Editorial: Vaccine Hesitancy

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Vaccination has been one of the most successful medical interventions to date, reducing the morbidity and mortality of vaccine-preventable infectious disease by over 90% in countries where vaccines are readily available[1]. Despite its success, the uptake of vaccines worldwide is declining; so much so that in 2019 the World Health Organisation declared that vaccine hesitancy, the reluctance or refusal to vaccinate despite the availability of vaccines, is one of the top ten threats to Global Health in 2019[2]. The reasons for decreased vaccination uptake are complex, but it is becoming increasingly clear that solutions to counter this trend are required as vaccine-preventable illness and death are increasing worldwide[3, 4].

Vaccines and how they work

Vaccines are typically composed of either a weakened version of a pathogen, or parts of a pathogen, which are able to elicit an immune response that protects against subsequent infection by the 'wild' variant of that pathogen[5]. Some vaccine formulations are supplemented with adjuvants which stimulate the immune system to generate a better response to the vaccine[6]. The majority of vaccines currently available stimulate protective immunity via the production of antibodies, proteins that are secreted by a specialised type of white blood cell, known as antibody secreting cells. Antibodies are able to bind to pathogens where they act as flags to target pathogens for destruction, and can block the ability of a pathogen to establish an infection. The benefit of this is that antibodies can facilitate the removal of pathogens before any symptoms of sickness occur[7].

Vaccines work because they trigger the immune system to respond in a similar way to an infection, thereby harnessing the body's natural defence system to prevent infections. The production of antibodies can occur in two different ways after a vaccine triggers white blood cells to respond to the pathogen-derived components of the vaccine: The first occurs when B cells, a type of white blood cell, are triggered to differentiate into antibody secreting cells within the body's tissues, and then produce antibodies that circulate throughout the body. This response is fast, but the protection induced by the vaccine is short-lived[8]. The second pathway to generate antibody secreting cells requires the collaboration of many different types of white blood cells, and is called the germinal centre reaction. This response has two unique features that make it important for vaccine-derived immunity, the first is that B cells undergo a rigorous process of selection before differentiating into antibody secreting cells, thereby improving the quality of the antibody response to the vaccine. The second, is that it produces long-lived antibody secreting cells that can persist for years in the bone marrow, providing a constant supply of antibodies that are released into the circulation. The combination of these two features results in a long-lived antibody response that is exquisitely tailored to fight pathogens if they are encountered after vaccination[9, 10].

Vaccine hesitancy

The reluctance or refusal of an individual to receive vaccinations, or to refuse on behalf of their dependents, can be due to a number of factors. These broadly relate to issues in vaccine confidence, complacency and convenience. A lack of confidence can pertain to vaccines themselves, or in the competence of the system that provides them; from the companies that make the vaccines to the healthcare providers that administer them. Vaccine complacency occurs when the perceived risk of a vaccine preventable disease is deemed sufficiently low as to not warrant

vaccination. Vaccine convenience refers to how easy it is for an individual to access vaccination services, and how appealing these services are[11]. All of these issues need to be considered and addressed in order to reduce vaccine hesitancy.

A world-wide survey on attitudes to vaccines shows that the majority of participants were positive about vaccination. Of the >65,000 surveyed, 12% disagreed with the statement "overall I think vaccines are safe", but interestingly, fewer disagreed with the statements "vaccines are important for children to have" and "overall I think vaccines are effective"[12]. This suggests that even when people who do not feel vaccines are safe, they consider them to be important. One of the key issues that contributes to decreased confidence in the safety of vaccines is the high prevalence of misinformation about vaccination on the internet and in social media, with anti-vaccine messaging being just as frequent as pro-vaccine articles, despite the risk of vaccine-induced harm being very low[13, 14]. The most damaging of these anti-vaccine articles are those that are patently untrue; the most infamous example is a retracted scientific article that purported to link the measles, mumps and rubella vaccine (MMR) to autism. Large scale studies have found no evidence to support a link between this vaccine and autism[15]. The wide availability of incorrect information about vaccines makes it increasingly difficult for individuals to make well informed choices for themselves, and for their dependents.

It would, however, be imprudent to assume that concerns about vaccine confidence are all unfounded, and are solely the result of misinformation. For example, in 2018 two Samoan children died following the administration of an incorrectly prepared MMR vaccine, and the subsequent drop in the vaccination rate has contributed to the current measles outbreak[4, 16]. This extreme example highlights the need for high quality checks and controls at all points of the vaccine development and delivery system. To increase confidence, information on this process must be readily available to healthcare professionals and to the public. A good example of this is the Global Vaccine Safety Initiative run by the World Health Organisation which provides key information on each vaccine and their relative risks[17]. Disseminating this type information effectively, in an easily accessible form, is essential to enable people to have accurate information to enable them to make well informed choices about vaccines.

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