



Vaccines: Responding to Terrors Old & New

ACOI 2021 Clinical Challenges for Hospitalists

May 13: 1:00 – 2:00 PM

Epidemics, Pandemics and the fear of death (or microbes)



Bryan Martin DO, MMAS, MACOI
Interim Chief, AI Division
Professor of Medicine
The Ohio State University



Bryan Martin DO, MMAS, MACOI

No Fiscal Disclosure



President Elect: World Allergy Organization

Previously:

President: American College of Allergy,
Asthma & Immunology

Deputy Director: National Vaccine
Healthcare Center Network, Washington DC

Director, Walter Reed Regional Vaccine
Healthcare Center, Washington, DC

Consultant for Allergy & Immunology to the
Army Surgeon General

Bryan Martin DO, MMAS, MACOI

Learning Objectives

Upon completion of this activity,
you will be better able to

Identify key
barriers to vaccine
administration in
the US

Understand why
people fear
vaccines

Help advise
patient's who have
concerns about
and reactions to
vaccinations

Mother Nature can't be forgotten: Pandemics are not new

Old Pandemics

- Small pox
 - Episodic epidemics
 - Not only fatal but disfiguring
- Plague (black plague)
- Spanish Flu (1918)
- Polio
- Yellow Fever

21st Century

- SARS: 2003
- H1N1: 2009
- Ebola: 2014
- MERS: 2015
- Zika: 2015
- COVID 19 (SARS COV-2): 2019

Major Pandemics

- 541 CE: The Plague of Justinian, centered in Constantinople, the capital of the Byzantine Empire
 - 30-50 million dead (estimated ½ world's population)
 - Yersinia pestis: aka plague
- 1347: Black death
 - Actually plague again, now in Europe
 - Kills 200 million in four years
 - Quarantine is invented in the early 1500's
 - Separate and Isolate the sick

The Plague lasted a long time...

- London had outbreaks about every 10 years from 1348-1665
 - 40 outbreaks in just over 300 years
 - About 20% of Londoners died with each outbreak
- 1665: the Great Plague
 - 100,000 Londoners die in just 7 months.
 - Public entertainment was banned, victims forcibly shut into homes with red crosses painted on the doors and dead buried in mass graves.

Plague suit

Invented by Dr. De Lorme (1584-1678): chief physician to King Louis XIII

Nose: ½ foot long shaped like a beak, filled with perfume with only 2 holes, one on each side, but that can suffice to breath

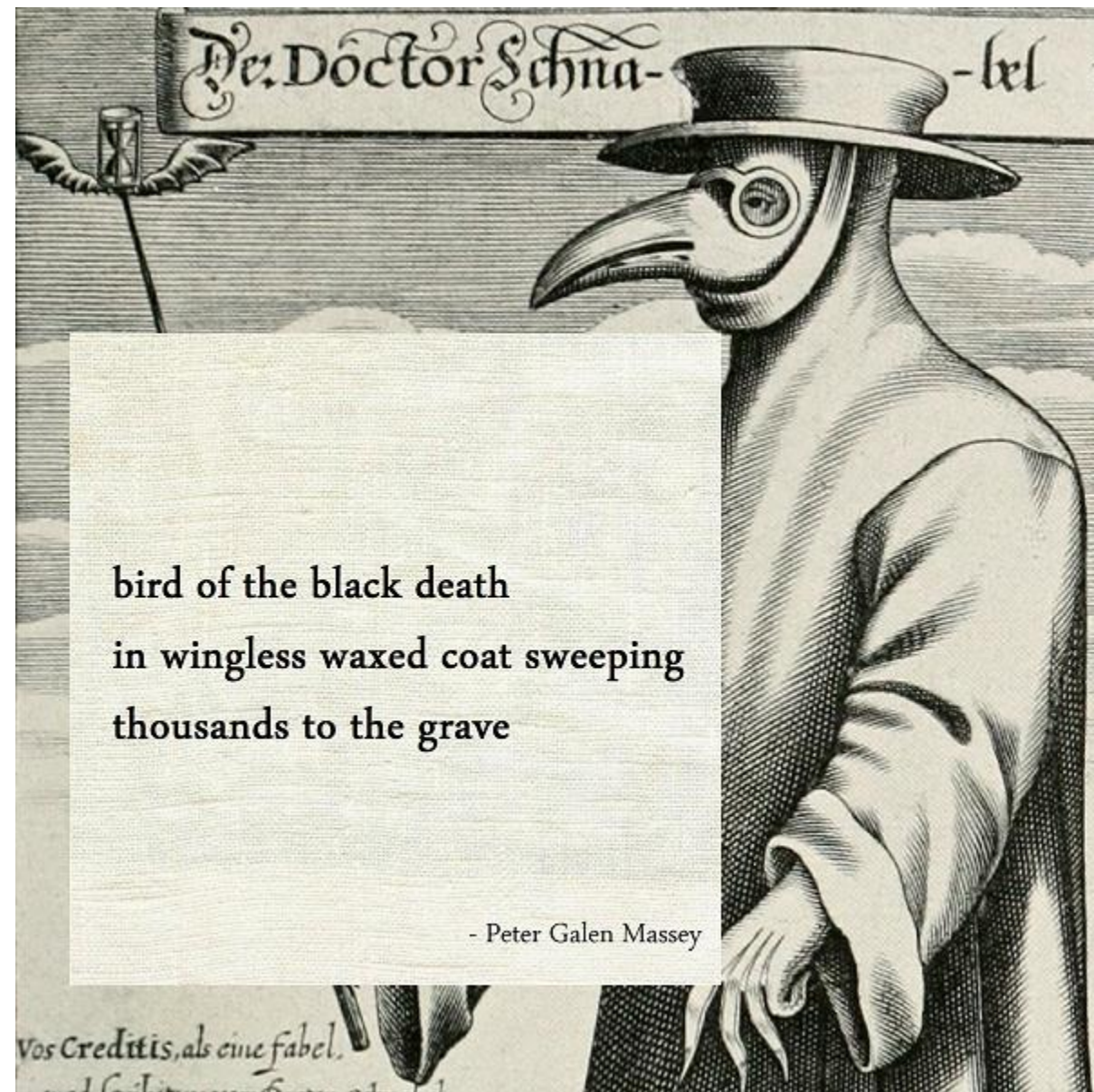
Boots: Moroccan goat leather

Breaches: attached to the boots

Short sleeved blouse in smooth skin:
bottom tucked into breaches

Hat and gloves: of smooth skin

Spectacles: over the eyes



Plague



COVID - 19



Smallpox

- “Old World” Disease: endemic to Europe, Asia and Arabia for centuries
 - Persistent menace that killed 30% of those infected and scarred the survivors
 - It is hard to over emphasize the effect of small pox on history.
- When Europeans came to the Americas in the 15 th century, they brought the smallpox virus with them.
 - Indigenous people of modern day Mexico and United states had NO natural immunity and tens of millions died
 - Estimated that 90-95% of the indigenous population of the Americas is killed in the next century
 - Mexico goes from 11 million people pre-conquest to 1 million
- Efforts at protection: insufflation then variolation and finally vaccination.

“Immunization” predates Immunologists!

- Smallpox immunization is over 1000 years old:
 - Some evidence of inoculation with infected matter before 200 BC in India or China
- One technique was insufflation:
 - Ground smallpox scab (variola) was insufflated into the nose in early China



Edward Jenner: 1796

Father of smallpox vaccination

- Dedicated his life, money, and reputation to spreading the use of vaccination

First vaccination developed in 1796

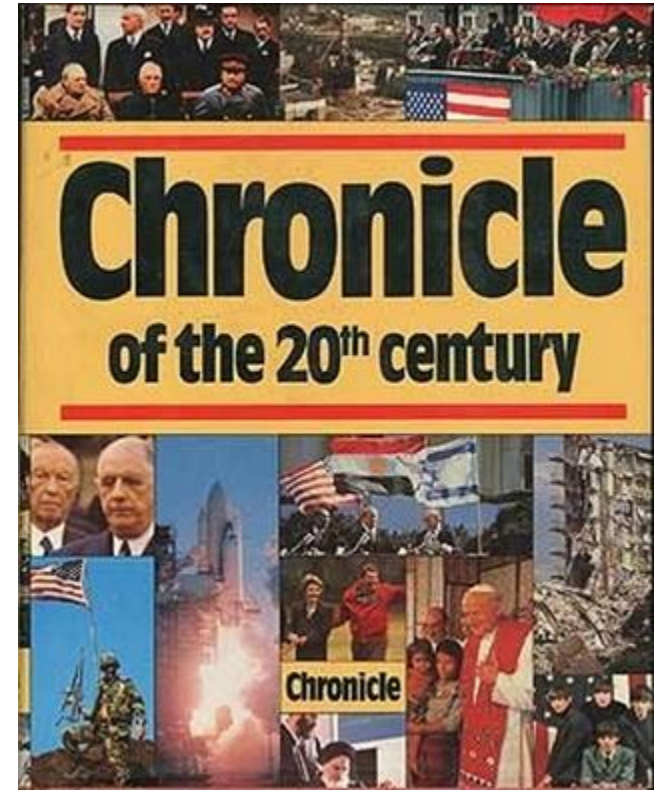
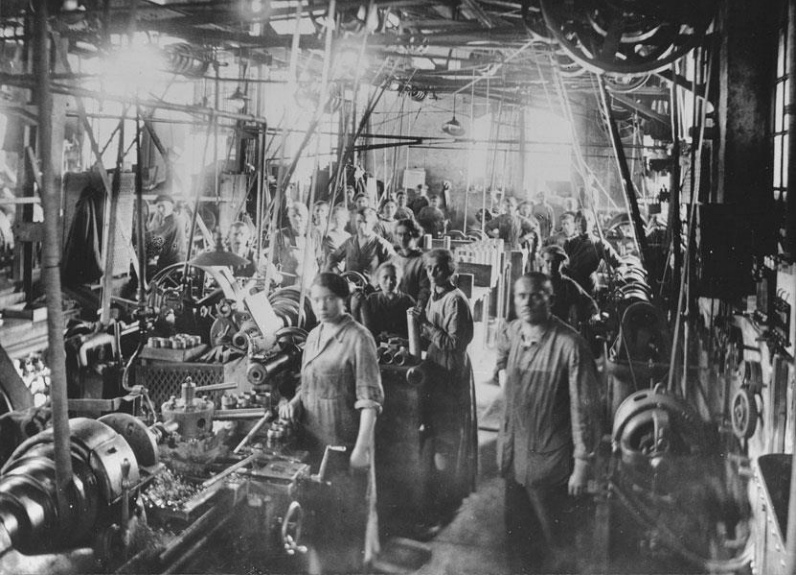
Vaccinates 24 children

- After several months, exposes them to smallpox (variolation)
- Repeats exposure 5 years later

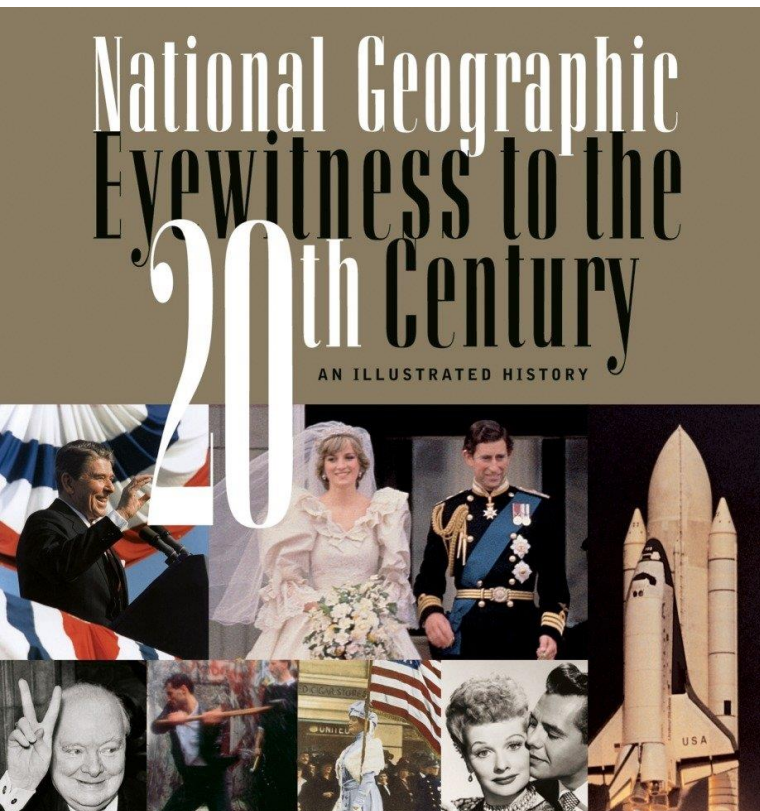


“The Cow Pock or the Wonderful Effects of the New Inoculation!”





The 20th Century



1916 NYC Polio Epidemic



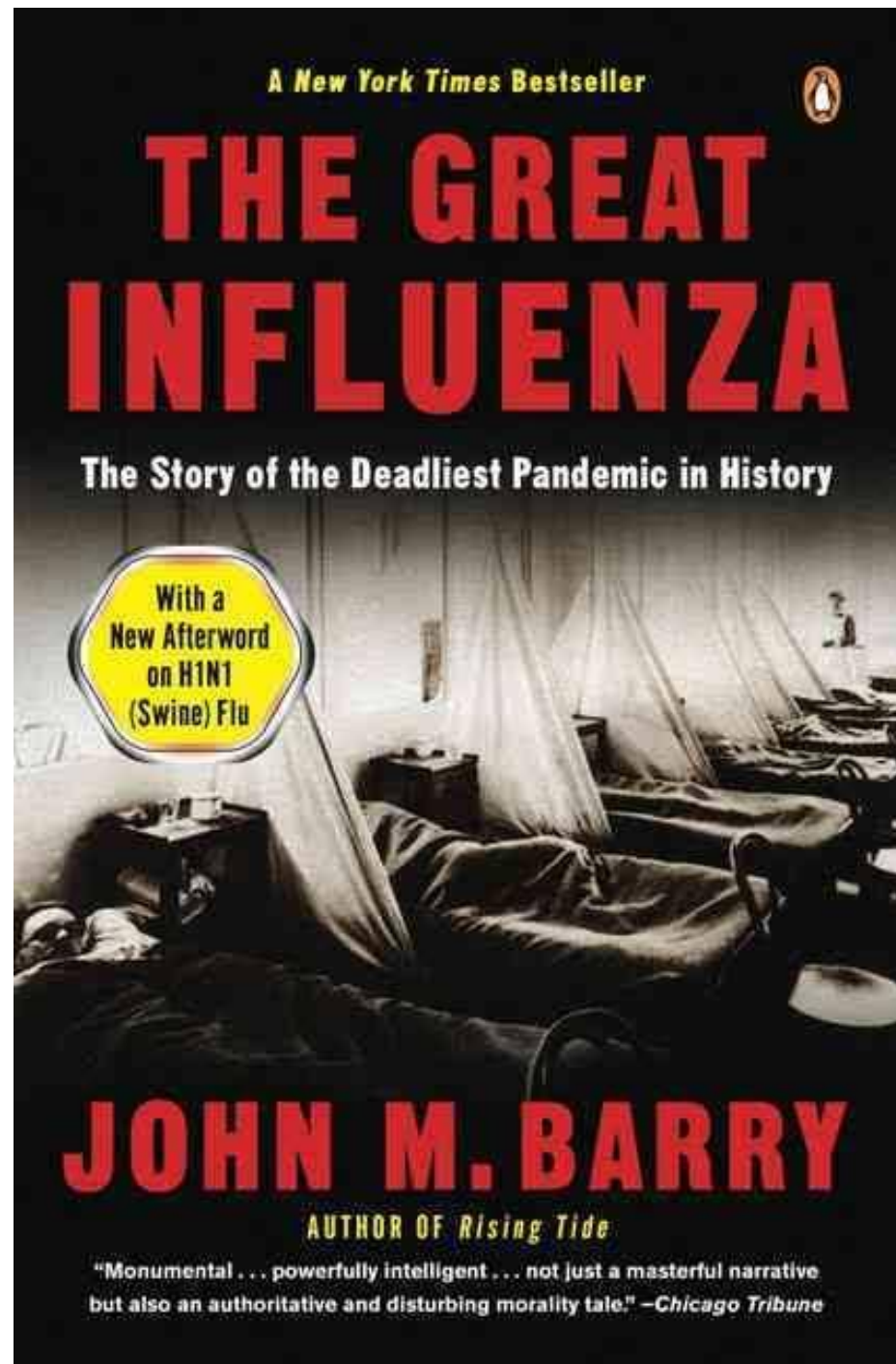
- All eyes are on the war in Europe
- Summer of 1916: NYC is quiet: playgrounds are empty due to a polio epidemic
 - No one knows how the recently identified polio virus is transmitted
 - 72,00 stray cats, suspected of harboring the virus are rounded up and exterminated
- Those who could, fled. Mothers dragged their children into crowds at train stations and ferry docks.
- Families with a case at home were quarantined
- 75% of those afflicted survived, many condemned to life in a wheelchair, on crutches or in bed



1916 NYC Polio Epidemic

- By August every isolation bed in NYC was occupied, many with more than one child
- At the peak of the epidemic a baby died approximately every 2.5 hours
- Fear permeated the city. When the weather turned cool, polio seemed to disappear
- Final toll:
 - Approximately 8,900 infected in NYC
 - 2,400 deaths, with many survivors paralyzed
- Nationwide 27,000 were afflicted, most under 5

And then:
1918 Influenza



1918 Influenza Epidemic

- Fall of 1918 a severe flu was noted, initially in soldiers mobilizing for war in Europe
 - In Camp Devens, outside Boston 12,000 soldiers were affected in September alone
- NYC was a primary embarkation point for the troops and quickly felt the brunt of the epidemic
- Death notices filled the newspapers; photos showed:
 - Stalwart looking young men in uniform
 - Glowing young brides in wedding gowns
- Obituaries listed entire families dead.
- The air reeked of decaying flesh as days passed before the death cart collected the dead.

CLOSING OF ALL PUBLIC PLACES IS STATE ORDER

Rapid Spread of Spanish Influenza Leads to Move by Health Secretary.

SCHOOLS ARE DISMISSED

Churches, Lodges, Theaters and Other Places Also Come Under Ban Effective Here.



FLU PANDEMIC OF 1918



DEATH BRINGS WARNING OF INFLUENZA

BAN ON DANCES IS PLACED BY HEALTH OFFICER

SCHOOLS CLOSED; NO SERVICES IN CHURCHES SUNDAY

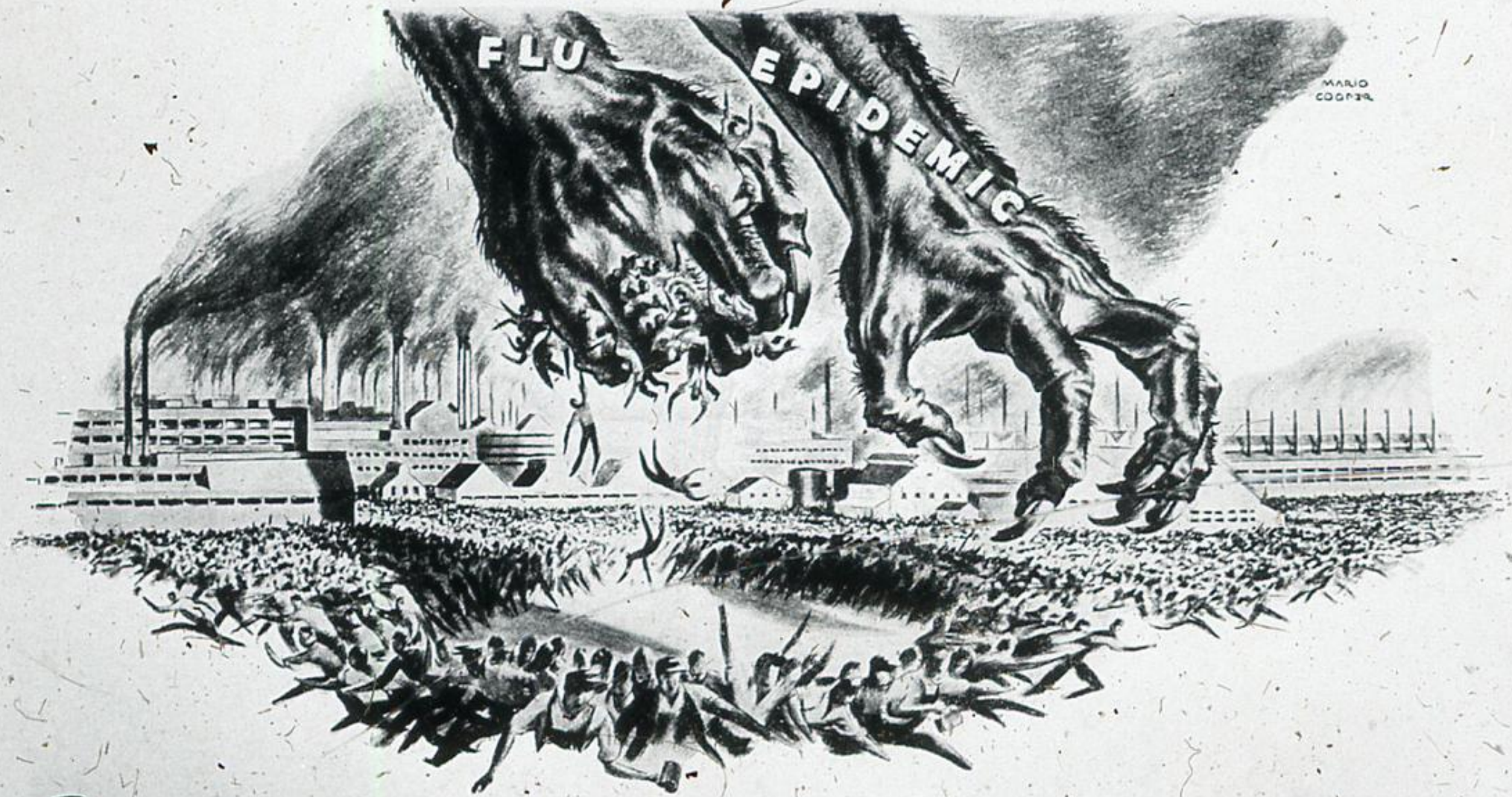
FLUSHING OR OILING OF STREETS URGED BY COUNCIL OF DEFENSE

FUNERAL BAN IS ORDERED

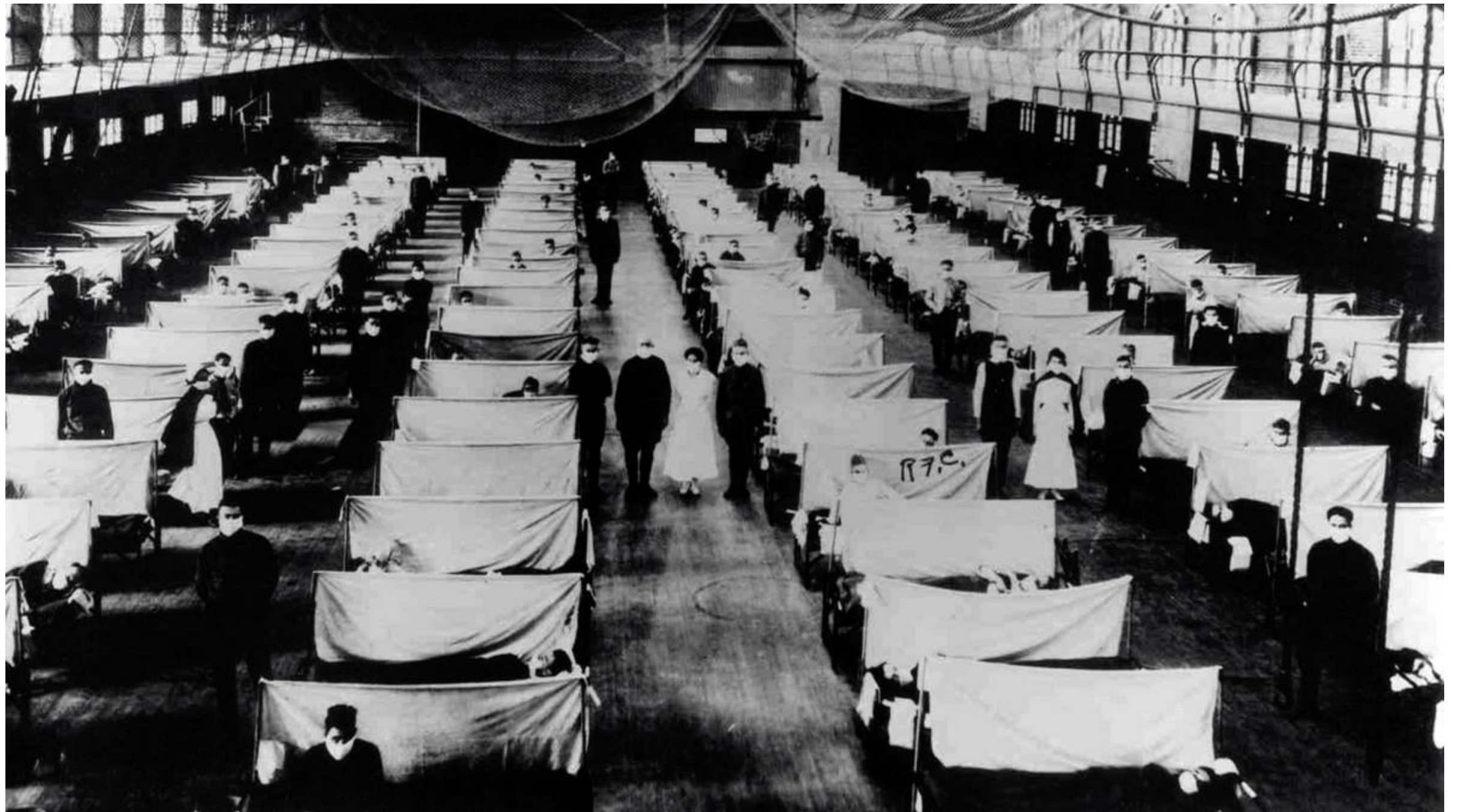
Voluntary Flu Ban Urged

NEWPORT GYM CLASSES STOPPED

NEWPORT 1 ORDERED



It almost stopped the works in 1918!



1918 Influenza Epidemic

- Desperate to ward off illness, and feeling medicine was unable to help, home remedies proliferated:
 - Wear of camphor balls, Extraction of all teeth, Red peppers, Strychnine, Whiskey, Chloroform
- Spring of 1919 Influenza had run its course
 - 20 million dead worldwide
 - 850,000 dead in the US
 - 33,000 in NYC
- One survivor of these epidemics was a young Jonas Salk, born in East Harlem on October 28, 1914.



The nose was an issue then, too!



ALL FLU RECORDS SMASHED IN DENVER IN LAST 24 HOURS

438 New Cases Reported, 17 Deaths of Influenza
And One of Pneumonia—New Regulations
Issued by City as Scourge Rages.

(Continued From Page One.)
The agreement reached daily for
masks to be worn by conductors during

keep the other person's locality. Of
course, when each person keeps his
own germ-banned in his own mask,
the other fellow doesn't get the harm-
ful contagion. In other words, you

Police Will Squelch All Halloween Fun

Orders To Disperse Gatherings And
Celebrations Tonight Be-
cause Of "Flu."

As "joy-killers" and "gloom-spread-
ers" members of the police force will
reign supreme tonight—Halloween—
usually a time of much merriment and
joy to youngsters and grown-ups alike
The "flu" has done it!



To Prevent Influenza!

Do not take any person's breath.
Keep the mouth and teeth clean.
Avoid those that cough and sneeze.
Don't visit poorly ventilated places.
Keep warm, get fresh air and sun-
shine.
Don't use common drinking cups,
towels, etc.
Cover your mouth when you cough
and sneeze.
Avoid Worry, Fear and Fatigue.
Stay at home if you have a cold.
Walk to your work or office.
In sick rooms wear a gauze mask
like in illustration.

1918 Hospital



2021 Hospital



The Legacy of Polio

<http://amhistory.si.edu/polio/howpolio/>

WHATEVER HAPPENED TO **POLIO**?



- THE AMERICAN EPIDEMICS
- **HOW POLIO CHANGED US**
- THE VIRUS AND VACCINE
- POLIO TODAY



- ACTIVITIES
- TIMELINE
- HISTORICAL PHOTOS
- RESOURCES
- VISITOR INFO

How Polio Changed Us

What **Legacy** Did Polio Leave?



- Disability Rights
- Social Effects
- Scientific and Medical Legacy

What Did a **Dime** Do?



- March of Dimes
- Franklin D. Roosevelt

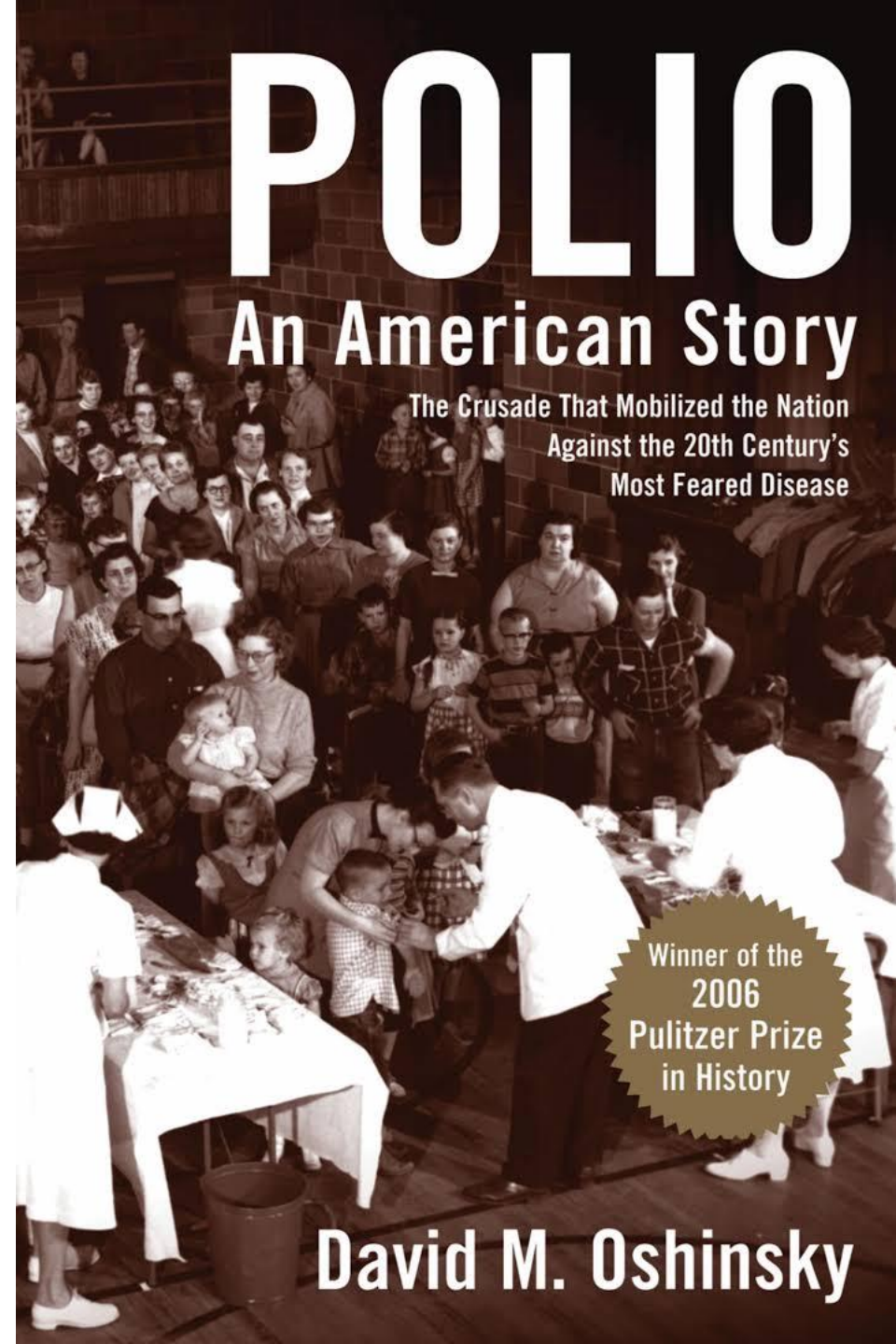
What Role Did **Technology** Play?



- The Medical World
- Rehabilitation
- Assistive Devices
- The Iron Lung and Other Equipment



Polio was a Problem



POLIO

An American Story

The Crusade That Mobilized the Nation
Against the 20th Century's
Most Feared Disease

Winner of the
2006
Pulitzer Prize
in History

David M. Oshinsky

Let's Review: Polio

Virus identified
as cause

1908

1916

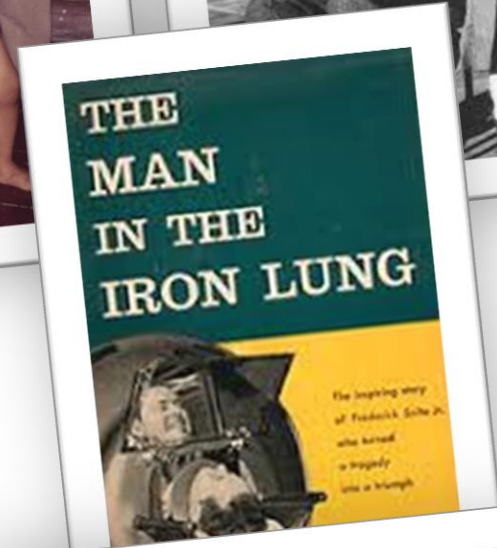
1921

1929

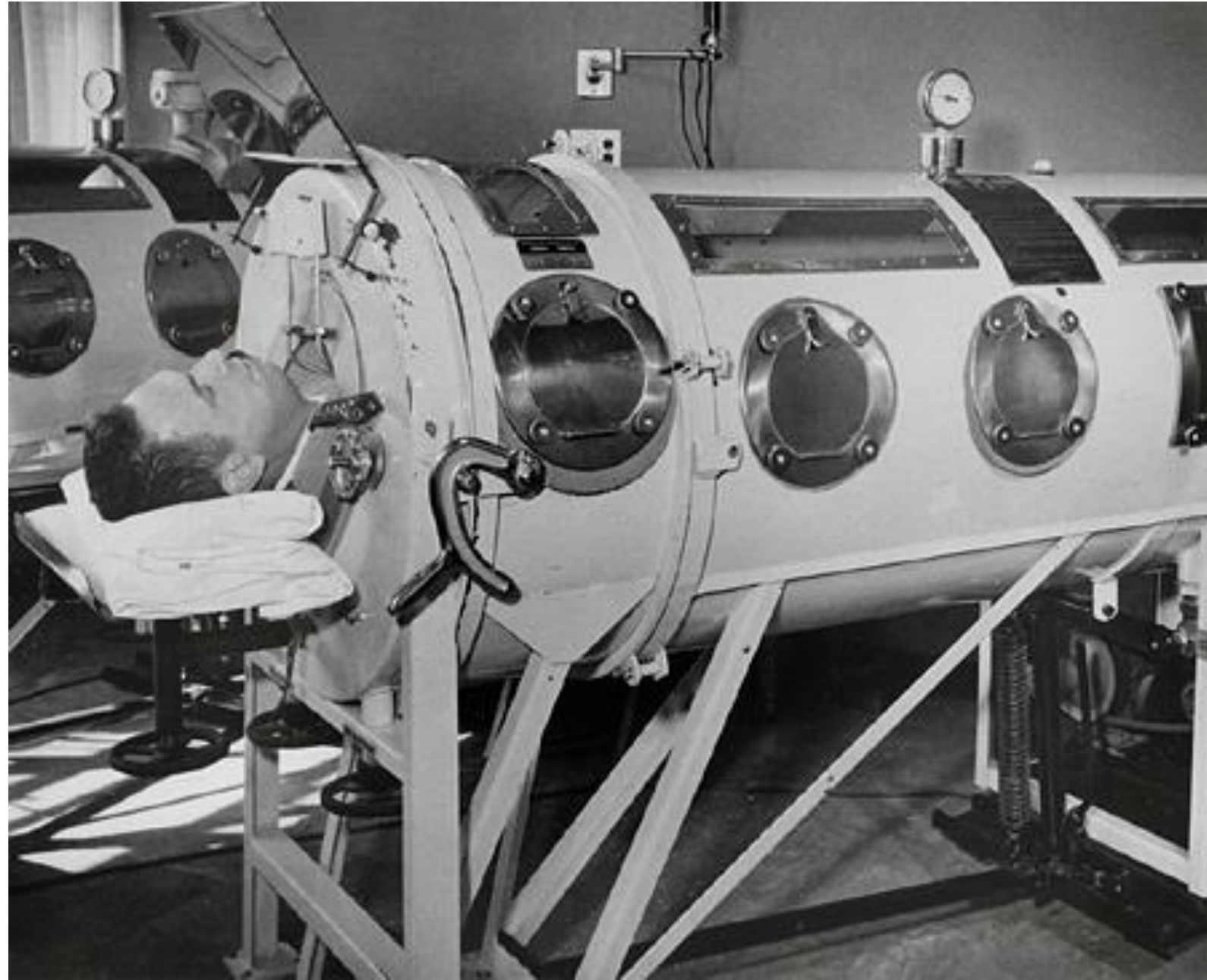
FDR contracts
at age 39

US epidemic

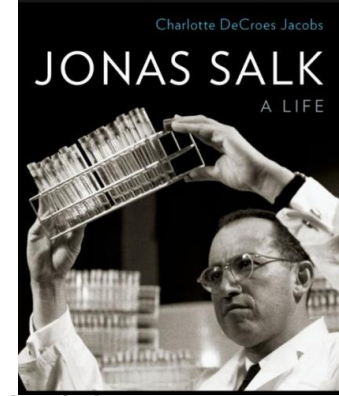
Iron lung
developed



Iron lung:
difficult for patients and nursing staff



June 1936: Jonas Salk, MD



- In medical school Salk becomes intrigued by a seeming paradox
 - It is possible to immunize against tetanus and diphtheria using toxins produced by these microbes after they were rendered harmless by chemicals
 - **Viral immunizations required actual infection with live virus; vaccines made from killed viruses wouldn't work or would confer only fleeting antibody response**
- While in medical school Salk shows that mice injected with inactivated influenza virus would create a measureable antibody response against influenza.

Polio Vaccine

- Everyone is waiting for a vaccine against this paralytic scourge!
- Enter the March of Dimes, born as the National Foundation for Infantile Paralysis (NFIP).
- 1943 the NFIP awarded a grant that included Albert Sabin, MD
- 1954: massive field trial involving 1.8 million schoolchildren known as “polio pioneers”
- Salk vaccine licensed on April 12, 1955.

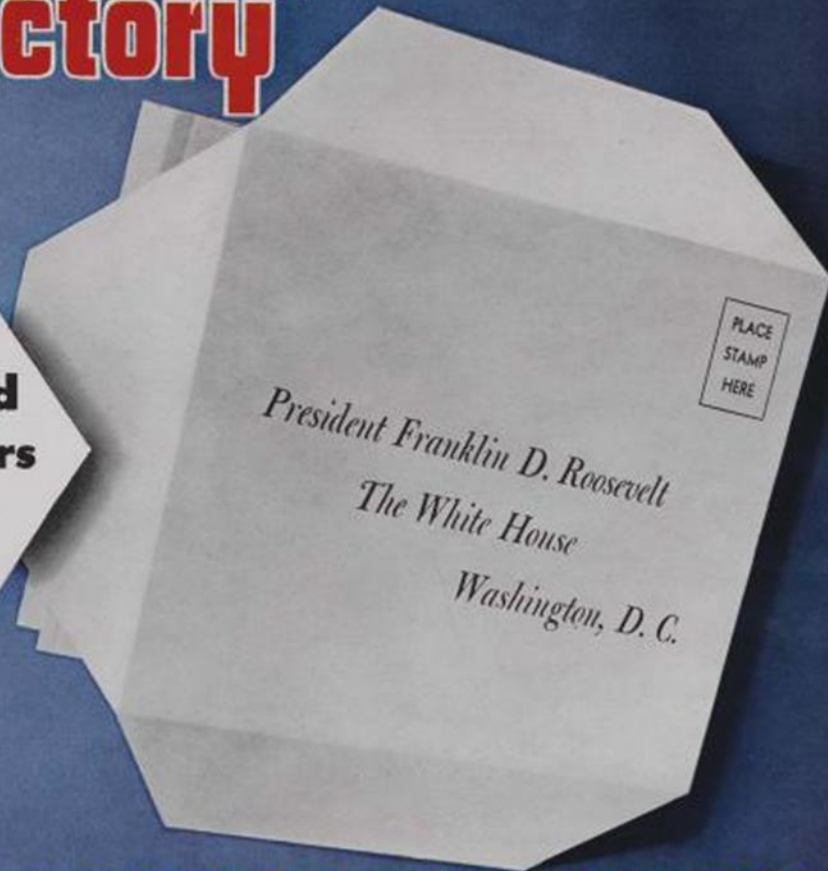


“...help me win My Victory”

**FIGHT
INFANTILE
PARALYSIS**



**Send a Birthday Card
with Dimes and Dollars
to Your President**



JOIN THE MARCH OF DIMES

The Celebration of the President's Birthday for **THE NATIONAL FOUNDATION FOR INFANTILE PARALYSIS**



April 12, 1955

- Announcement that an inactivated (Salk) Polio vaccine would be available for the public
- Many in the microbiology world still felt that an inactivated viral vaccine was not appropriate, and argued that we should wait for the attenuated polio vaccine
- Argument
 - Polio virus entered through GI
 - Oral polio was best strategy
 - Inactivated only helped when Polio in the bloodstream



Pharmaceutical Industry Responds

- Salk does not patent his vaccine
 - “It belongs to the world”
 - Donated “public” money paid for his research
- 6 pharmaceutical companies were licensed to make inactivated polio vaccine
 - Within hours of its approval thousands of cartons of polio vaccine were rushed across the country.
 - Supply could not meet demand
 - Cutter Laboratories
 - Shipped 1 ton of vaccine within 72 hours of licensing

April 25, 1955 (13 DAYS after licensing)

- Notification that a Chicago infant had been admitted with paralysis of both legs 8 days after polio shot
- More cases of active polio after immunization were reported in the next several days
 - All occurred within 10 days of inoculation
 - All were from vaccine supplied by Cutter Laboratories
 - Between April 18 and 27 approximately 400,000 children had received Cutter vaccine
- Soon secondary cases were reported following vaccination
 - Some of these patients were shedding virus

Investigation

- Investigation revealed
 - Cutter protocol, while approved, varied from the Salk protocol; shrinking testing for live virus from 5 times during processing, to 2.
 - Precipitation in Cutter vaccine allowed virus to survive.
- All companies had some difficulty with the viral inactivation
 - Lots with active virus were simply discarded
 - No requirement to report tainted lots



THE Cutter Incident

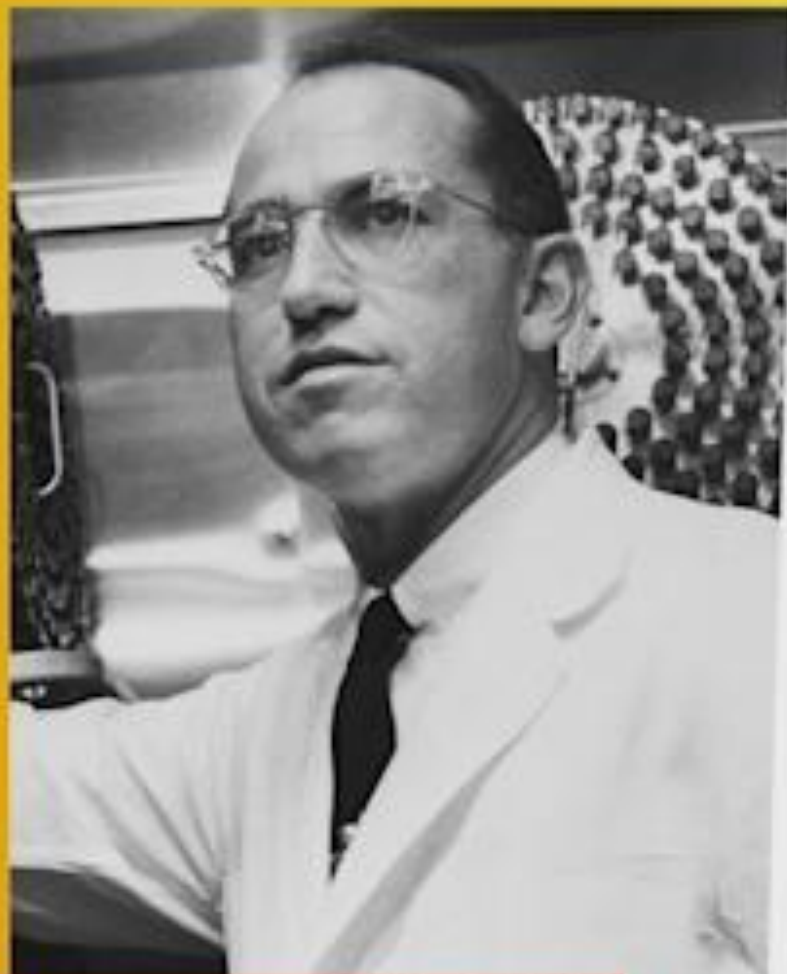
HOW AMERICA'S FIRST POLIO VACCINE LED TO THE GROWING VACCINE CRISIS
 Paul Offit, M.D.

Result of Cutter incident

- Between April 17 and June 30, 1955
 - 260 individuals contracted polio from the Cutter vaccine
 - 94 among those vaccinated
 - 126 Family members of those vaccinated
 - 40 community contacts of those vaccinated
 - 11 Died
 - 75% suffered some sort of disability
- **Millions of children went unvaccinated due to fear of the vaccine affects – DISTRUST!**
 - July 1955: Massachusetts suffered a polio epidemic
 - Approximately 4,000 contracted polio
 - 1,700 were paralyzed

Public confusion

- By mid May manufacturers had been inspected and lots of vaccine released, but by this time the public was confused and distrustful
- Patients turned to their family doctors for advice
 - Physicians had received no information on the problem, they knew no more than the public
- Sabin, working on an attenuated live virus vaccine, testified that the Salk vaccine needed to be completely overhauled
 - Attenuated live viral vaccine would be safer and more effective
 - Two polio vaccine “camps:”
 - Inactivated vs live attenuated



JONAS SALK

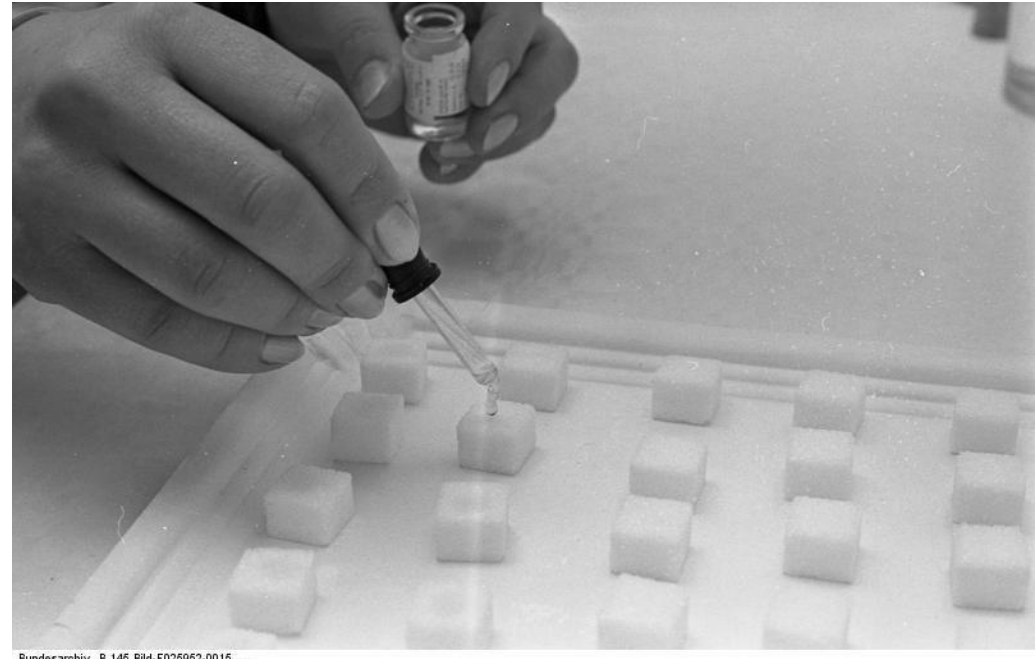


ALBERT SABIN

PTL

Live attenuated Polio Vaccine

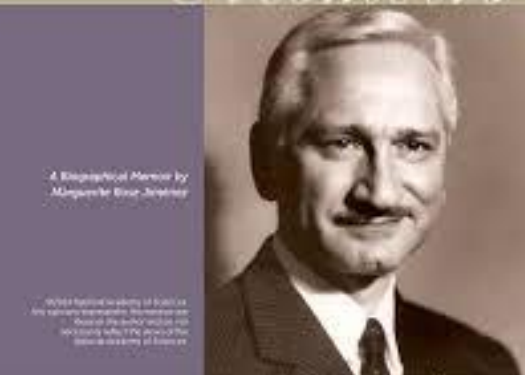
- Sabin continued to work on the live attenuated polio vaccine
- Licensed in 1961, Sabin lobbied to have his “sugar cube vaccine” be the primary vaccine for polio
- Sabin argued that even those who were fully vaccinated with the Salk vaccine should receive the Oral vaccine, as there was no proof Salk vaccine provided lifelong immunity.
- 1962 oral vaccine is the vaccine of choice in US
 - Ease of administration
 - Less cost
 - Skilled nursing not needed





Albert B. Sabin
1906-1993

BIOGRAPHICAL *Memoirs*



A Biographical Memoir by
Marguerite Elise Johnson

World National Academy of Sciences
The National Academy of Sciences
Member of the Public Health and
Security Administration
The National Academy of Sciences

NATIONAL ACADEMY OF SCIENCES



ALBERT B. SABIN, MD 1906-1993

Albert B. Sabin developed the oral, live-virus polio vaccine at the University of Cincinnati College of Medicine and Children's Hospital Research Foundation, where between 1939 and 1969, he conducted his most significant research. His vaccine has nearly eradicated the dreaded "infantile paralysis" that killed or maimed millions of children. Dr. Sabin, who considered Cincinnati his home, made many other significant medical discoveries here, particularly in the area of tropical diseases. Presidents and royalty worldwide honored him, including President Bill Clinton who said he was "one of the great heroes of American medicine." His numerous awards include the U. S. National Medal of Medicine (1970), Presidential Medal of Freedom (1986), Medal of Liberty (1986), and Order of Friendship among Peoples awarded by the President of the Supreme Soviet of the U.S.S.R.



THE OHIO BICENTENNIAL COMMISSION
THE INTERNATIONAL PAPER COMPANY FOUNDATION
THE OHIO HISTORICAL SOCIETY
2003

34-31



TODAY IS SABIN ORAL SUNDAY

"Knock-Out the Crippler" with "Polio Punch"

SERVING FROM 11 A.M. to 7 P.M. IN 60 LOCATIONS

On May 27th, 84% of the population of Omaha took advantage of the Sabin Oral Sunday Vaccine Program. In this 84%, the vital preschool age groups in the Greater Omaha area were completely covered. BUT DON'T FORGET! . . . Polio knows no age limitations, it could strike anyone, young or old. Don't take a chance . . . start today with your Sabin Oral Vaccine Program. This is your opportunity to receive greater immunity more quickly against Types I, II, III of the Polio Virus. Let us all strive for a goal of 100% participation of all the people in Greater Omaha.

"Polio Punch" will be available at any of the SOS Centers listed below. It is not necessary that you go to the center nearest you, however it is recommended that you do. The locations have been selected following a study of area and population. This will assure the most orderly and even flow through each Center.



AN SOS CENTER IS LOCATED NEAR YOU

But, to speed up the process the administration of the oral vaccine program, fill out the questionnaire now. Some before and bring it with you. It will save you time.

S. O. S.
SABIN ORAL SUNDAY

AN ORAL VACCINE TO KICK OUT POLIO IN THE U.S. IS AVAILABLE NEAR YOU. THE BROTHERS MICHARDI GROUP HAS DEVELOPED AN ORAL POLIO VACCINE.

SABIN ORAL POLIO VACCINATION

FOR COMPLETE PROTECTION, YOU AND ALL MEMBERS OF YOUR FAMILY MUST TAKE TWO DOSES OF VACCINE.

TIME 1: 8:00 AM - 12:00 PM
TIME 2: 1:00 PM - 5:00 PM

YOU CAN SAVE TIME BY COMPLETING THIS QUESTIONNAIRE BEFORE YOU GO TO YOUR LOCAL SOS CENTER NEAR YOU.

Please Print

Name: _____ Age: _____
Address: _____
City: _____ State: _____

For What Age Group and Sex of All Other Persons in Your Household Who Have Not Had 2 Doses of the Oral Polio Vaccine?

Full Name	Full Name	Sex	Age
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

I hereby state that I am the parent or guardian of the minor listed above and I hereby request that you take the appropriate steps to administer the oral vaccine to my child.

Signature of Parent or Guardian _____

NOTE: A contribution of \$1.00 per dose is suggested to cover costs. The cost will be refunded.

SOS CENTER LOCATIONS (Adult Schools)

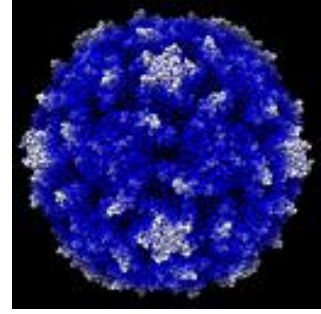
Blairwood-40th North 51st St., Stoughton, Neb.	Midway-15th-42nd Western Avenue	Rocky-12th South 48th St.
Missouri-42nd North 28th Avenue	Plattsmouth-20th Main Street St.	Rocky-12th South 28th St.
Bellevue-42nd North 51st St.	Waltham-18th Main Street St.	Outback-18th West Center Road
Mount Pleasant-22nd North 51st St.	Franklin-20th Franklin St.	Waukegan-18th Main St.
Shawnee-22nd North 14th Avenue	Langston-20th Franklin St.	Camden-21st South 18th St.
Valley Elementary-Valley, Neb.	Kelso-21st North 28th St.	Benning-21st Riverside Blvd.
Reynolds-21st Road St.	Reynolds-21st North 28th St.	Jefferson-21st North St.
Central Park-21st North 51st St.	Scandinavia-21st North 51st Avenue	Rocky-21st South 28th Avenue
Scotch-21st North 51st St.	Waltham-21st North 28th Avenue	South Omaha-21st and "P" Sts.
Elkhorn Elementary-Elkhorn, Neb.	Craighead Medical-Craighead and "D" Street	Waltham-21st and "H" Sts.
Forney-21st North 51st St.	Stearns-21st and Harvey	Laurens-21st and "L" Sts.
Stella-21st-21st Squaring St.	Berkley-21st North 51st St.	Radford-21st and "D" Sts.
Laurens-21st LaFayette St.	Central Omaha-21st Dodge St.	Madison-21st Madison St.
Bevan-21st-21st Maple St.	Waltham-21st and Pacific	Payette-21st South 28th St.
Spaulding-21st Corby St.	Washington-21st Mainway St.	Payette-21st South 28th St.
Older-21st-21st North 42nd St.	Jefferson-21st South 51st St.	Payette-21st South 28th St.
Howard-Kennedy-21st North 28th St.	Madison-21st South 28th St.	Payette-21st South 28th St.
Franklin-21st North 28th St., E. Omaha	Spring-Highway-21st and Walnut	Bellevue-21st-21st and Washington Sts., Bellevue, Neb.
Laurens-21st North 14th St.	Bella Espinoza-21st South 28th St.	Berkeley-Highway-Berkeley, Neb.
Underwood-21st-21st and Western		

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Adverse events to live Polio Vaccine

- By June of 1962 reports of paralysis in patients who had received the oral polio vaccine began to surface.
 - These cases were investigated
 - Vaccine Associated Paralytic Polio (VAPP)

Polio Vaccines Introduction & Uptake

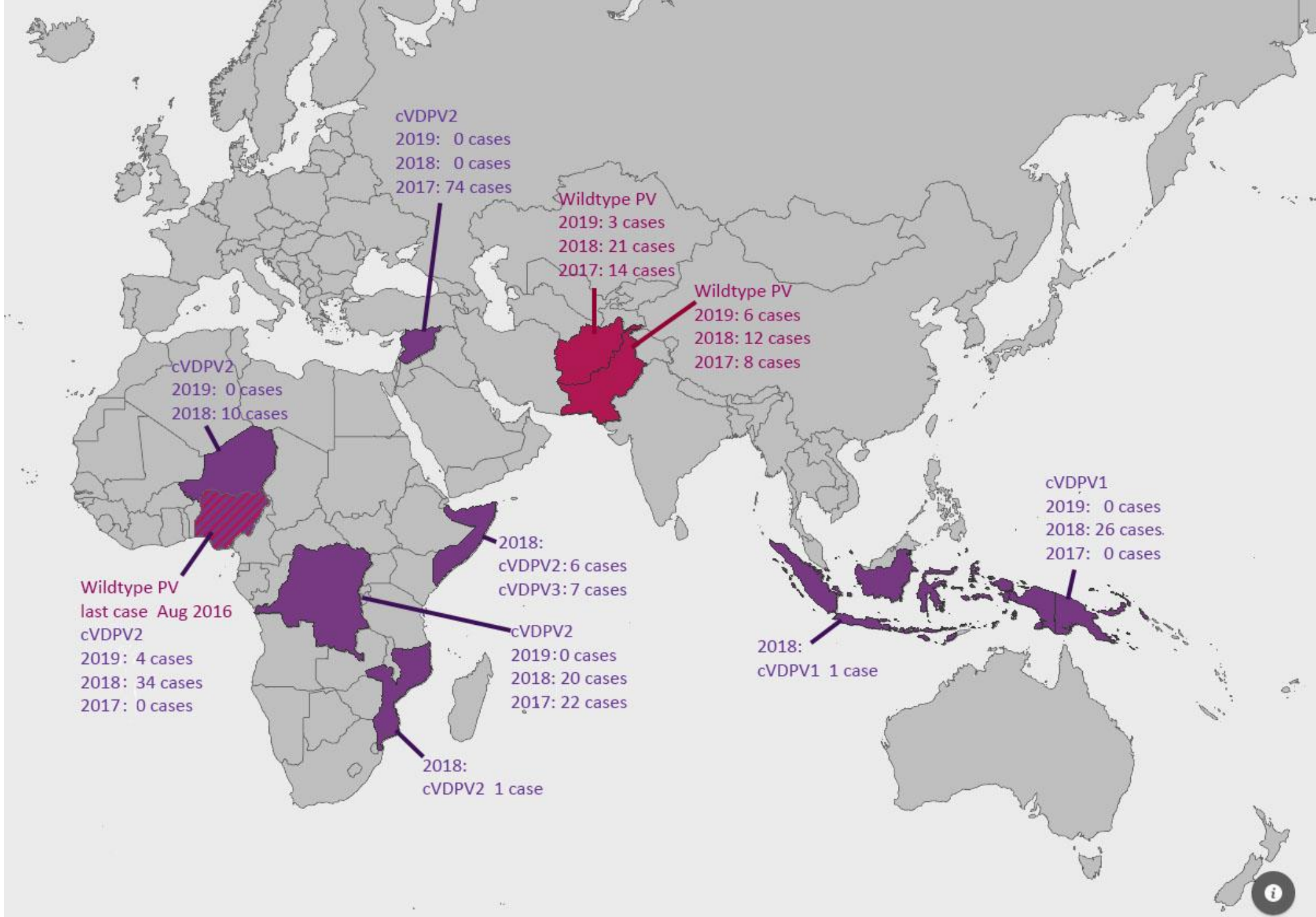


- IPV
 - Injectable inactivated polio vaccine
 - Jonas Salk developed in 1953, commercially 1955
- OPV
 - Oral polio vaccine, live attenuated vaccine
 - Albert Sabin develops in 1957, commercially 1961
 - Easier to give
- 1955-1957 Incidence of polio in US falls by 85-90%
- 1979: last case of wild polio virus in US, last case of smallpox in the world

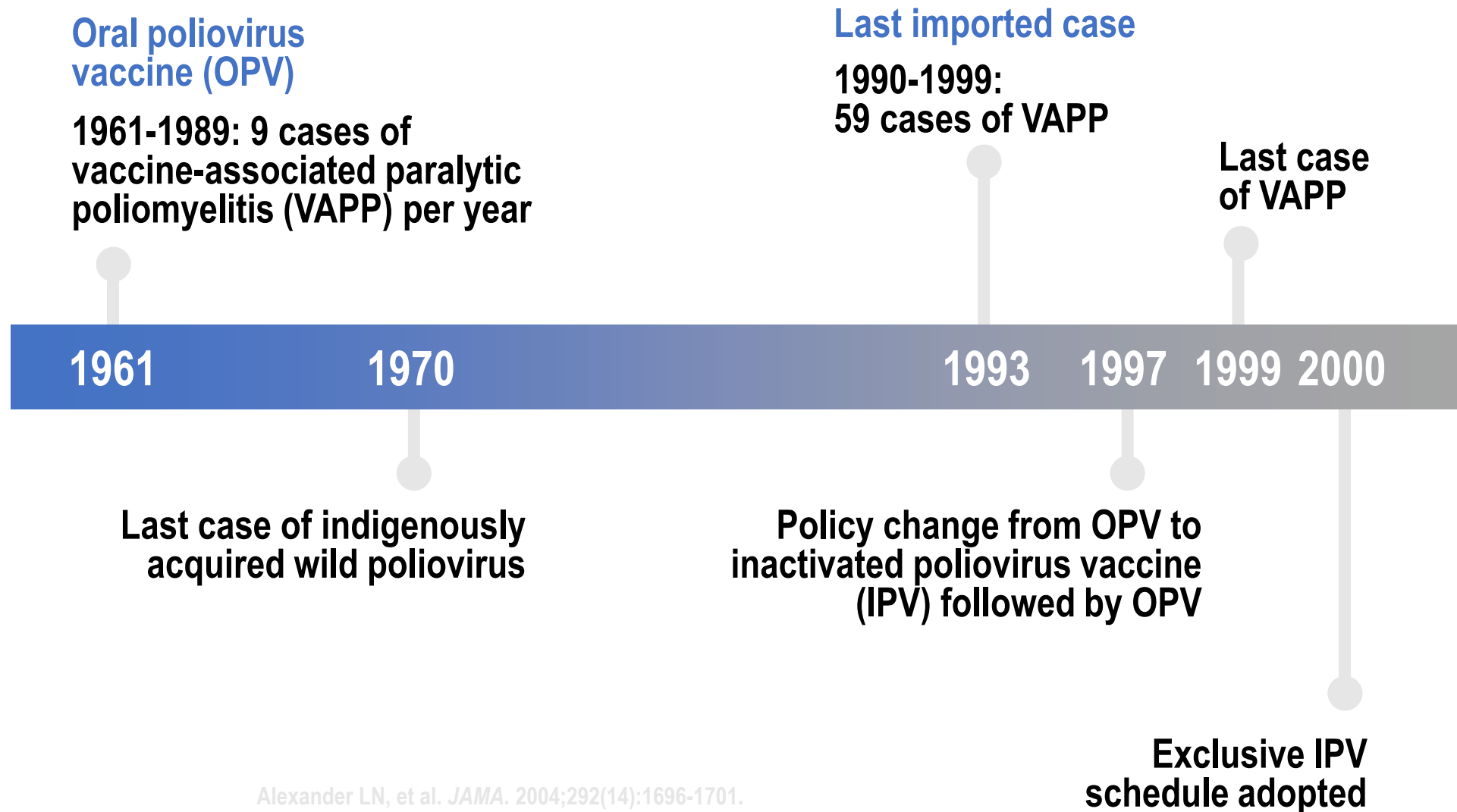
There Is Still Danger That Polio Can Return



Upheaval in world makes it worse, not better.



Poliomyelitis: Vaccine Policy Changes in the United States



Vaccines in the public eye



Vaccine Hesitancy

- WHO definition: “...a complex and rapidly changing global problem that requires ongoing monitoring.”
- This used to be called the Vaccine NO movement
- This is not a US phenomenon, nor is it new
- **Why are people so afraid of something that is so good for them?**
 - November 28, 2016 Google Hits
 - Vaccine No: 57,300,000
 - Vaccine Hesitancy: 91,100

Reported Morbidity, Vaccine-Preventable Diseases, & Vaccine Adverse Events in US

Disease	20th Century Annual Morbidity*	2000 [†]	2010 ¹	% Reduction (2010)
Diphtheria	175,885	4	0	100
Measles	503,282	81	63	>99
Mumps	152,209	323	2612	98
Pertussis	147,271	6755	27,538	86
Polio (wild)	16,316	0	0	100
Rubella	47,745	152	5	>99
Congenital rubella syndrome	823	7	0	100
Tetanus	1314	26	26	96
Invasive Hib disease	20,000	167	240	99
Total	1,064,845	7515	30,484	97.4
Vaccine adverse events	0	13,497 [‡]	~28,000 ²	††

HIB=*Haemophilus influenzae* bacteria.

*Maximum cases reported in prevaccine era and year. [†]Provisional. [‡]Adverse events after vaccines against diseases shown on table=5296. ^{††}Estimated because no national reporting existed in the prevaccine era.

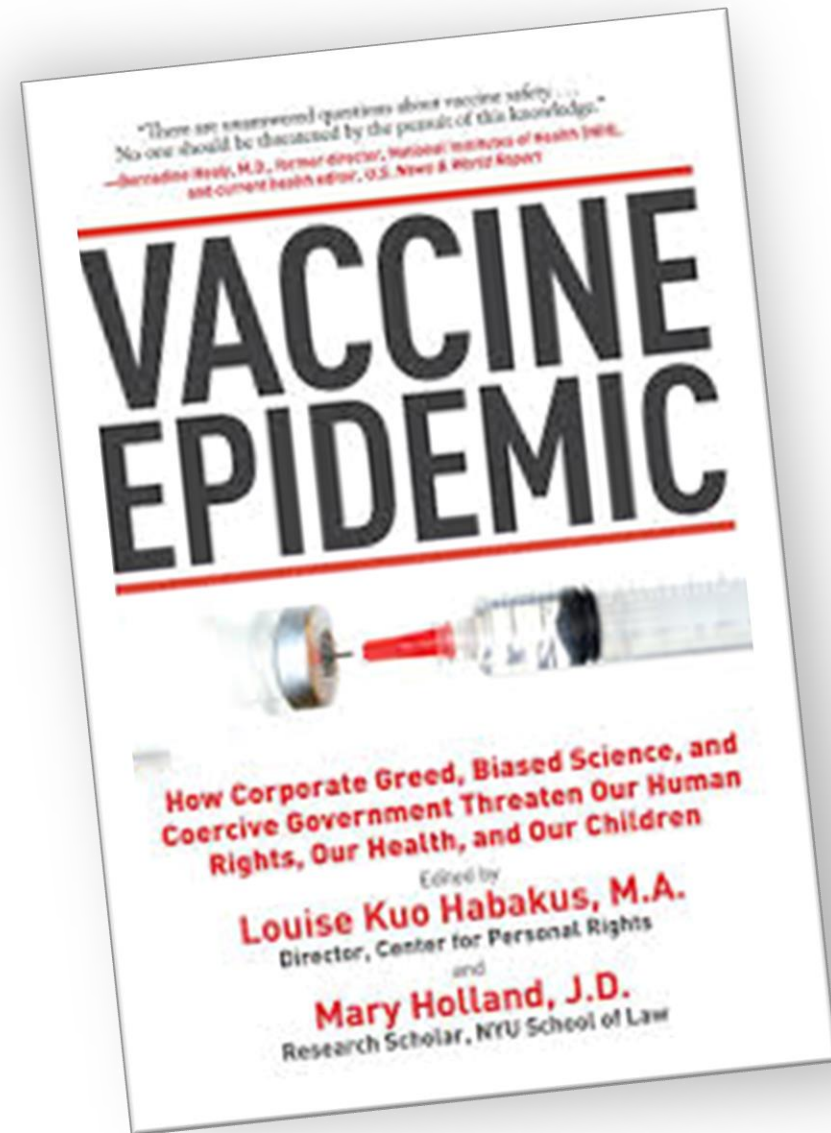
Adapted from original by Dr. Robert Chen.

1. <http://www.cdc.gov/mmwr/preview/mmwrhtml/su6004a9.htm>. 2. Unpublished CDC data.



The True Epidemic

- The incidence of vaccine adverse events is approximately equal to the incidence of disease
- ~28,000 adverse events from over 220 million doses of vaccine per year are distributed in the United States



Vaccines in the Public Mind

Vaccines are victims of their own success

As incidence and fear of disease go down, fear of vaccine side effects become increasingly disconcerting

Concerns

Too many routine vaccines

Too many shots at the same time

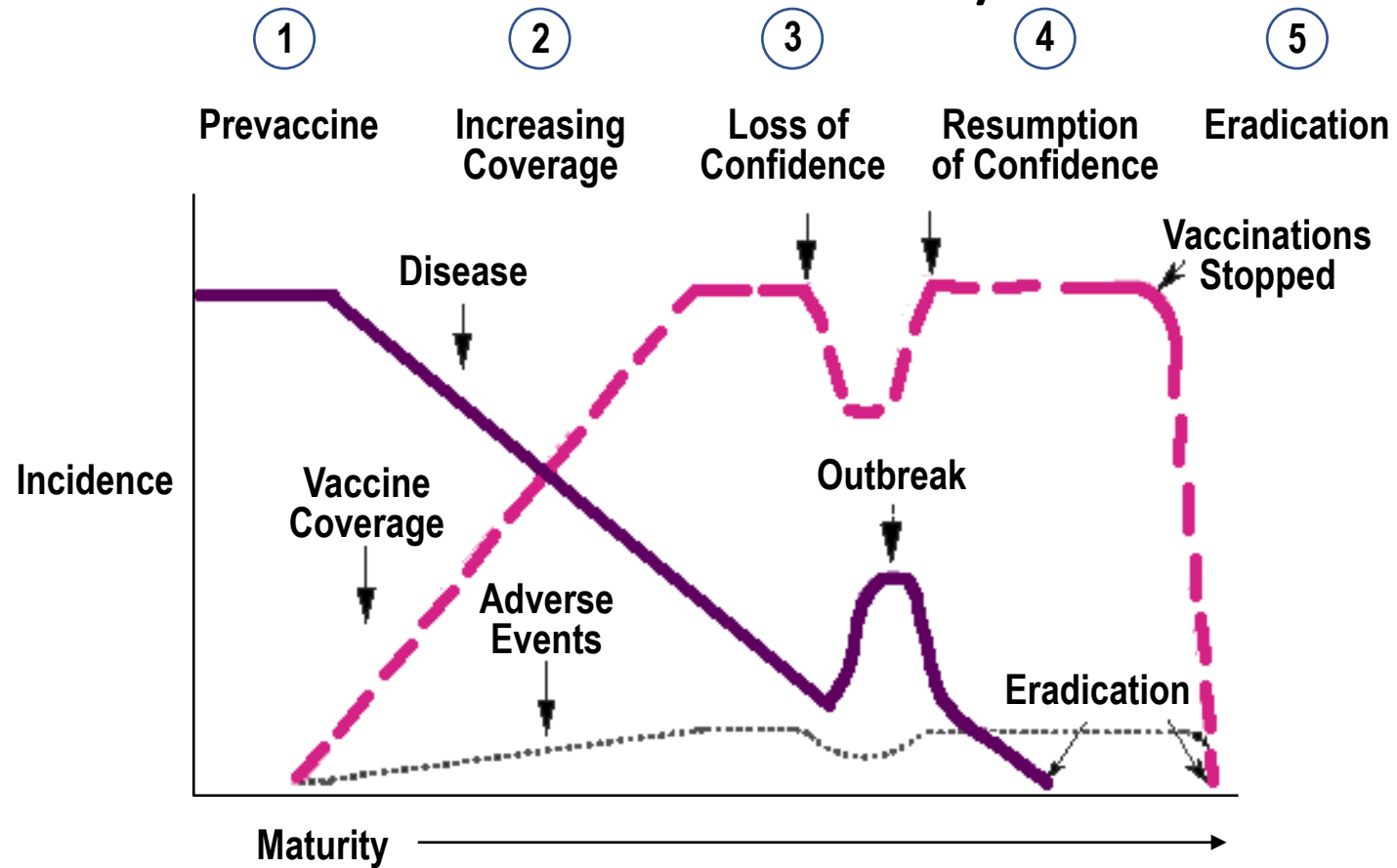
Too many side effects

- Vaccine risk > disease risk

“What’s in those vaccines?”

Mandatory vaccination

Evolution of Immunization Program and Prominence of Vaccine Safety

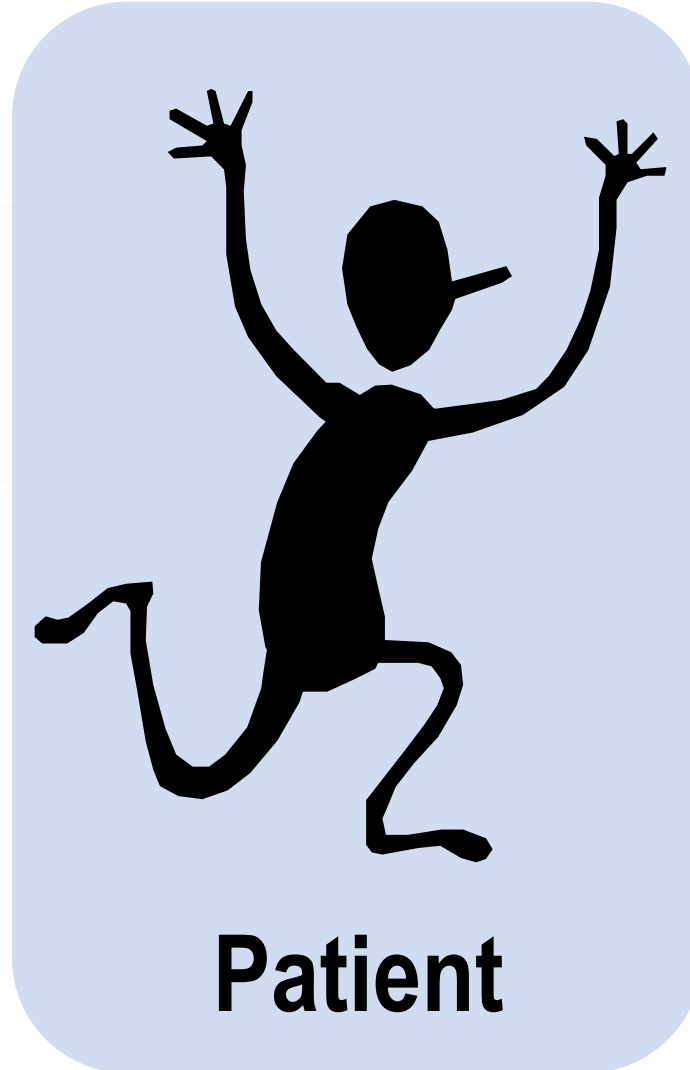


Unintended Dilemma



**Fear of Shot
Consequences**

**What is my
personal risk
for an adverse
reaction?**



Patient



**Fear of Disease
Consequences**

**Is the risk
of disease real
for me?**

Summary

- In spite of their proven efficacy, vaccines continue to be **distrusted** and **underutilized**

- Clinical guidelines are available for administration of adult vaccinations, but are not always followed

Summary (cont.)

Healthcare providers need to work together

- Help patients understand the need

Dispel common misconceptions regarding vaccination

- Help make it easy to get vaccinations

Increase the poor rates of adult vaccinations

- Take every opportunity to ensure patients receive scheduled vaccines

And now...

Back to Dr. Blackburn

