# Vaccines & public health

Vaccines are used to prevent diseases or deal with the infections already in the body. They work by making use of several parts of the adaptive immune response. The adaptive immune response contains pathogen specific responses, and cells with long lasting memory so they can fight away infections a while after the exposure. Vaccines do this by injecting small amounts of dead or inactive pathogens, these pathogens carry antigens which then trigger your body into producing antibodies to get rid of the disease.

Upon administration of a vaccine the first response to the pathogen is the Innate Immune system as it has the adaptive response around 5 or 6 days after the exposure to the pathogen. This is called the primary response. The secondary response however is a more rapid and effective response the next time the same pathogen encounters the immune system. This is due to the vaccine exposing the pathogen to your body, allowing your body to create a much stronger immune system response with the ability to fight off the pathogen swiftly.

To start a protective immune response to a pathogen in the body, vaccines use four ways to create the response, including the vaccines being live attenuated, meaning making the pathogen weaker and safer, so no harm is done to the person. The pathogen is weakened as it is modified to not be able to reproduce or cause disease. The second way is the pathogen being inactivated and then formulated into the vaccine. This makes sure the pathogen cannot revert to its original form or become infectious and harmful for the human. The third way is through manufacturing and isolating the toxin before formulating it into the vaccine. The final type of vaccination is submit vaccines, which isolates parts of the pathogen before it goes into the vaccine. This kind of vaccination is effective when trying to neutralise the pathogen.

Vaccination is one of the most effective ways to prevent influenza infection, but the vaccines are limited in several different ways. For example, Influenza vaccines have a typically small vaccine capacity, with a long production time. The vaccines also have a lack of cross reactivity and a range of efficiency in certain populations. Symptoms shown by individuals infected by influenza infections include chills, fever, headaches, etc. However, more severe cases can lead to cardiovascular complications and bacterial infections, each of these cases could lead to death if not treated. Individuals more vulnerable to this disease include people with typically weaker immune systems, elderly or young children, classifying them as high-risk populations.

Although not everyone is available to get a vaccine, most children are following a vaccination schedule set in place by the NHS. Certain groups of adults are also recommended to get any additional vaccinations if needed. Research shows the recommended vaccines depend mostly on where you are, as different areas are more vulnerable to certain diseases than others, for example, individuals living in tropical areas may be more likely to catch infectious diseases such as yellow fever or cholera than someone living in a cooler, land bound area.

Sometimes, people can experience swelling at the site of vaccination, pain, or discomfort. This is what we typically call adverse effects as the government records these side effects to ensure vaccine safety, so that healthy individuals do not suffer severe side effects or get

harmed by the vaccination. All vaccines are thoroughly tested for safety within clinical trials to ensure side effects are minimal and the vaccines are effective. When testing a vaccine, researchers also look out for efficiency: meaning how well it works. They also look for the most effective dosage, enough to be effective but not too much to harm the individual. The final thing doctors are required to look out for when testing vaccinations is the toxicity, to ensure the vaccine is not dangerous for individuals to use. Due to these tests being put into place, severe reactions to vaccinations are rare, making getting vaccinated the safer option against dealing with the disease without vaccines. For example, one in fifteen people with measles are likely to get complications such as pneumonia if not treated. Whereas the likelihood of individuals gaining problems with vaccines is very slim. Vaccinations that have come from research have effectively managed nearly to the point of eradication some diseases in the western world for example smallpox and tuberculosis.

Vaccinations usually follow a schedule, as children and adults may be more vulnerable to certain diseases at certain ages throughout their life. This can include babies having a ‘6-in-1' vaccine to start their protective immune response against the six diseases including diphtheria, hepatitis B, Haemophilus influenzae type b, polio, tetanus and whooping cough. Babies are given three doses of this vaccine to ensure safety from a young age, protecting them from diseases they are most vulnerable to.

In conclusion, I believe medicine would be a course I would like to study in university as I enjoyed researching and finding out how different vaccines and medicines work for certain diseases, and how certain groups of people can be more likely to get certain infections. I would like to continue doing medical research in the future.