POLIO UPDATE

Joint AHMP Cyber Chapter - ChABSA Meeting
9-20-22

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"Since the days of the cave man,
the Earth has never been a Garden of Eden,
but a Valley of Decision
where resilience is essential to survival…
to grow in the midst of dangers is the
fate of the human race."

Rene Dubos
"Mirage of Health"
1901 -1982
Microbiologist, Environmentalist

The Garden of Eden

Our grandparents and great grandparents lived their daily lives with the constant threat of an untimely death due to host of deadly infectious diseases. Epidemics and their attendant losses were a reality of life for them.

The current generations have grown unaccustomed to human loss due to any cause and have found it very difficult to accept the threat of any global pandemic (even that of HIV) and, as a result, tend to not prepare.

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Introduction

- **Emerging infectious diseases require a collaborative effort to combat including the basic sciences, clinicians from medical and veterinary fields, public health experts, politicians, and the media.**
- **Clinicians recognize a new disease entity but this might only be a first step for starting an enormous scientific effort.**
- **Gaps in knowledge is common with respect to the mechanism or treatment of emerging diseases and its elucidation often opens new windows, may result in revolutionary discoveries that could improve clinical practice in general.**
- **Emergency Departments around the country are taking travel histories and isolation is commonplace.**

Definition Of Emerging and Reemerging Diseases

Emerging disease => new location
- Dengue in the Western Hesmisphere 1970's
- Molluscum contagiosum in AIDS patients 1980's
- Swine Flu (H1N1) Influenza Pandemic 2009
- Chikungunya in the Western Hemisphere 2014
- Ebola in West Africa 2014
- Zika in the Western Hemisphere 2015
- Monkeypox Importation in USA 2004; Globally 2022
- Polio in NYC, London, Israel 2022

Reemerging Diseases => new time (>35 years hiatus) or due to mutation
- Molluscum contagiosum AIDS Epidemic 1980's (Poxvirus in MSM)
- CA-MRSA USA 1990 (novel community-acquired; not nosocomial)
- Measles Epidemic in USA 2015 (Filipino Disneyland tourist)
- Typhus Surge in Los Angeles Homeless population 2019
- SARS-CoV in Hong Kong 2003; Saudi Arabia 2014; Seoul 2015; COVID-19

The Various Presentations of Emerging Infectious Disease

- A newly identified disease caused by a known pathogen
  - Group A Streptococcus and Toxic Shock Syndrome
- A newly identified disease caused by a previously unknown pathogen
  - HIV
- A new infection caused by change in virulence of a known pathogen
  - Escherichia coli O157:H7 strain (HUS); Molluscum contagiosum (HIV)
- A previously unrecognized infection that is appearing in areas where the habitat is changing (e.g deforestation, etc)
  - Lyme borreliosis; Plasmodium knowlesi; Clostridium difficile NAP1/BI/027; Enterohemorrhagic Escherichia coli

The Various Presentations of Emerging Infectious Disease

- Newly identified reservoirs of "old" infection
  - Trypanosoma brucei rohdesiense (Sleeping Sickness) in Cattle
  - SARS in Civets; MERS-CoV in Camels; ? SARS-CoV2 in Bats
- "Old" infections that have reemerged and have become resistant to antimicrobial agents
  - Multidrug-resistant tuberculosis; New Delhi metallo-beta-lactamas 1 producers, malaria, vaccine-preventable disease,

  MDR C. difficile; VRE, MRSA
- "Old" infections that have reemerged as a result of a break down in public health initiatives / infrastructure

  - Childhood Diseases (Measles, Pertusis, Polio, Diphtheria), Malaria

The Various Presentations of Emerging Infectious Disease

- "Old" infection that has emerged due to advances in medical technology
  - Acinetobacter; Exserohilium rostratum
- A recognized infection spreading to a new area, species or populations.
  - West Nile Disease Chikungunya; Zika virus in the Western Hemisphere; Monkeypox pandemic in MSM
  - Rift Valley Fever; Ebola Virus Disease in West Africa
- "Old" infection deliberately altered to cause intentional harm
  - Bacillus anthracis 2001; ? SARS-CoV2 (COVID-19)
- A known disease caused by an unknown infectious pathogen
  - Helicobacter pylori and peptic ulcer disease

History of Polio

Poliomyelitis has existed for thousands of years and is naturally occurring in humans.

Polio was once one of the nation's most feared diseases, with annual outbreaks causing thousands of cases of paralysis, primarily in children.

Prior to the introduction of the polio vaccines, in the 1950's, the virus was a source of dread, especially during summer months, when the potential for it to spread tended to peak.

In those days, preventative steps including closing public swimming pools, asking that parents keep their children indoors, and quarantining of entire towns.

An Egyptian stele thought to represent a person with polio, 18th Dynasty (1403–1365 BC)

Sign at Town Limits restricting entry of children under 16

The United States experienced its first major polio outbreak in the summer of 1916, with the epidemic centered in New York City. Many surrounding communities closed their doors to outsiders, using heavily armed policemen to patrol the roads and rail stations in search of fleeing New Yorkers and their children. The epidemic lasted through October, claiming 27,000 American lives. New York City reported 8,900 cases and 2,400 deaths, 80 percent being children under five. *March of Dimes.*

Poliomyelitis (aka Polio)

A disease caused by any of the three serotypes of poliovirus.

There are two clinicapresentations of polio infection: a minor illness which does not involve the central nervous l system (CNS) and a major illness involving the CNS, which may be paralytic or nonparalytic.

In about 1 percent of infections the virus can migrate from the gastrointestinal tract into the central nervous system (CNS) (adults > children)

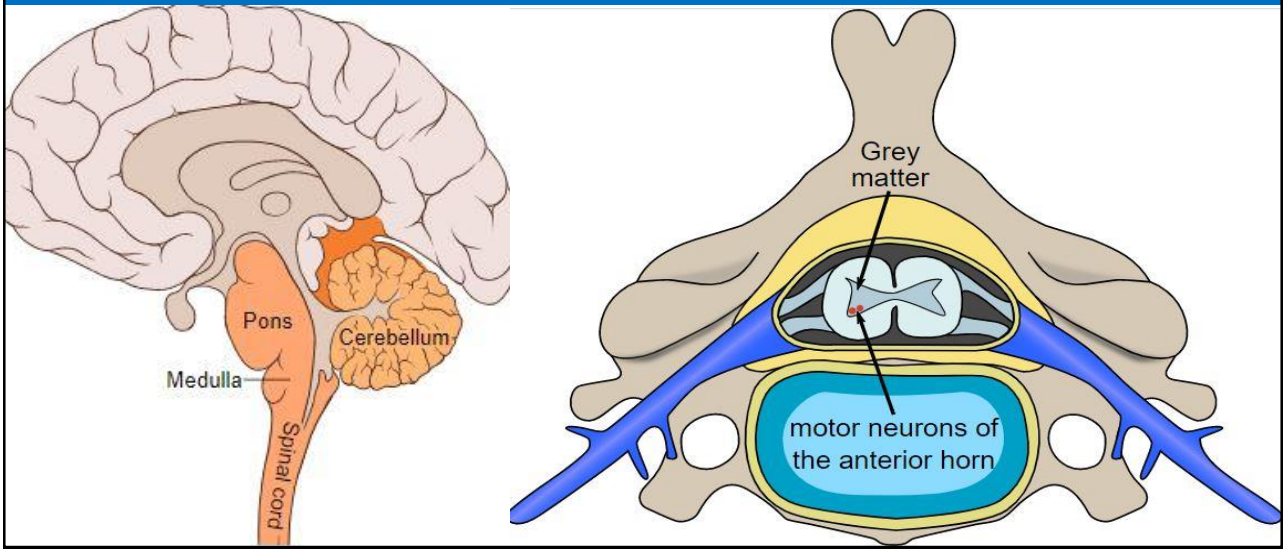
Nonparalytic Polio presents as an viral meningitis, with symptoms of headache, neck, back, abdominal and extremity pain, fever, vomiting, stomach pain, lethargy, and irritability.

Paralytic Polio occurs in about one to five in 1000 cases and is associated with the virus spreading along certain nerve fiber pathways, preferentially replicating in and destroying motor neurons within the spinal cord, brain stem, or motor cortex resulting in a rapid progressive paralysis of the affected muscles..

The weakness most often involves the one leg (spinal polio), and less commonly involve the muscles of the head, neck, and diaphragm (bulbar or bulbospinal)

In those who develop paralysis, between 2 and 10 percent die if the paralysis affects the breathing muscles.

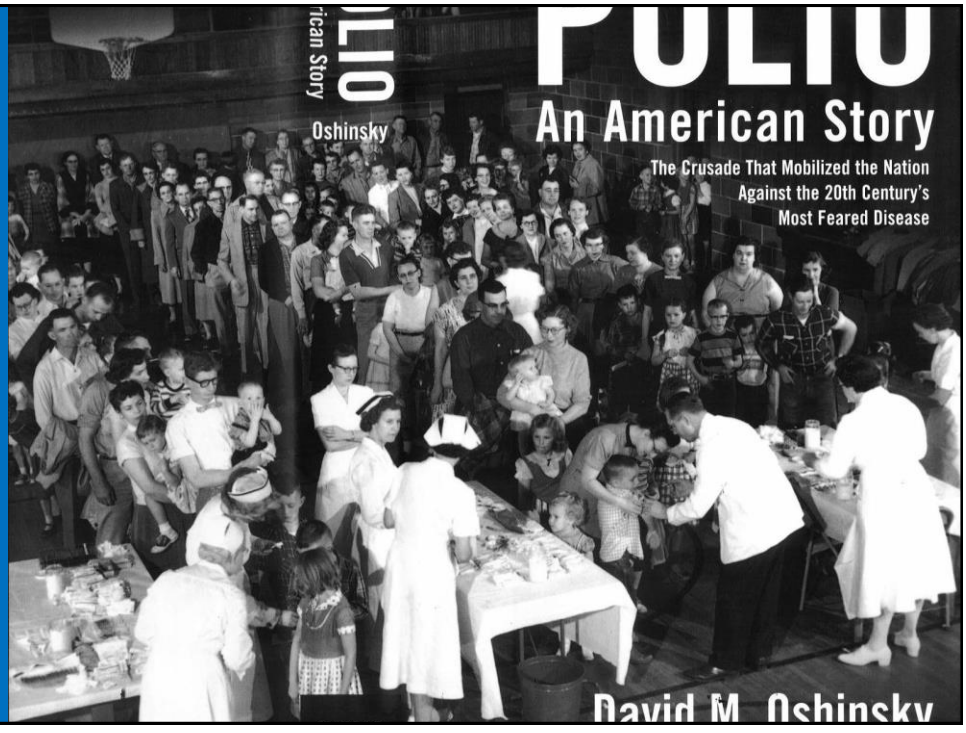
Bulbar, bulbospinal, and Spinal Polio depends where the



Outcomes of poliovirus infection in children

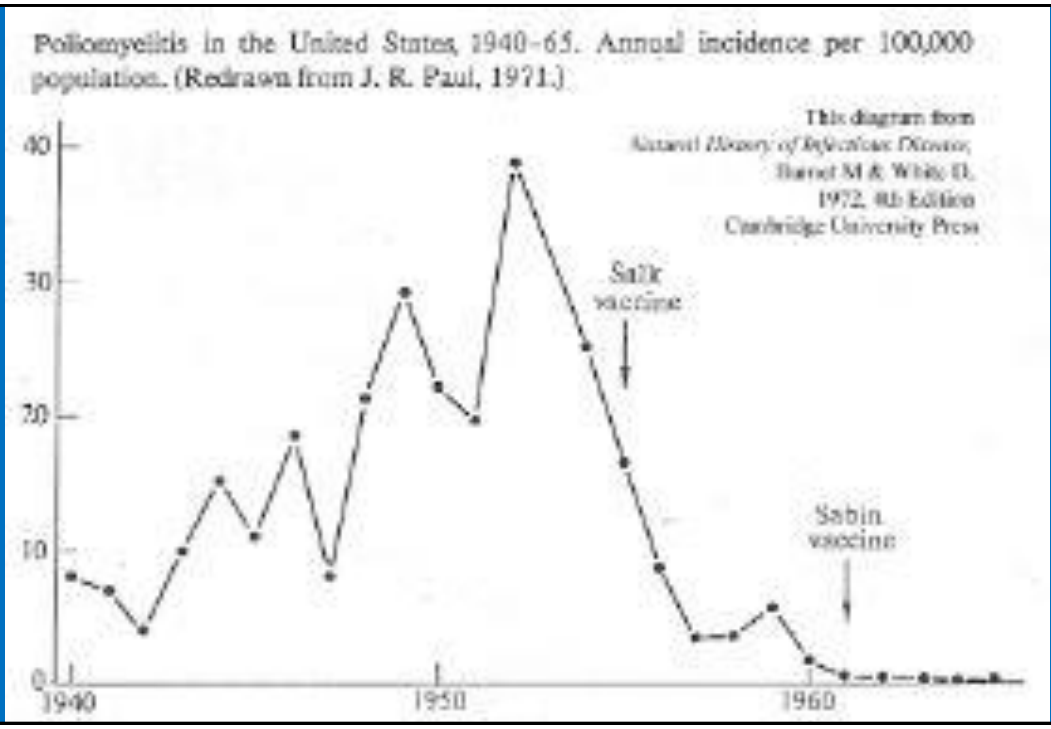
Outcome	Proportion of cases[1]
No symptoms	72%
Minor illness	24%
Nonparalytic aseptic meningitis	1–5%
Paralytic poliomyelitis	0.1–0.5%
— Spinal polio	79% of paralytic cases
— Bulbospinal polio	19% of paralytic cases
— Bulbar polio	2% of paralytic cases

Mass Vaccination with the Salk Vaccine 1957



Mass Vaccination of Salk Polio Vaccine University of Pittsburgh 1957

Polio Oral Sabin Vaccine 0.5cc absorbed in sugar cubes Mass Vaccination 1960's and currently via droplet vials



Global Eradication of Polio

Since 1957, all 50 states and Washington DC require school-age children to be vaccinated when entering childcare or public school; Adults are also recommended to get another polio booster if traveling overseas to areas of active Polio transmission (e.g. Pakistan, Afghanistan)

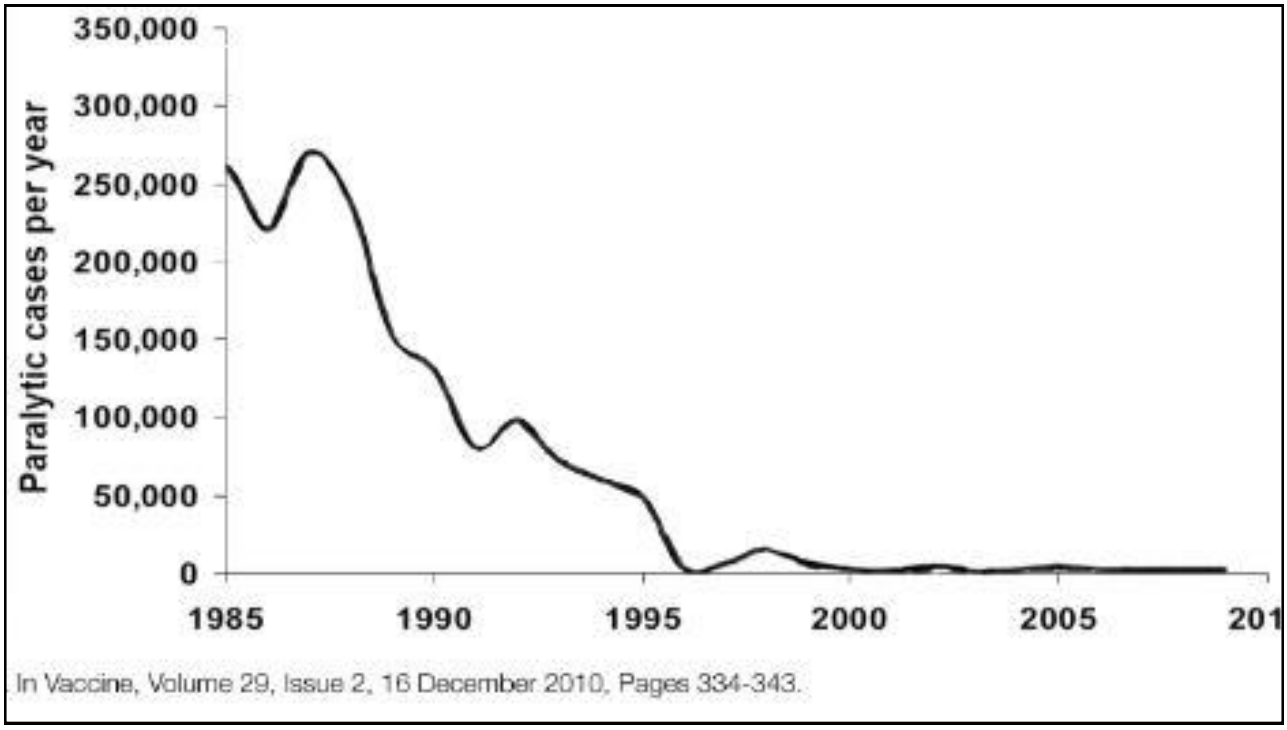
There had been no naturally occurring cases in the US since 1979 despite 350,000 cases worldwide.

A global effort to eradicate polio from the world by 2000 started in 1988, mainly through mass vaccination with oral polio vaccine.

Wild Type 3 Polio (WPV3) was eradicated from the world in 2012

Wild Type 2 Polio (WPV2) was eradicated from the world in 2015

Currently, outbreaks of wild strain Polio 1 (WPV1) occur in Pakistan and Afghanistan and outbreaks due to vaccine-derived Polio 2 (cVDPV2) continue in various African counties with lower vaccination rates.

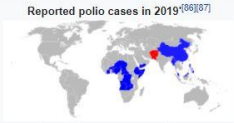


In Vaccine, Volume 29, Issue 2, 16 December 2010, Pages 334-343.

Global Eradication of Polio with OPV

175 WPV vs 365 cVDPV Paralytic Cases Globally in 2019

Reported polio cases in 2019[86][87]



Country	Wild cases	Circulating vaccine-derived cases (cVDPV)	Transmission status	Type
Pakistan	147	22	endemic	WPV1 cVDPV2
Afghanistan	29	0	endemic	WPV1
Angola	0	129	cVDPV only	cVDPV2
DRC	0	86	cVDPV only	cVDPV2
CAR	0	19	cVDPV only	cVDPV2
Ghana	0	18	cVDPV only	cVDPV2
Nigeria	0	18	cVDPV only	cVDPV2
Philippines	0	15	cVDPV only	cVDPV1 cVDPV2
Ethiopia	0	12	cVDPV only	cVDPV2
Chad	0	9	cVDPV only	cVDPV2
Benin	0	8	cVDPV only	cVDPV2
Togo	0	8	cVDPV only	cVDPV2
Myanmar	0	6	cVDPV only	cVDPV1
Somalia	0	3	cVDPV only	cVDPV2
Malaysia	0	3	cVDPV only	cVDPV1
Zambia	0	2	cVDPV only	cVDPV2
Burkina Faso	0	1	cVDPV only	cVDPV2
China	0	1	cVDPV only	cVDPV2
Niger	0	1	cVDPV only	cVDPV2
Yemen	0	3	cVDPV only	cVDPV1
Total	175	365		

Current Situation in USA

There is increase in all childhood diseases, including polio., due in part to:

- reduced routine immunizations during the COVID-19 pandemic,
- the unprecedented flood of unscreened, unvaccinated aliens entetring the US
- A large population of ultraorthodox Hassidic Jew in Rockland County who resist vaccination for philosophical reasons. Note: A measles epidemic in 2018-2019 was also fueled by vaccine resistance in Rockland County.

On 7-21-22, an unvaccinated 20-year-old man from Rockland County developed paralytic polio *cVDPV Type 3).

ON 8-12-22, NY health officials reported polio virus was found in the city sewage system in June and July, indicating the ongoing polio epidemic in the local communities.

On 9-9-22, the New York Governor declared a State Disaster Emergency due to Polio with statewide polio vaccination rates dropping to 79% and in some counties down to 60%.

Polio in the wastewater in NYC, London and Israel

- Since 2000, the US and most developed countries have only used inactivated poliovirus vaccine (Type 1 & 2)
- A 3-dose course of inactivated polio vaccine provides 99% protection
- In endemic countries, live attenuated oral polio vaccine is still used and the virus has been observed to revert (1-2/1,000,000) back into a paralysis-causing stain
- Most people infected with the vaccine-derived polio virus have no symptoms only 1 out of 200 develop paralysis.
- The presence of circulating poliovirus in the surveillance wastewater samples underscores the importance of increasing vaccine uptake in the under-vaccinated communities (e.g. immigrants from Africa, ultraorthodox Jews, etc.).
- To complicate matters more, since 2014, there has been an enterovirus (EV-D68) that has been causing outbreaks of "polio-like" paralysis in children in the USA. Furthermore, the COVID-19 Pandemic has significantly reduced the participation in our national childhood immunization programs.

Solution

All children over the age of 2 months should be vaccinated against polio and against other childhood diseases.

Vaccinate all unvaccinated adults, including pregnant women, with a polio vaccine and against other childhood diseases.