

**UNDERSTANDING THE HUMAN IMMUNE SYSTEM:
THE POWER THAT INFLUENCES THE ENDURANCE OF
THE SPECIES**

Honors Thesis

**Presented in Partial Fulfillment of the Requirements
For the Degree of Bachelor of Science in Biology**

In the School of Arts and Sciences
at Salem State University

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Salem State University
2019

ABSTRACT

Evolution has influenced the human immune system and allowed our species to endure amidst numerous plagues, but also to coexist with ubiquitous microbial symbionts on the human animal. Estimates of the ratio of human cells to resident microbial cells in the human body range from 1:1 to 1:10, and within the numerous bacterial species that exist, only a small percentage are pathogenic. The work of the 2018 Nobel Prize winners in Physiology or Medicine allowed for the production of new tools to understand how to stimulate the immune system to fight cancerous cells; human cells gone ‘rogue’, through immune checkpoint inhibitors. Though a strong understanding of the immune system is critical for maintaining health and wellness, in certain populations in the US, quality education regarding human health and the immune system is often absent. Today citizens may obtain information about immunizations through their pediatricians but also from the internet, and the potential misinformation distributed there by anti-vaccination groups. Since immunization campaigns have been successful in decreasing the prevalence of serious disease in the US, the fear of falsely claimed adverse effects of vaccination outweighs the fear of contracting the disease and may lead parents to choose not to immunize their children.

It is proposed to create an online resource that has the power to bridge the gap between quick conversations pediatricians allot with parents and the misinformation of dense internet resources. This educational tool examines the components of the human biome, the immunization schedule for children, and myths which have given immunizations a negative connotation. Just as the adaptive immune system is educated by immunizations to fight against disease, parents will obtain the power to impact the

lives of their children through knowledge of how the immune system works to make informed decisions about their children's future health.

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Acknowledgments

First, I would like to acknowledge Kimberly Poitevin, Associate Professor of Interdisciplinary Studies and Faculty Fellow of the Commonwealth Honors Program at Salem State University, for her continuous support and encouragement through the spark of the lightbulb when we thought of this project to the completion of the final presentation. Without Kimberly Poitevin, I would not have pursued this creative endeavor, nor would I have believed in my abilities to create a thesis. I wish to express my sincere gratitude to my thesis advisor Dr. Amy Sprenkle, Associate Professor of Biology at Salem State University, for providing me with all the necessary facilities for this research. I am thankful for the wealth of knowledge and expertise in immunology. I am also grateful to Dr. Roopika Risam, Faculty Fellow for Digital Library Initiatives at Salem State University. I am thankful and indebted to her for sharing expertise in creating websites, and sincere and valuable guidance and encouragement extended to me. Lastly, I would like to thank Scott Nowka, Chair of the Commonwealth Honors Program at Salem State University, for the continuous encouragement and motivation.

Introduction

The importance of creating this digital scholarship is to bridge the gap between the information that doctors tell their patients and the lack of knowledge that patients have. Patients look to their doctors as their primary source of medical information. Searching on the internet, as even I have seen through this research, often leads to dead ends or misinformation. Many scholarly papers are only accessible if you pay money for a membership to a journal, which unfortunately means that patients will not access that information. Much of my research had to be completed on the Salem State campus to have access to scholarly journals. Doctors, on the other hand, only tell patients the information that they remember, or they answer the questions that are asked. Even doctors understand that they will never remember to tell their patients everything about a vaccine, which is why there are a plethora of fliers and pamphlets pasted all over the walls of doctors' offices. The fliers are not just decorations, but rather they serve a purpose to remind the doctors to inform patients and spark patient questions. Therefore, patients are making potentially deadly decisions about immunizations based on a small amount of information and possible false information from antivaccination campaigns due to this communication gap. The terminology used in health care as well as immunology is complex and hard to understand as a parent. Therefore, this tool will serve as a database for patients and physicians to reference for information about specific immunizations, common misconceptions, and the basic immunology behind how vaccines work within the body. The hope of this project is to help parents see the benefits of vaccinations towards their child's immune system.

Website Link



Follow this link to view the project:

jordancierpich.wixsite.com/powerofimmunizations

Processing Information

The primary goal of this project was to create a scientific based resource which informs the United States public of the latest information published about the risks and benefits of vaccinations. This goal was achieved by using the Centers for Disease Control and Prevention (CDC) as my primary source of information. The CDC is a federal agency under the Department of Health and Human Services that is a leader in public health information. This online resource that I created is based on the immunization schedule published by the CDC every February. Therefore, the information on the CDC website is up to date and current information about the most recent scientific evidence.

This website also aims to provide a resource for patients and physicians to reference for information about the basic immunology behind how vaccines work within the body. In the section titled The Human Body, the human biome, human physical barriers to disease, basic immunology, and herd immunity threshold is explained. By including this detailed section explaining how vaccinations work within the body, the hope is that parents will be less afraid of the vaccination.

Another goal of this project was to alert the public that the effects of a disease outweighs the risks of vaccinations. This was achieved through the two sections of the website titled Vaccinations and The Myths. In the Vaccinations section, each of the fifteen vaccinations recommended for children until age eighteen years old are explained. Each vaccination page includes information about when the vaccine is recommended but also detailed information about the disease(s) that the vaccine prevents against. Such information includes how the disease is contracted, the virulence of the disease, how/if the disease is diagnosed, the signs and symptoms of the disease, and the mortality rate of

those who contract the disease. By explaining details of the disease(s) and including images of the consequences of the disease, it is proposed that parents will become more aware of the negative effects of some childhood diseases the current population may have never seen in their lifetime.

In The Myths section, common misconceptions about the risks of vaccinations are explained with scientific evidence. The myths that this project attempted to answer include:

- Combination vaccines can overwhelm the natural immune system.
- Vaccines can cause autism.
- Vaccines contain mercury and other heavy metals which poison my child.
- The HPV vaccine is only recommended for women because it prevents cervical cancer.
- The HPV vaccine promotes sexual activity in adolescents.
- Vaccines contain the live virus and can make my child sick.
- I do not need to vaccinate my child because herd immunity will protect them.

Using scientific data and reputable sources, the history of these misconceptions and reasonable explanations are offered. Using these two sections, the goal was to increase the fear of some childhood diseases that may not have been seen in decades and to decrease the fear of risks of vaccinations.

Another wish for this website was to be comprehensible by the public, includes those who do not study the sciences. Throughout much of my research, I noted that many websites focused on public health information had two or more different formats, including a “consumer view” and a “professional view.” This can be seen on both the

CDC website when searching for the vaccination schedule as well as Merck Manual, a public health website focused on educating the public on medical information. By studying the formatting and the dialect of the “consumer view” between these two resources, I concluded that the website must be concise, informative, and easy to navigate. These resources also provided examples of how to explain information that the public considers common knowledge.

This goal was also achieved by sharing this website with other students at Salem State University and students who attended the National Collegiate Honors Council (NCHC) conference of 2019 in Baltimore, MD. Many of these students offered valuable feedback about the information shared in the website about what was explained well, information they had never heard about before, and information which needed more explanation. From these experiences, I learned that many people have not heard about herd immunity or the human biome. But, many people have heard of many misconceptions about vaccinations. Therefore, I increased the detail in The Human Body section and made The Myths section more concise with links to websites with more detail if the viewer wished to gather more information. The Human Body section also expanded to include the Herd Immunity Threshold section which explains the variables that affect herd immunity and how the public can help protect their families indirectly. By gathering raw feedback from friends and peers, the goal to make the website comprehensible by the public was advanced.

Additionally, another goal was to make this website accessible to people with disabilities. Originally, this website was created using the platform called wordpress.com. This is a free platform that allows the user to create free blogs that are flexible and

adaptable to change. But the decision to switch to a wix.com site derived from the ability to make the website accessible. Wix offers a function within their platform to allow consumers to utilize text to read and font increasing technology. Additionally, the colors of the website and the font styles were also chosen to help consumers with visual impairments access the resource.

Reflections

This online guide was intended to be an accessible website backed with scientific data to deliver valuable information to the current child bearing population. The use of an online guide as a platform caters to the technology-based society we are evolving into. With the use of hyperlinks to outside sources such as the Centers for Disease Control and Prevention (CDC), users can easily find additional information outside of this tool without the risk of finding misinformation.

The future implementation of this online guide will be to conduct studies to determine if the content on this website is both informative but also easy to understand. The studies would be conducted with individuals both outside of the healthcare field as well as health care professionals to gather data on the effectiveness of this tool in bridging the gap between the conversations with primary care physicians and patients. The consumer can give feedback on areas which were not explained clearly. The health care professionals can request additional information be added to the website. The goal of this future research will be to create an effective, user friendly guide which is informative and easy to navigate.

Additionally, this website must be marketed for consumption. In hindsight, I wish I had created a QR code for this project before it was presented in Baltimore. A QR code could have been handed out to students for them to take home to their institutions to share. Since a goal of this project was to increase the accessibility of information about immunizations, this additional step would have shared this website with the North East region of the United States.

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