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Pathogen Challenge

Human Papilloma Virus (HPV)

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Human Papilloma Virus (HPV) is the leading cause of cervical cancer. Cervical cancer is the fourth most common cancer in women. In 2018, an estimated 570 000 women were diagnosed with cervical cancer worldwide, and about 311 000 women died from the disease.[1] Cervical cancer was first described in 400 BCE by Pericles Hippocrates, a Greek physician and scientist; it was also said to be incurable.[2] Since its first discovery, other scientists have researched the disease.

In the 1800s, Dr. Rigoni Stern noted that cervical cancer was rare amongst nuns yet was common in sex trade workers. This revelation allowed further scientists to focus on transmission via sexual intercourse. German virologist Dr. Harald zur Hausen noted that the Herpes simplex type 2 (HSV-2) emerged as the prime suspect based on seroepidemiological observations.[3] In 1974, Dr. zur Hausen started work on understanding the relationship between HSV-2 and cervical cancer. His initial work found that there were several different types of papillomaviruses. His team worked to identify the various strains. It was not until 1979 that his colleague isolated and cloned the first DNA from genital warts, HPV-6. By 1983 Dr. zur Hausen and his team had conducted enough testing to show that HPV-16 DNA was present in about 50% of cervical cancer biopsies, HPV-18 in the early experiments in slightly more than 20%.[3] Unfortunately, his lobbying of pharmaceutical companies to work on a vaccine was put off as it was felt there was no market.

In late 1995 an article was published in *Proceeding of the National Academy of Science* entitled "Systemic immunization with papillomavirus L1 protein completely prevents the development of viral mucosal papillomas." [4] This study was done with animal models by injecting the vaccine into the pad of the canine. These models proved to have complete immunity to experimentally induced oral mucosal papillomas.[4] It was not until 2006, a further 11 years later, that the vaccine Gardasil[5] was available for human use through the Food and Drug Administration (FDA). Today there are three vaccines available 9-valent HPV vaccine (Gardasil® 9, 9vHPV), quadrivalent HPV vaccine (Gardasil®, 4vHPV), and bivalent HPV vaccine (Cervarix®, 2vHPV)—have been licensed by the U.S. Food and Drug Administration (FDA). All three HPV vaccines protect against HPV types 16 and 18 that cause most HPV cancers.[6] In North America, the U.K., Australia and China, there are less than 9.4 cases per 100000 in parts of Africa and South America; HPV is still very prevalent at 87.3 cases per 100000.[7]

Multiple reasons abound for the lack of vaccination against HPV. In counties with depressed economies, lack of infrastructure, screening programs, government-run immunization programs and lack of vaccine all contribute to high-level cervical cancer. In North America, some parents delay vaccination for lack of information or worry about potential post-vaccine complications. Some have religious beliefs, noting that abstinence would be the preferred method for the prevention of HPV. It was interesting to read that in the United States, those with a higher income, therefore, potentially higher education, were more likely to refuse or delay the vaccine.[8] A global effort is needed to eliminate all cancers caused by HPV. Access to immunization, education to immunization and responsibility to immunize are all attainable.

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