HERD IT ALL BEFORE: THE IMPORTANCE OF IMMUNIZATIONS TO PUBLIC HEALTH

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WHAT IS IMMUNIZATION?

- Immunization is the process whereby a person is made immune or resistant to an infectious disease
 - Proven tool for controlling and eliminating life-threatening infectious diseases
 - Estimated to avert between 2 and 3 million deaths each year
 - One of the most cost-effective health investments especially for vulnerable populations
- Vaccines stimulate the body's own immune system to protect the person against subsequent infection or disease
- Two types of immunity
 - Active immunity
 - Passive immunity

World Health Organization.. https://www.who.int/topics/immunization/en/



WHY ARE IMMUNIZATIONS IMPORTANT?

- Among all populations in the United States is one of the most cost-effective means of preventing disease
- Approximately 42,000 adults and 300 children die each year from vaccine-preventable disease
- Society gains a collective immunization as more and more people become immune to a particular disease
 - Polio, for example, was eliminated in the United States in 1979 after vaccinations became widespread
- The CDC estimates 21 million hospitalizations and 732,000 deaths will be avoided among children born in the last 20 years as a result of vaccines

THE ECONOMIC VALUE OF IMMUNIZATIONS

- Among adults over the age of 50, the four major vaccine-preventable diseases (influenza, pneumococcal disease, shingles, and pertussis) cost the United States \$26.5 billion a year
 - Influenza, a vaccine-preventable disease, costs the US \$10.4 billion annually
- The CDC estimates vaccinations will save nearly \$295 billion in direct costs and \$1.38 trillion in total costs to society
- Childhood vaccines alone are projected to save \$13.5 billion in direct costs and \$68.8 billion in total societal costs for all children born in a particular year
- The CDC estimates 21 million hospitalizations and 732,000 deaths will be avoided among children born in the last 20 years as a result of vaccines

https://www.ahip.org/why-immunizations-are-importa

HOW VACCINES PROVIDE IMMUNITY

- Training the immune system to recognize and combat pathogens, either viruses or bacteria
- Certain molecules from the pathogen must be introduced into the body to trigger an immune response
- The immune system can safely learn to recognize them as hostile invaders, produce antibodies, and remember them for the future
- The immune system will recognize the antigens immediately and attack aggressively well before the pathogen can spread and cause sickness
- Basic Vaccine Concepts
 - Protein Subunit
 - Viral Vector
 - mRNA















TYPES OF VACCINES

- Live Attenuated Vaccine
 - Created by reducing the virulence of a pathogen, but still keeping it viable
 - Produce infection and immune response without symptoms
 - Often confer long-term immunity
- Inactivated Vaccine
 - Fewer side effects than live vaccines
 - Less robust immune response
 - Can be made for viruses or bacteria
 - Always a need for multiple doses
- Conjugate Vaccine
 - Specific protein or carbohydrate that induces immune response
 - Created by joining an antigen to a protein molecule
 - Significantly more successful in immunizing babies and children

https://www.creative-biolabs.com/vaccine/live-attenuated-and-killed-vaccine-design.htm?msclkid https://www.historyofvaccines.org/content/types-vaccines

LIVE ATTENUATED VERSUS INACTIVATED

Feature	Inactivated vaccine	Live attenuated vaccine
Stability	high	low
Shelf life	long	short
Reversion of virulence	not	possible
Safety	good	poor
Dose	high	low
No. of doses	multiple	single
Efficacy	poor effects; last a short time	good effects; last a long time
Need for adjuvant	yes	no
Duration of immunity	less	many years
Antibody response	lgA lgG	lgG
СМІ	poor	good

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VACCINE INGREDIENTS

- All ingredients of vaccines play necessary roles either in making the vaccine, triggering the body to develop immunity, or in ensuring that the final product is safe and effective
- Adjuvants help boost the body's response to vaccine. (Also found in antacids, buffered aspirin, antiperspirants, etc.)
- **Stabilizers** help keep vaccine effective after manufactured (Also found in foods such as *Jell-O*[®] and resides in the body naturally.)
- **Formaldehyde** is used prevent contamination by bacteria during the vaccine manufacturing process. Resides in body naturally (more in body than vaccines). (Also, found in environment, preservatives, and household products.)
- Thimerosal is also used during the manufacturing process but is no longer an ingredient in any vaccine except multi-dose vials of the flu vaccine. Single dose vials of the flu vaccine are available as an alternative. No reputable scientific studies have found an association between thimerosal in vaccines and autism

ALUMINUM

- Aluminum is used in some vaccines as an adjuvant ingredient that improve the immune response. Adjuvants can allow for use of less antigen. They have been used for this purpose for more than 70 years
- Aluminum is the most common metal found in nature. It is in the air and in food and drink. Infants get more through breast milk or formula than vaccines. Most of the aluminum taken into the body is quickly eliminated
- Most of the aluminum taken into the body is quickly eliminated.





THIMEROSAL

- A mercury-based preservative that has been used for decades in the United States in multi-dose vials
- Added to vials of vaccine that contain more than one dose to prevent growth of germs, like bacteria and fungi
- Thimerosal contains ethylmercury, which is cleared from the human body more quickly than methylmercury, and is therefore less likely to cause any harm
 - When thimerosal enters the body, it breaks down to ethylmercury and thiosalicylate, which are readily eliminated
- Most common side-effects are minor reactions like redness and swelling at the injection site
 - Some people may be allergic to thimerosal
- Thimerosal use in medical products has a record of being very safe
 - Data from many studies show no evidence of harm caused by the low doses of thimerosal in vaccines.







Adjuvants	Class	Vaccine
TLR-DEPENDENT A	DJUVANTS	
AS04 RC-529	Alum-adsorbed TLR4 agonist (31)	HBV, HPV HBV
CpG 7909 CpG1018 IC31	TLR9 agonist (39)	HBV, Influenza, etc. HBV, Cancer TB
Imiquimod	TLR7 agonist (43)	Cancer
Flagellin	TLR5 agonist (42)	Influenza
AS01	Combo TLR4	Malaria
AS02	Combo TLR4	Malaria, TB, Cancer
AS15	TLR4 +TLR9	Cancer
TLR-INDEPENDENT	ADJUVANTS	
Alum	Mineral salts (1), (2)	Diphtheria, tetanus, pneumococcus, etc.
MF59	Oil-in-water emulsion (22), (29)	Influenza
AS03		Influenza
AF03		influenza
Virosomes	Liposomes	HAV
Iscomatrix	Combination	HCV, influenza, HPV, cancer
Montanide ISA51 Montanide ISA720	Oil-in-water emulsion	Malaria, HIV, cancer Malaria, HIV, cancer
LT	Bacterial toxins	Influenza, ETEC
LTK63		Influenza, TB, HIV
TLR-dependent and TL ical trials. Those show while those in orange - References cited are p ETEC, enterotoxigenic hepatitis C virus; HIV, virus: 1 Tabile toris. T	R-independent adjuvants in in green are componen have been tested in clinici rovided for those adjuvan E. coli; HAV, hepatitis A v human immunodeficien R. uberculopis	have been tested in human clin hts of licensed human vaccines, I trials, but are not yet approved Is discussed in detail in the text irus; HBV, hepatitis B virus, HCV, cy virus; HPV, human papillome

MYTHS ABOUT VACCINES

- Vaccines cause autism
- It's not necessary to vaccinate so early in life
- The vaccine schedule is too aggressive and should be spaced out
- Vaccinations cause the diseases that they are meant to prevent
- Vaccines contain unsafe toxins
- The effectiveness of vaccinations has never been proven
- Not vaccinating my child affects only my child

IMMUNIZATION SIDE EFFECTS

- No vaccine is without risk but are considered safe and effective
- If side effects occur, most cases are usually mild
- Side effects usually disappear in a few days
- Extremely rare instances a high fever, in excess of 104 F, can occur with a vaccine
- Severe allergic reactions can occur
- The United States' long-standing vaccine safety program closely and constantly monitors the safety of vaccines

https://www.chop.edu/centers-programs/vaccir



SAFETY BY THE NUMBERS

- Nearly 90 percent of vaccine side effects are not serious, according to the Center of Disease Control
- More than 20 rigorous scientific studies have shown that there is no link between the MMR vaccine and autism
- A 2011 report from the National Academy of Medicine reviewed more than 1,000 vaccine studies and concluded that serious reactions to vaccines are extremely rare
- Two doses of the measles vaccine are about 97 percent effective at preventing measles



- For every 1,000 children who get measles, one or two will die from the disease
- A 2011 study found that the rotavirus vaccine had prevented 65,000 U.S. children from being hospitalized with rotavirus since 2006
- The HPV vaccine was introduced in 2006, and during the next four years, the rate of HPV infections among teen girls decreased by 56 percent, despite a relatively low vaccination rate in this age group, according to a 2013 study
- After the introduction of the chicken pox vaccine, cases of the disease fell nearly 80 percent in the U.S. over a decade, according to a 2012 study





VACCINES TIMELINE

- 19th Century after Dr. Jenner's discovery of "cow pox" as the first relatively safe vaccination against smallpox
 - Vaccine development finally made another major step forward 85 years later when Louis Pasteur identified bacteria as a major culprit behind several diseases and used this knowledge to produce the first "lab-made" vaccination
- 20th Century scientists built upon the immunological fundamentals discovered over the past century and developed individual vaccinations for 27 major infectious diseases
 - By the year 2000, centuries-old scourges like smallpox and measles were virtually eliminated from the developed world, along
 with yellow fever, polio and several others
- 21st Century since 1995, five new vaccines were added to the children's immunization schedule in the U.S.
 - The pneumococcal conjugate vaccine, added in 2001, likely saved 13,000 U.S. lives from 2001 to 2008. And the rotavirus vaccination, added in 2006, is now estimated to prevent 40,000 60,000 hospitalizations yearly

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VACCINATIONS IMPACT ON PUBLIC HEALTH

- Vaccination has greatly reduced the burden of infectious diseases
- Independent experts and World Health Organization have shown that vaccines are far safer than therapeutic medicines
- By 1978, smallpox had been all but eradicated around the planet, small pox was mostly eradicated in 1979 and measles in 1982
 - The U.S. was certified polio free in 1994, and rubella and congenital rubella syndrome cases dramatically declined
- Standard administrations given to infants, which include DTap, IPV, MMR, Hib, hepatitis B and Varicella
- Vaccines are more important than ever, but despite the nationwide programs and government assistance, approximately 10 percent of U.S. children are not being vaccinated for required immunizations









ANTI-VACCINE MOVEMENT

- Opposition to vaccination has existed as long as vaccination
- Critics of vaccination have taken a variety of positions, including opposition to the smallpox vaccine in England and the United States in the mid to late 1800s
 - Anti-vaccination leagues were formed to protest the use of the smallpox vaccine
- More recent vaccination controversies such as those surrounding the safety and efficacy of the diphtheria, tetanus, and pertussis (DTP) immunization, the measles, mumps, and rubella (MMR) vaccine
- The Vaccination Act of 1853 ordered mandatory vaccination for infants up to 3 months old, and the Act of 1867 extended this age requirement to 14 years, adding penalties for vaccine refusal
 - The laws were met with immediate resistance from citizens who demanded the right to control their bodies and those of their children

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ANTI-VACCINATION MOVEMENT

- The percentage of children who did not receive any vaccination by age 2 has risen from 0.9% for children born in 2011 to 1.3% for children born in 2015
- According to the American Academy of Pediatrics, at least 20 states have introduced bills this year that would
 - Broaden the reasons why parents can exempt kids from getting vaccines even if there isn't a medical need
 - Require doctors to provide more information on the risks of vaccines
- Anti-vaxers cite several other reasons as well: a distrust of government and pharmaceutical companies, in some cases; individual rights and religious freedoms

https://www.cnn.com/2019/03/06/health/vaccine-exemption-bills-across-us-trnd/index.

Most bills don't make it into law due to potential to negative effects on public health

THE VACCINE ACT OF 2019

- Vaccine Awareness Campaign to Champion Immunization Nationally and Enhance Safety Act
- Amends the Public Health Service Act
- Provide for a national system for surveillance of vaccine rates, to authorize research on vaccine hesitancy, to increase public understanding of the benefits of immunizations, and for other purposes
 - Actions must be completed by the Centers for Disease Control
- National Vaccine Advisory Committee must assess national confidence in vaccines and update a specified 2015 report
- Will strengthen the U.S. public health system's capacities to predict and prevent vaccine-preventable outbreaks
 and support health care providers with educational tools to discuss vaccination with families.

https://www.idsociety.org/idsa-newsletter/june-12-2019/urge-congress-to-support-the-vaccines-act/

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ANTI-VACCINE MOVEMENT

- The Anti Vaccination Society of America was founded in 1879, following a visit to America by leading British antivaccinationist William Tebb
 - Two other leagues, the New England Anti Compulsory Vaccination League (1882) and the Anti-vaccination League of New York City (1885) followed
- In 1902, following a smallpox outbreak, the board of health of the city of Cambridge, Massachusetts, mandated all city residents to be vaccinated against smallpox
 - Henning Jacobson refused vaccination on the grounds that the law violated his right to care for his own body how he knew best
 - In 1905 the Court found in the state's favor, ruling that the state could enact compulsory laws to protect the public in the event of a communicable disease

VACCINES LINKED TO CONTROVERSY

- Diphtheria, Tetanus, and Pertussis
 - Neurological disorders
- Measles, Mumps, and Rubella
 - Bowel disease
 - Autism
- Thimerosal containing vaccines
 - Autism
 - Attention deficit hypersensitivity disorder
 - Speech or language delay

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MMR AND AUTISM

- Many large, well-designed studies have found no link between MMR and autism
- Autism usually becomes apparent around the same time MMR is given no evidence of causality
- Autism probably has multiple components, including genetics
- The 1998 study by Andrew Wakefield that started this concern was based on 12 children who were preselected for study

https://www.historyofvaccines.org/index.php/content/articles/history-anti-vaccination

- In 2004, 10 of the 13 authors of this study retracted the study's interpretation
- On 2/2/2010, the editors of The Lancet retracted the paper following the ruling of the U.K.'s General Medical Council
- In January 2011, the BMJ published a series of articles showing Wakefield's work was not just bad science, but deliberate fraud.

SIMULTANEOUS VACCINE ADMINISTRATIONS

- Babies begin being exposed to immunological challenges immediately at the time of birth
- Healthy babies constantly make antibodies against bacteria and viruses
- Vaccines use only a tiny proportion of a baby's immune system's ability to respond
 - Children receive more vaccines than in the past, today's vaccines contain fewer antigens
- Smallpox vaccine alone contained 200 proteins; the 14 currently recommended routine vaccines contain fewer t han 150 immunologic components

NATURAL INFECTION VERSUS IMMUNIZATION

- Natural infection usually does not cause better immunity than vaccination
- The price paid for natural disease can include:
 - Paralysis
 - Permanent brain damage
 - Liver failure
 - Liver cancer
 - Deafness
 - Blindness
 - Loss of limbs
 - Death

http://media.chop.edu/data/files/pdfs/vaccine-education-center- too-many-vaccines.pd

MANDATORY VACCINATION REQUIREMENTS

- Public health experts see that as good news in the battle against spreading potentially deadly diseases, while vaccination skeptics worry about safety issues and civil rights
- State and local vaccination requirements for daycare and school entry are important tools for maintaining high vaccination coverage rates, and in turn, lower rates of vaccine-preventable diseases
- All states provide medical exemptions, and some state laws also offer exemptions for religious and/or philosophical reasons
- Studies have shown that vaccine exemptions tend to cluster geographically, making some communities at greater risk for outbreaks



IMMUNIZATION SCHEDULES AND GUIDANCE

- By age
- Catch-up schedule
- Medical Indications
- Healthcare Providers

https://www.cdc.go







VACCINATIONS FOR AGE 65 AND OLDER

- As you get older, your immune system weakens and it can be more difficult to fight off infections
- You're more likely to get diseases like the flu, pneumonia, and shingles and to have complications that can lead to long-term illness, hospitalization, and even death
- Additionally, over 60 percent of seasonal flu-related hospitalizations occur in people 65 years and older
- Recommended Vaccinations
 - Shingles vaccine, which protects against shingles and the complications from the disease (recommended for healthy adults 50 years and older)
 - Pneumococcal polysaccharide vaccine (PPSV23), which protects against serious pneumococcal disease, including meningitis
 and bloodstream infections (recommended for all adults 65 years or older, and for adults younger than 65 years who have
 certain health conditions)
 - Pneumococcal conjugate vaccine (PCV13), which protects against serious pneumococcal disease and pneumonia (recommended for all adults with a condition that weakens the immune system, cerebrospinal fluid leak, or cochlear implant)

ttps://www.cdc.gov/vaccines/adults/rec-vac/index.html

VACCINATIONS FOR ASPLENIA

- Asplenia is a medical condition which is the absence of the normal functioning of the spleen
- The spleen is an important and significant organ of the body that has an important role in filtering blood and maintaining the function of our immune system
- Recommended vaccinations
 - Haemophilus influenzae type b vaccine
 - Pneumococcal vaccines
 - Influenza vaccine
 - Meningococcal vaccines

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WEAKENED IMMUNE SYSTEM AND VACCINATIONS

- Your immune system can be compromised in several different ways
- Can be acquired disease like HIV or congenital condition such as common variable immunodeficiency
- Medications play a part, too, such as biologic drugs used to treat rheumatoid arthritis and similar conditions
- Live attenuated vaccines carry the biggest risk for immunocompromised patients
 - Herpes zoster
 - MMR
 - Influenza

https://health.clevelandclinic.org/if-your-immune-system-is-compromised-can-you-get-vaccinated/

HEALTH CONDITIONS WITH VACCINE CONSIDERATIONS

- Asplenia
- Diabetes Type 1 and Type 2
- Heart Disease, Stroke, or Other Cardiovascular Disease
- HIV Infection
- Liver Disease
- Lung Disease including Asthma



COVID-19VACCINE

- A vaccine to prevent COVID-19 is perhaps the best hope for ending the pandemic
- Vaccine development can take years, researchers aren't starting from scratch to develop a COVID-19 vaccine
 - Past research on SARS and MERS vaccines has identified potential approaches
- Coronaviruses have a spike-like structure on their surface called an S protein
- The S protein attaches to the surface of human cells
- A vaccine that targets this protein would prevent it from binding to human cells and stop the virus from reproducing

https://www.mayoclinic.org/diseases-conditions/coronavirus/in-depth/coronavirus-vaccine/art-2048488



PATHWAYS TO DEVELOP AND PRODUCE A COVID-19 VACCINE

- Global health authorities and vaccine developers are currently partnering to support the technology needed to
 produce vaccines
 - Live attenuated vaccine
 - Live virus vaccines often need extensive safety testing
 - Inactivated vaccine
 - May not provide protection that's as strong as that produced by live vaccines
 - Genetically engineered vaccine
 - Uses genetically engineered RNA or DNA that has instructions for making copies of the S protein
 - No infectious virus needs to be handled
 - Genetically engineered vaccines are in the works, none has been licensed for human use

https://www.mayoclinic.org/diseases-conditions/coronavirus/in-depth/coronavirus-vaccine/art-20484859

https://www.uspharmacist.com/article/pharmacists-role-in-preventing-vaccine-preventable-d

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PHARMACIST ROLE IN IMMUNIZATION

- Pharmacists in all 50 states are now allowed to administer at least some vaccines
- While immunizations may be provided upon physician order for an individual patient, standing orders or
 protocols may help increase vaccination levels for some VPDs, such as influenza and pneumococcal disease
- In a recent study, standing orders allowed pharmacists to vaccinate eligible inpatients against pneumococcal disease and influenza, resulting in significantly increased vaccination rates among high-risk patients
- In another study, pharmacists in a lipid clinic vaccinated high-risk cardiovascular patients against influenza under a standing-order protocol, significantly improving vaccination rates
- Pharmacist in Florida can administer all vaccines to patients 18 years and older









- Pharmacies are participating in public health testing for COVID-19
- State and local health departments will inform pharmacies about procedures to collect, store, and ship specimens appropriately
- Cloth face coverings should NOT be worn by staff instead of a respirator or facemask if more than source control is required
- Adult vaccination should be considered if the service can be delivered during a visit with no additional risk to the patient or the health care provider
- Pharmacies should develop a strategy for screening patients for fever and symptoms of COVID-19 prior to providing vaccinations

https://www.cdc.gov/coronavirus/2019-ncov/hcp/pharmacies.htm

SUMMARY

- Vaccines have had a profound impact on modern medicine and public health
- Vaccinations are not without risk but are considered safe and effective
- Immunizations and supporting policies have the ability to eliminate disease within communities
- The emergence of COVID-19 will likely add another vaccine to our preventative armamentarium
- Pharmacists are now key players in providing immunizations to patients

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QUESTION ONE

What are not types of immunity?

- A. Passive
- B. Active
- C. Classic



QUESTIONTWO

True or False-Thimerosal and MMR vaccine are associated autism?

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QUESTION THREE

True or False-Pharmacist in Florida can administer all vaccines to patients of any age?

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