

Vaccine Vacuum



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Mid America Immunization Symposium

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Goals

- Three things:
 - Things you will never see
 - Things you may see
 - Things you will see
- Vaccine Heroes
- Work to do

Timeline of Vaccines US

- 1945 – Inactivated influenza vaccine - trivalent
- 1948 – Diphtheria, tetanus, and pertussis vaccines combined to form DTP
- 1955 – Inactivated polio vaccine (shot)
- 1962 – Live polio vaccine (oral)
- 1963 – Measles vaccine
- 1967 – Mumps vaccine
- 1969 – Rubella vaccine
- 1971 – MMR combination
- 1981 – Hepatitis B vaccine
- 1985 – Hib vaccine
- 1992 – DTaP vaccine
- 1995 – Varicella vaccine
- 1995 – Hepatitis A vaccine
- 2000 – Pneumococcal conjugate vaccine
- 2003 – Intranasal influenza vaccine — trivalent
- 2005 – Meningococcal (ACWY) conjugate vaccine
- 2005 – Tdap vaccine
- 2006 – HPV vaccine for females (2 or 4 types)
- 2006 – Rotavirus vaccine (RotaTeq®)
- 2006 – Shingles vaccine (Zostavax® for ≥ 60 yrs)
- 2008 – Rotavirus vaccine (RotaRix®)
- 2009 – HPV vaccine for males (4 types)
- 2013 – Intranasal influenza vaccine — quadrivalent
- 2014 – Meningococcal B vaccine
- 2014 – HPV vaccine (9 types of HPV [Gardasil® 9])
- 2017 – Second shingles vaccine (Shingrix® ≥50 yrs)
- 2017 – Adult hepatitis B vaccine (Heplisav-B®)

Multiple types of enhanced flu vaccines at various years.

56 Organisms!!

<https://www.chop.edu/centers-programs/vaccine-education-center/vaccine-history/vaccine-availability-timeline>; <https://www.historyofvaccines.org/timeline/all>

US Impact of Vaccines in the 21st Century

Disease	Pre-vaccine Annual Morbidity	2017 Total	% Decrease
Smallpox	48,164	0	100
Diphtheria	175,885	0	100
Pertussis	200,752	18,975	90.5
Tetanus	1,314	33	97.5
Polio (paralytic)	16,316	0	100

US Impact of Vaccines in the 21st Century

Disease	Pre-vaccine Annual Morbidity	2017 Total	% Decrease
Measles	503,282	120	100
Mumps	186,000	6,109	97
Rubella	47,745	7	100
Congenital rubella	823	5	99.9
Varicella	4,085,120	8,775	97.9
Haemophilus influenzae b	20,000 (est.)	34 (est.)	99.8

1. MMWR 1999; 48:243-8
2. MMWR 2004; 51:1-84;
3. <https://wonder.cdc.gov/nndss/static/2017/annual/2017-table3.html>;
4. <https://www.cdc.gov/mumps/outbreaks.html>

Death

In 1900, 21,064 smallpox cases were reported, and 894 patients died.

In 1920, 469,924 measles cases were reported, and 7575 patients died.

In 1920, 147,991 diphtheria cases were reported, and 13,170 patients died.

In 1922, 107,473 pertussis cases were reported, and 5099 patients died.

<https://www.cdc.gov/mmwr/preview/mmwrhtml/00056803.htm>

Holy Cow! Have You Herd...?

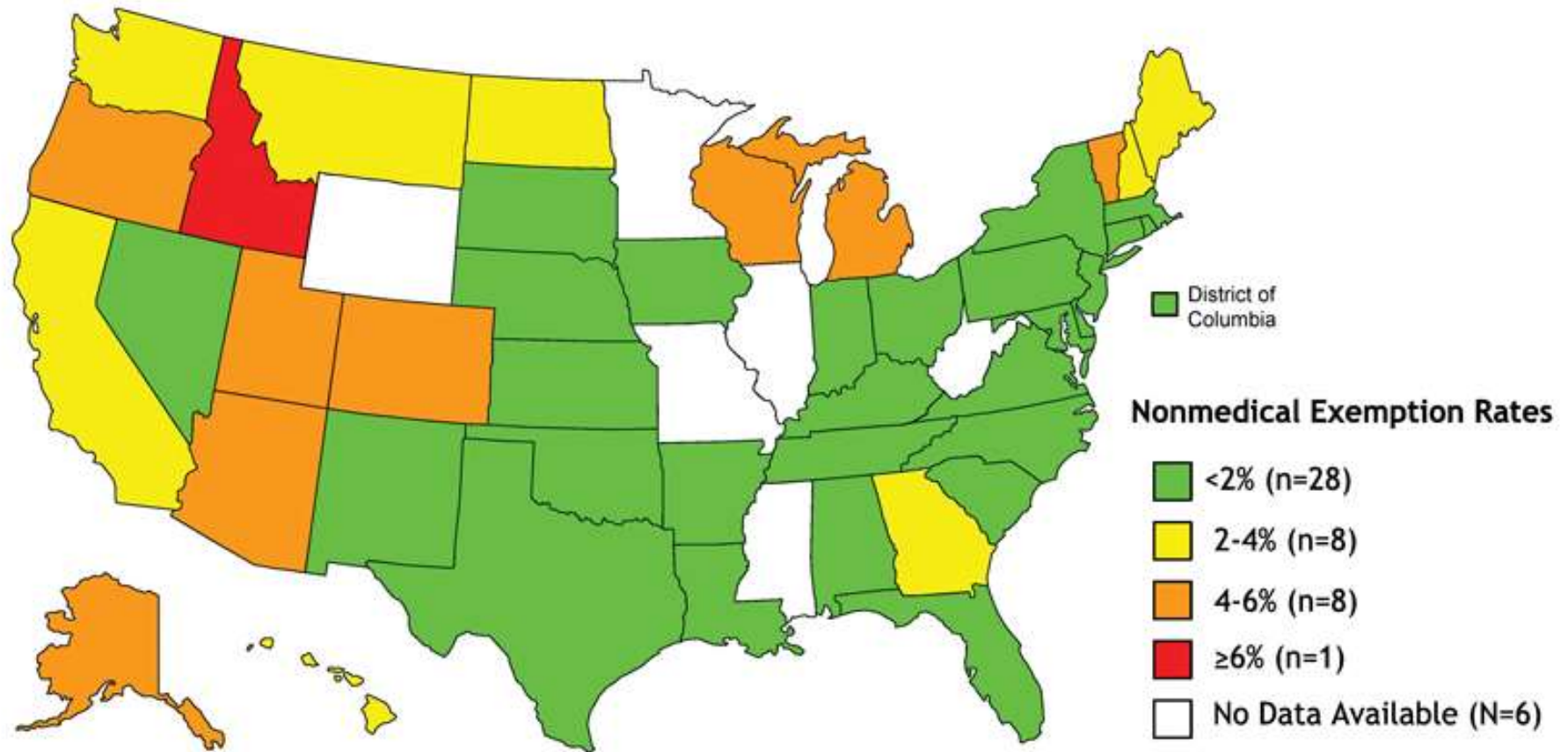
Estimated herd immunity thresholds and critical vaccination coverage using generally accepted reproductive numbers for common vaccine-preventable diseases

Vaccine-Preventable Disease	R_0 * ^{59} ^{60}	Herd Immunity Threshold (%) ^{31}	Critical Vaccination Coverage** (%) ^{31}
Diphtheria	4 to 5	75–80	79–84
Measles	11 to 18	91–94	96–99
Mumps	7 to 14	86–93	90 to 98
Rubella	6 to 14	83–94	87 to 99

**herd immunity thresholds are adjusted to account for vaccine effectiveness.

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6033611/>

Est. % Kindergarteners with Nonmedical Exemption 2015



Vaccine Victories:

Things You Won't See (I hope!)

- Polio
- Smallpox
- Diphtheria: gray tonsillar membrane
- Tetanus: lockjaw
- Rubella: mild, arthralgia, adenopathy
- Rubella syndrome: devastating
- Meningococcal meningitis/sepsis: hearing and limb loss

**I will not show you any of these with two exceptions
because you won't see them!**

P.S. I have seen them all but one. Old...

Things You Should Never See





POLIO VACCINE

CBS Television interview, on [See It Now](#) (12 April 1955)

[Edward R. Murrow](#): Who owns the patent on this vaccine?

[Jonas Salk](#): Well, the people, I would say. There is no patent. Could you patent the [sun](#)?

Salk quotes: “The reward for work well done is the opportunity to do more.” “Our greatest responsibility is to be good ancestors.”

<https://www.youtube.com/watch?v=erHXKP386Nk>

Sabin did not patent his vaccine either! Oral vaccine stops GI transmission.

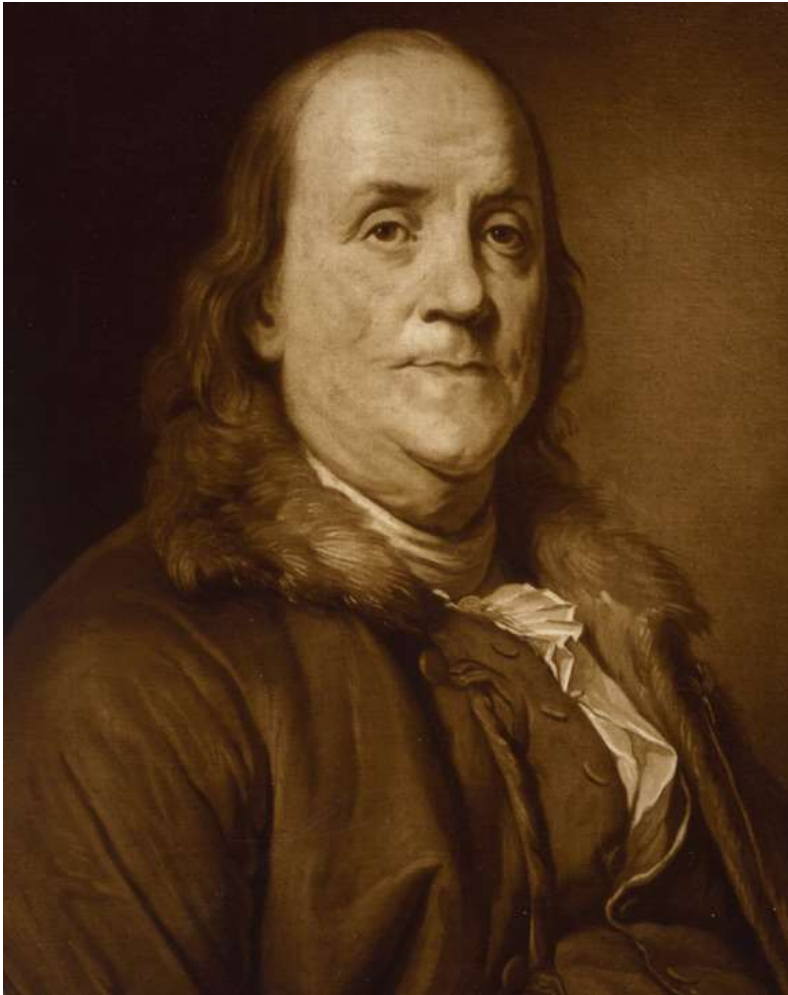
Polio/Polio Vaccine



- Julius Younger, Byron Bennett, L. James Lewis, and secretary Lorraine Friedman were all part of Salk's team
- 1.8 million children in Salk vaccine trial including his own family
- 1 in 200 infections caused paralysis
- 2019: 85 cases in Pakistan 69 and Afghanistan 16, type 1
- Type 2 last seen in 1999; WHO: eradicated from the planet!
- Type 3 last seen in 2012; to be declared eradicated next month!



<http://polioeradication.org/news/>



“In 1736 I lost one of my sons, a fine boy of 4 years old, by the smallpox...I long regretted bitterly and I still regret that I had not given it to him by inoculation; this I mention for the sake of parents, who omit that operation on the supposition that they should never forgive themselves if a child died under it; my example showing that the regret may be the same either way, and that therefore the safer should be chosen.”

-Benjamin Franklin,
1791

History of Smallpox

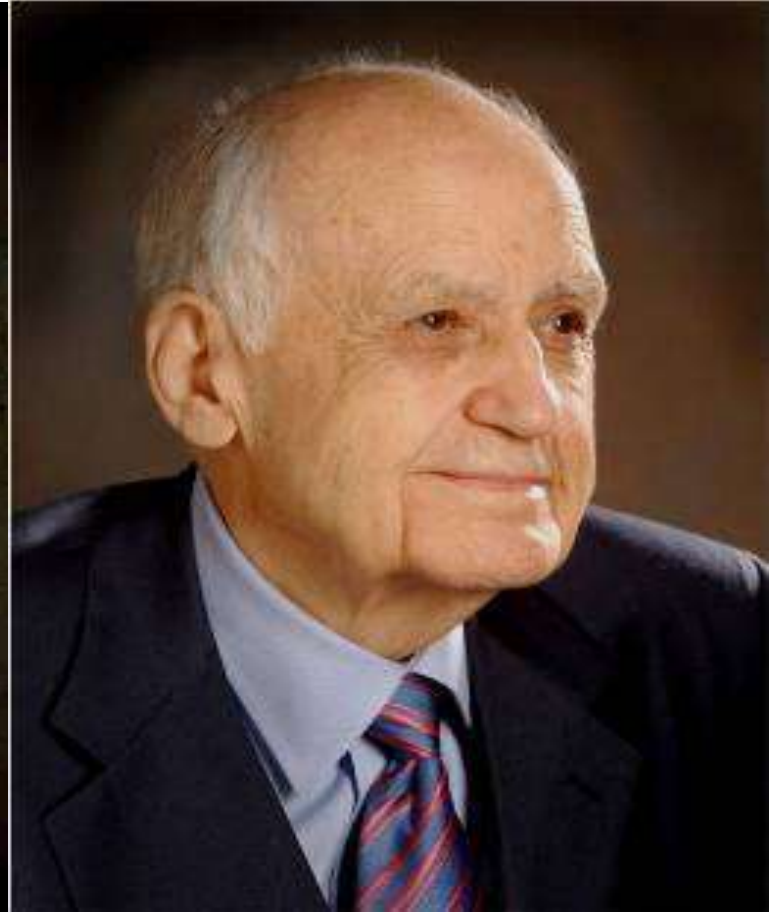


- Anthropological evidence of smallpox from 13,000 yrs ago
- Estimated 500 million deaths through time
- US 1721 Boston smallpox epidemic
- Cowpox and the milk maid: vaccinia vs variola
- Edward Jenner 1796 and Thomas Jefferson 1806
 - *“You have erased from the calendar of human afflictions one of its greatest.”*
- 1906 purity of vaccines; eventual FDA establishment
- Last case smallpox 1977; WHO 1980 “eradicated”
- Smallpox vaccine still available; no longer used routinely
- BUT gene modification poses new threats

Who are these people?



Wolfgang Mozart: Composer of 41 symphonies



Maurice R. Hilleman: Inventor of 40 vaccines,
8 of which are on the routine schedules

Including: Measles, Mumps, Rubella, Chickenpox, Hepatitis A, Hepatitis B,
Hib, and Meningitis

Things You May See

- Measles: how many people **died** from measles in **2017** in the world? **110,000 mostly children**
- Mumps
- Chickenpox
- Hepatitis A or B
- Pneumococcus
- Cholera
- Hemophilus influenzae b



Raold Dahl

- Olivia, my eldest daughter, caught measles when she was seven years old. I was sitting on her bed showing her how to fashion little animals... when it came to her turn...she couldn't do anything. "Are you feeling all right?" I asked her. "I feel all sleepy, " she said. In an hour, she was unconscious. In twelve hours she was dead.
- It really is **almost a crime** to allow your child **to go unimmunised**. ...it is never too late. All school-children who have not yet had a measles immunisation should beg their parents to arrange for them to have one as soon as possible.

<http://roalddahl.com/roald-dahl/timeline/1960s/november-1962>

- 1,250 cases in US 2019

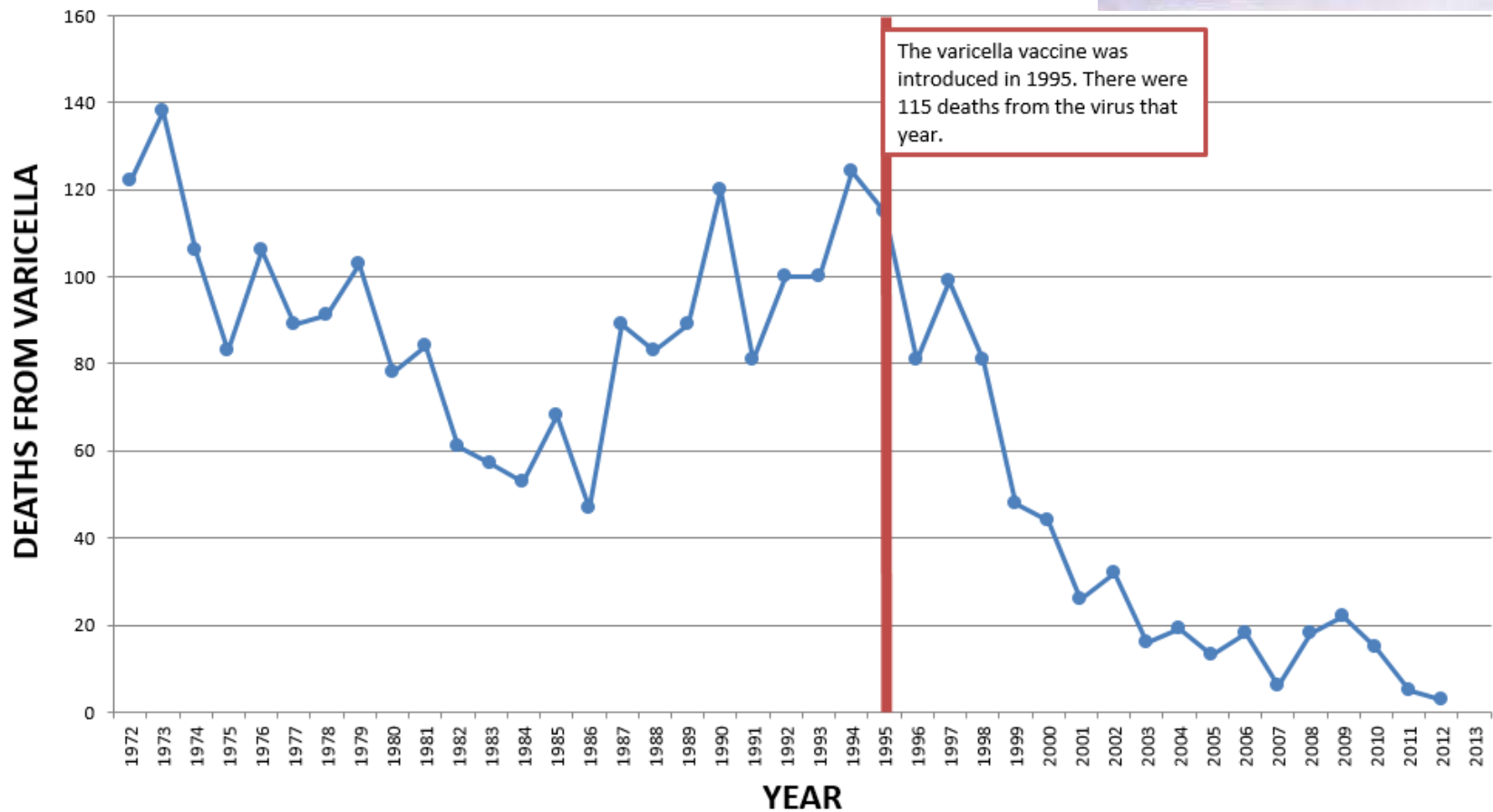
https://www.cdc.gov/mmwr/volumes/68/wr/mm6840e2.htm?s_cid=mm6840e2_e&deliveryName=USCDC_921-DM10756

Varicella

<https://www.cdc.gov/vaccines/pubs/pinkbook/varicella.html>



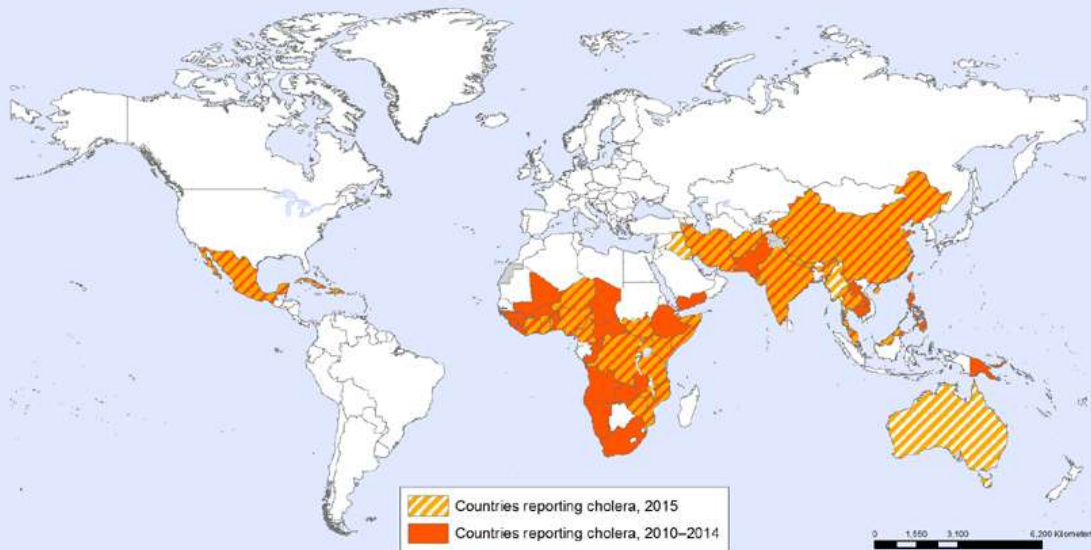
**Varicella (Chickenpox) Deaths
1972-2013**



Cholera



Countries reporting cholera, 2010–2015



The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

Data Source: World Health Organization
Map Production: Information Evidence
and Research (IER)
World Health Organization



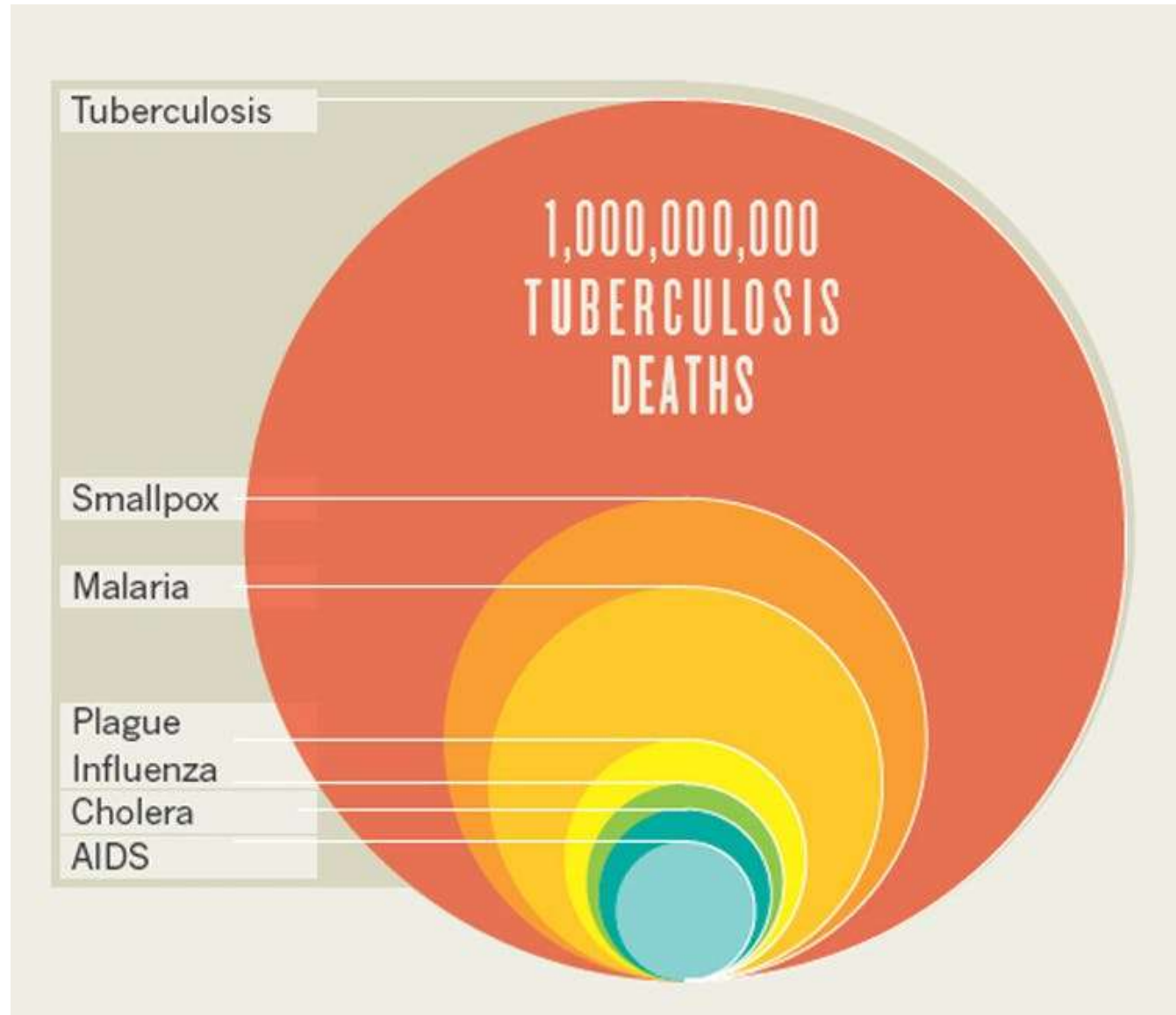
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QUIZ: What is the greatest infectious disease killer of all time?

- A) plague
- B) malaria
- C) influenza
- D) tuberculosis
- E) smallpox
- F) cholera
- G) HIV
- H) measles

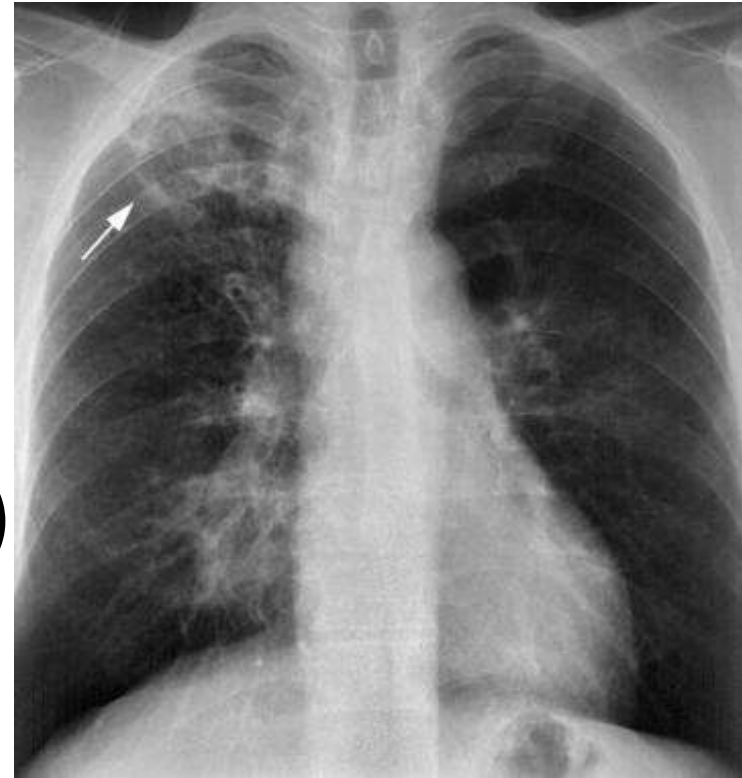
Tuberculosis



<http://theconversation.com/four-of-the-most-lethal-infectious-diseases-of-our-time-and-how-we-re-overcoming-them-78101>

Tuberculosis Vaccine?

- 1/3 of world's pop. has TB!!
- BCG (bacille Calmette-Guerin) good for infants + children; not so good for adults
- GSK's Investigational Vaccine Candidate: M72/AS01E shows promise for prevention of TB disease in a Phase 2b trial conducted in Kenya, South Africa and Zambia; VE =54%
- TB drug resistance strains; HIV



Things You Will See

- HPV: no more Pap smears?
- Pertussis
- Shingles
- Rotavirus
- Influenza



QUIZ

Who is this person?



Harald zur Hausen

How many years did it take to develop his HPV vaccine?

21 years for HPV4

Finding HPV

- **Age 21 to 29:** Every 3 yrs with cytology (Pap testing).
- **Age 30 to 65:** Every 5 yrs with HPV test alone (primary HPV testing), **OR** every 3 yrs with cytology alone, **OR** every 5 yrs with HPV co-test (Pap + HPV test). U.S. Preventive Services Task Force prefers primary HPV testing **OR** Pap testing alone.
- **Younger Than Age 21:** Screening is not recommended for women <21 yrs of age. (Too many self-resolving HPV infections!)
- **Older Than Age 65/no screening:** if adequate prior screening adequate (3 consecutive negative cytology results within 10 yrs or 2 consecutive negative HPV results within 5 yrs, with most recent test occurring within 5 yrs) and not at high risk for cervical cancer.
- **No Cervix: No Screening;** if cervix removed for benign reason.

“...the era of classic PAP smear is indeed coming to an end...”

Don't forget warts

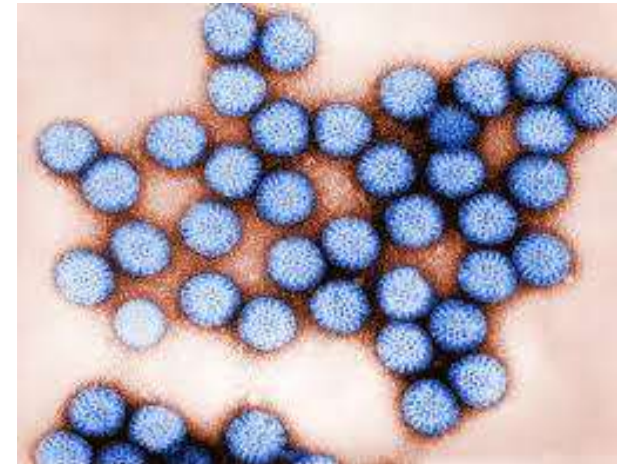


Rotavirus vaccine:

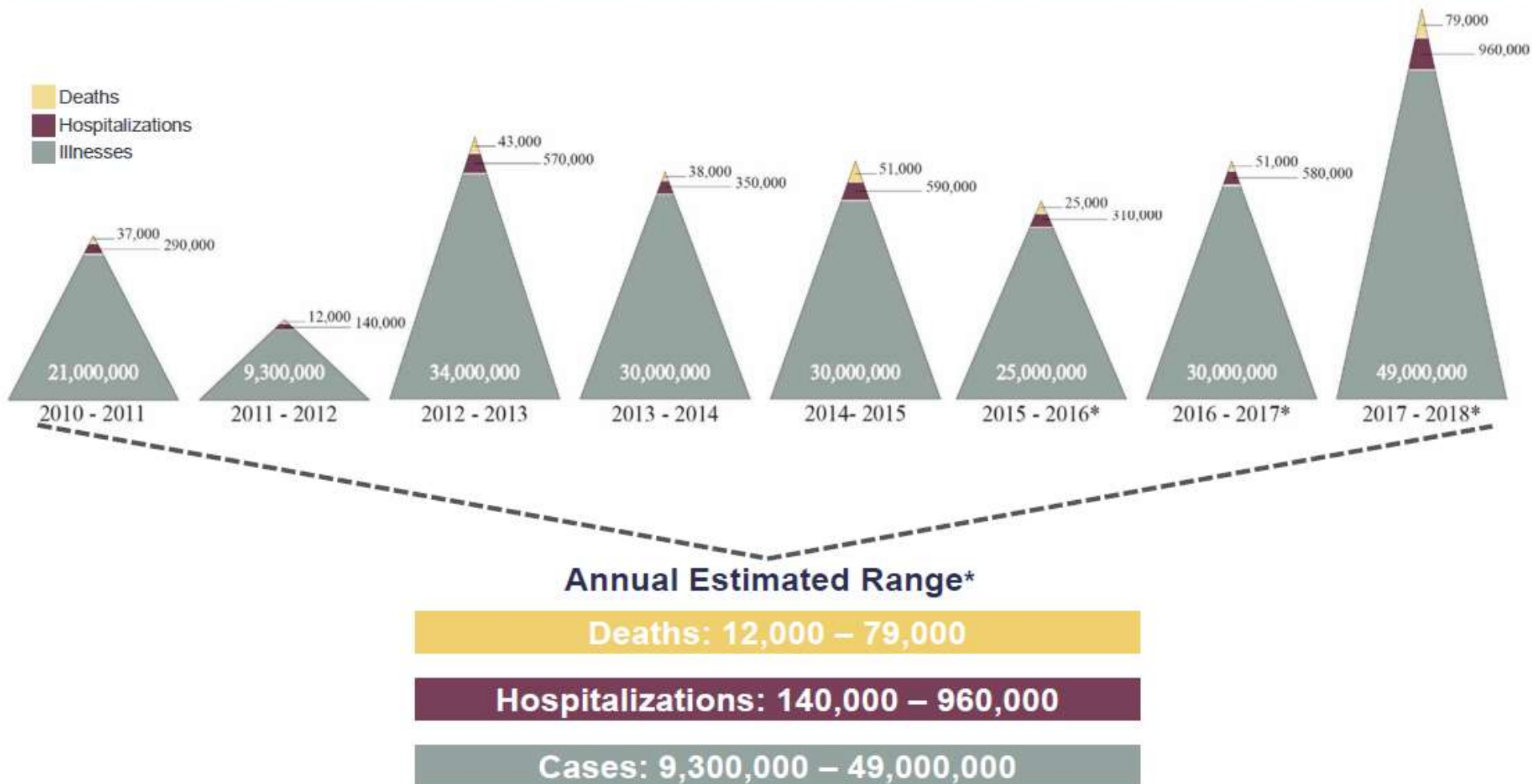
73% uptake



- Median annual % of stool tests + for rotavirus:
 - Prevaccine: 25.6% (range = 25.2–29.4)
 - Postvaccine: 6.1% (range = 2.6–11.1)
- Median annual peak in rotavirus positivity:
 - Prevaccine: 43.1% (range = 43.8–56.3)
 - Postvaccine: 14.0% (range = 4.8–27.3)
- Season duration:
 - Median of 26 weeks (range = 23–27)
 - Median of 9 weeks (range = 0–18).



Estimated Influenza Burden in the United States



* Estimates are based on mathematical models that account for under-detection, medical care seeking behavioral surveillance, deaths that occur outside of the hospital or associated with/without respiratory and circulatory causes

Reference: 1. CDC <https://www.cdc.gov/Laboratory-confirmed-influenza-associated-hospitalization-flu/about/burden/index> Accessed July 30, 2019.

Despite current vaccines!!

Available But Not Routinely Used Vaccines

- Japanese encephalitis: routine in guess where?
- Rabies: when to use? Drives me batty...
- Adenovirus: military, type 4 and 7
- Tickborne encephalitis
- Typhoid fever: travel
- Cholera: outbreaks
- Yellow fever: travel
- Hepatitis E



Activity: discuss with a neighbor

- What improvements in current vaccines would you like to obtain? List 2.

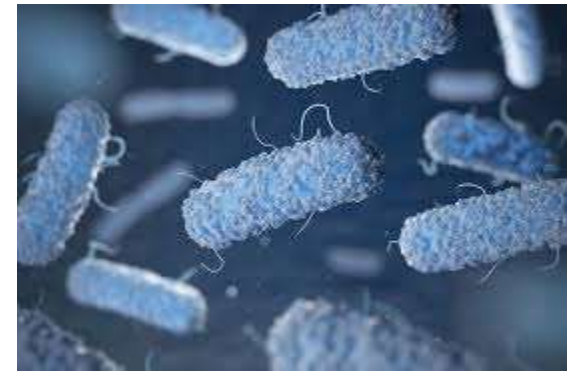
- Other than TBC, malaria, and HIV, what 3 diseases need a good vaccine?

Vaccine Pipeline

- E. coli* (major sepsis; death)
- Respiratory syncytial virus* (11,000 die)
- Cytomegalovirus
- Clostridium difficile* (15,000 die)
- Lyme disease*
- Dengue fever* (current vaccine +/-)
- Ebola virus
- Zika virus
- Malaria
- HIV
- Tuberculosis
- Streptococcus pneumoniae*
- Streptococcus pyogenes
- Tuberculosis
- Universal Influenza Vaccine*
- Campylobacter jejuni
- Chagas Disease
- Chikungunya
- Enterovirus 71 (EV71)
- Group B Streptococcus (GBS)
- Herpes Simplex Virus*
- HIV-1
- Human Hookworm Disease
- Leishmaniasis Disease
- Nipah Virus
- Nontyphoidal Salmonella Disease
- Norovirus*
- Paratyphoid fever
- Schistosomiasis Disease
- Shigella
- Staphylococcus aureus*

*** We see lots!!!**

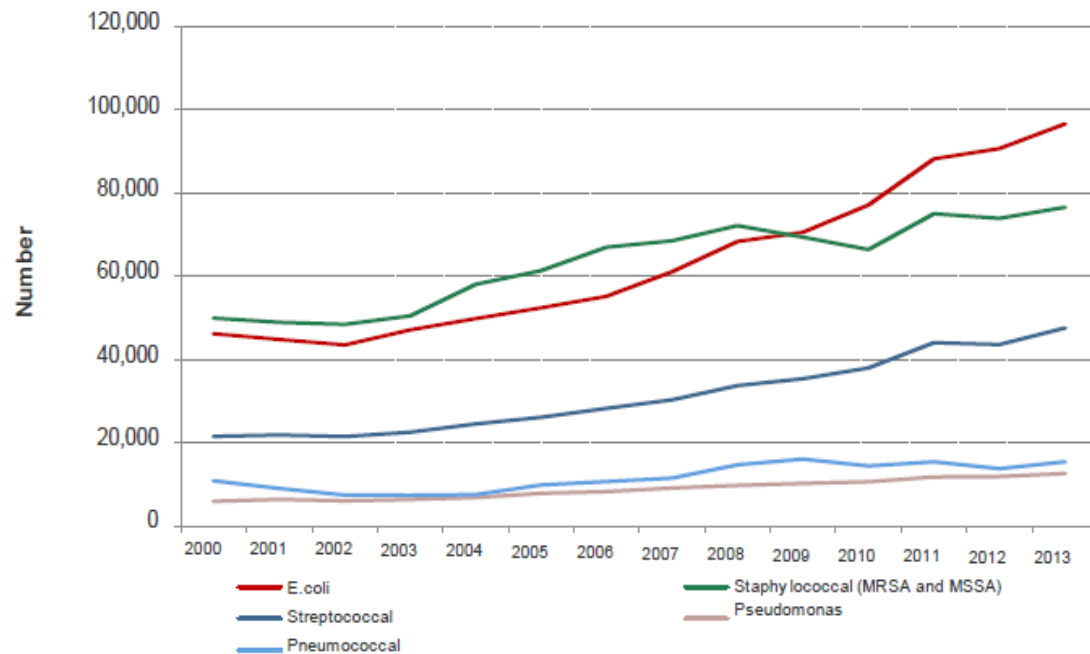
Escherichia coli



- E. coli 0157:H7
- US: UTI/sepsis
 - 7 million UTIs/yr
 - 400,000 hospital
- UK, incidence of E. coli bacteremia is est. at 90/100,000 population
case fatality rate of 11/100,000 population

E.coli bacteremias have overtaken MRSA/MSSA as a leading cause of hospital admission in the US

Bacteremia: hospital admissions* by etiology US, 2000-2013¹



* based on principal diagnosis

Estimate based on currently available data in case no preventive measurements are undertaken

Combat Vaccine Resistance

- Avoid vaccinator vaccine fatigue: better vaccines coming!
- Assess every patient on every office visit for vaccination needs: like a vital sign
- Office vaccine champion(s) but engage entire staff
- Use presumptive rather than participatory approach
- Use patient reminders: iPhone, email, texts, postcards
- Use standing orders
- Default appointments:
“Your next appointment for flu vaccine is ...”
- Document adult vaccines:
wallet card, iPhone



Resources

- CDC schedules
<https://www.cdc.gov/vaccines/schedules/index.html>
- Shots Immunizations by AAFP/STFM
www.aafp.org/shots
- Online resources: CDC and IAC
- ACIP email
<https://www.cdc.gov/Other/emailupdates/>
- Full list from Immunization Action Coalition (IAC) at
<http://www.immunize.org/resources/apps.asp>
<http://www.immunize.org/express/>

Favorites

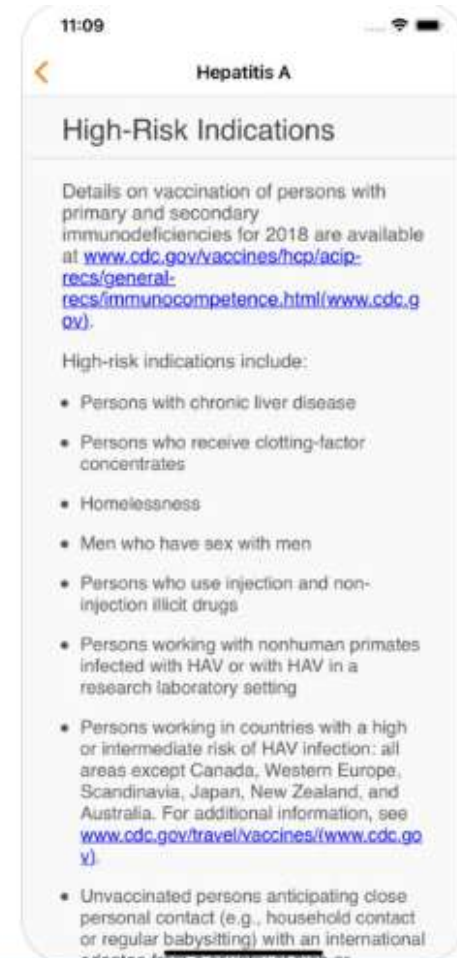
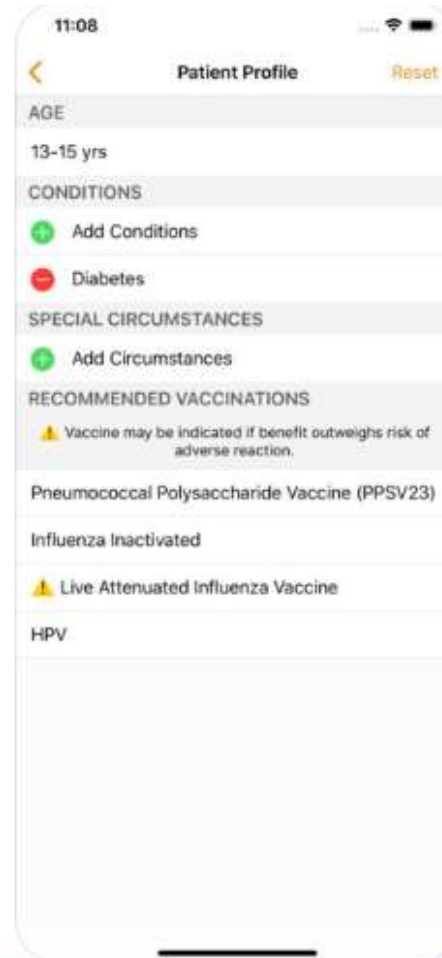
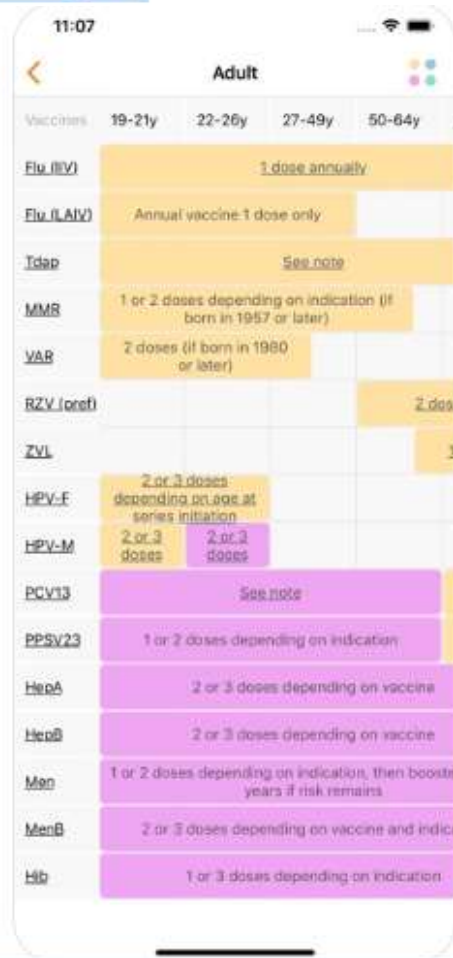
WEB SECTIONS

PRINTABLES

1. Handouts (educational materials) for Patients and Staff
2. Vaccine Information Statements
3. Ask the Experts
4. IAC Express
5. Subscribe to IAC Express
6. Clinic Tools
7. Standing Orders for Vaccination
8. Screening Checklists for Vaccination
9. Vaccinating Adults: Step-By-Step Guide
10. ACIP Recommendations
11. Package Inserts
12. Technically Speaking Columns
13. PowerPoint Slide Sets
14. Photos
15. State Laws and Mandates
16. CDC Schedules
17. Unprotected People Stories
18. Contact Info for States
19. Shop IAC



Shots Immunization by AAFP/STFM



Screening Checklist for Contraindications to Vaccines for Adults

PATIENT NAME _____

DATE OF BIRTH _____ / _____ / _____
month day year

For patients: The following questions will help us determine which vaccines you may be given today. If you answer "yes" to any question, it does not necessarily mean you should not be vaccinated. It just means additional questions must be asked. If a question is not clear, please ask your healthcare provider to explain it.

	yes	no	don't know
1. Are you sick today?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Do you have allergies to medications, food, a vaccine component, or latex?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Have you ever had a serious reaction after receiving a vaccination?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Do you have a long-term health problem with heart, lung, kidney, or metabolic disease (e.g., diabetes), asthma, a blood disorder, no spleen, complement component deficiency, a cochlear implant, or a spinal fluid leak? Are you on long-term aspirin therapy?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Do you, or does a close family member, have cancer, leukemia, HIV/AIDS, or any other immune system problem?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. In the past 3 months, have you taken medications that affect your immune system, such as prednisone, other steroids, or anticancer drugs; drugs for the treatment of rheumatoid arthritis, Crohn's disease, or psoriasis; or have you had radiation treatments?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Have you had a seizure or a brain or other nervous system problem?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. During the past year, have you received a transfusion of blood or blood products, or been given immune (gamma) globulin or an antiviral drug?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. For women: Are you pregnant or is there a chance you could become pregnant during the next month?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Have you received any vaccinations in the past 4 weeks?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

FORM COMPLETED BY _____ DATE _____

FORM REVIEWED BY _____ DATE _____

Did you bring your immunization record card with you? yes ☐ no ☐

It is important for you to have a personal record of your vaccinations. If you don't have a personal record, ask your healthcare provider to give you one. Keep this record in a safe place and bring it with you every time you seek medical care. Make sure your healthcare provider records all your vaccinations on it.

Immunization Action Coalition

<http://www.immunize.org/catg.d/p4065.pdf>

Remember to provide your adult patients with some record of vaccination. Cell phones, wallet cards.

ADULT IMMUNIZATION RECORD
Always carry this record with you and bring your healthcare provider or school health staff a copy to show.

Vaccine	Type of vaccine	Date given (month/day/year)	Healthcare professional or clinic name	Date next dose due
Hepatitis B (hepatitis, blood, skin, eye, sexual, needle, injection)				
Hepatitis A (hepatitis, blood, skin, eye, sexual, needle, injection)				
Meningitis (meningitis, blood, skin, eye, sexual, needle, injection)				
Polio (polio, blood, skin, eye, sexual, needle, injection)				
Tetanus, Diphtheria, Pertussis (tetanus, diphtheria, pertussis, blood, skin, eye, sexual, needle, injection)				

DATE BORN: _____
 LAST NAME: _____
 FIRST NAME: _____
 MIDDLE NAME: _____
 PHONE: (____) _____
 ADDRESS: _____
 CITY: _____ STATE: _____ ZIP: _____