a pandemic, characterized by a novel influenza A virus that rapidly spread worldwide, infecting numerous individuals. Due to the novelty of the virus, very few people possessed immunity against it. Between 1918 and 1919, the Spanish flu affected an assessed 500 million individuals worldwide, encompassing around 33% of the world's populace at that period. The virus resulted in approximately 50 million fatalities, with about [675,000 losses occurring in the U. St. [31

- Less common vaccine

The scientists refer those viruses that have undergone these alterations as "variants." They are still SARSCoV-2, however their behavior could be somewhat different (39). The European Region of the WHO has developed into the epicenter of the pandemic, reporting more than forty percent of all confirmed cases worldwide. As of the 28th of April in the year 2020, the Region accounted for 63% of the worldwide death from the virus. . [38,39,40]

. Sinovac

The Sinovac vaccine is an inactivated vaccine with an efficacy of 48.9%. It's recommended for individuals aged 18 years and older. However, there's insufficient data available to assess its efficacy or potential risks in pregnant women. The World Health Organization (WHO) suggests using the Sinovac vaccine in prenatal females when the assistances to the prenatal individual offset probable dangers. The Strategic Advisory Group of Experts on Immunization (SAGE) recommends a two-dose regimen for the Sinovac vaccine, with an intermission of 2–4 weeks among the primary and second dosage. [48]

. Sino pharm

COVID-19 vaccine BIBP, an inactivated vaccine (Vero Cell), demonstrates an efficacy of 78.1%. However, it's not recommended for individuals below 18 years old pending additional studies in this age group. Regarding pregnant women, insufficient data exist to evaluate vaccine efficiency or related dangers during pregnancy. WHO advises the usage of this vaccine in prenatal females if the assistances of immunization outweigh possible risks [50]

Conclusions

There is a significant possibility of another epidemic occurring. The changing climate, along with intensive agricultural practices and more international travel, is making it easier for illnesses to rapidly spread over the globe. Therefore, we need to enhance health systems across the world so that we can better avoid pandemics, prepare for them, and react to them when they occur. There are several valid points of view that may be taken into consideration on the relative undesirability of mortality and morbidity in various age groups. The suggested approach for estimating the predicted benefits from a variety of vaccinations enables decision makers to examine the consequences of adopting a variety of points of view on the final rankings of the vaccines. In consideration of the situation over a more extended period of time, it was proposed that these kinds of activities be given a low priority (while some growth might happen in the interruption between humanity and fertility decrease). Because a part of population growth will be driven by a drop in the death rate of newborns and children, it is imperative that agricultural planning and health planning be integrated in order to avert food shortages. However, the true benefits that come from new vaccines will not be distributed in an equal manner across locations, countries, socioeconomic categories, ethnic groupings, age groups above 50, or any other segments of the population.

Other non-quantifiable factors, such as the accessibility of another methods of sickness control or management, the possible influence of an epidemic sickness on health care conveniences, and the possibility of completely eradicating a particular disease are all examples of things that are examples of things that could potentially have an effect on the rankings of projects

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