Global Immunizations: Resource Library
American Academy of Pediatrics, 2014
Global distribution of deaths among children under five (2012)

6.6 million children died in 2012

More than half due to conditions that could be prevented or treated with access to simple, affordable interventions.

About 45% of all child deaths are linked to malnutrition.
90 million lives saved since 1990

216 million children died before age 5 from 1990-2012

To achieve MDG 4, an additional 3.5 million children’s lives need to be saved in 2013-2015.

If current trends continue in all countries, the world will not meet the MDG 4 target until 2028. By then, an additional 35 million children will die.
Leading causes of death in children < 5: risk factors and response

<table>
<thead>
<tr>
<th>Cause of death</th>
<th>Risk factors</th>
<th>Prevention</th>
<th>Treatment</th>
</tr>
</thead>
</table>
| Pneumonia or other acute respiratory infections    | • Low birth weight  
• Malnutrition  
• Non-breastfed children  
• Overcrowded conditions | • **Vaccination**  
• Adequate nutrition  
• Exclusive breastfeeding  
• Reduction of household air pollution | • Appropriate care by a trained health provider  
• Antibiotics  
• Oxygen for severe illness |
| Childhood diarrhea                                 | • Non-breastfed children  
• Unsafe drinking water and food  
• Poor hygiene practices  
• Malnutrition | • **Vaccination**  
• Exclusive breastfeeding  
• Safe water and food  
• Adequate sanitation and hygiene  
• Adequate nutrition | • Low-osmolarity oral rehydration salts (ORS)  
• Zinc supplements |
Global Disease Burden of Vaccine-Preventable Deaths (< 5 years)

- 17% of global total mortality
- Estimated 1.5 million deaths in children preventable through *routine vaccination*


*WHO estimates
Vaccines are some of the most effective tools modern medicine has developed; as crucial to our lives as good roads...And the diseases those vaccines fight do not care about borders... so we must act to ensure that all children everywhere are immunized because what's good for children around the world is also good for our children and all of us at home.

– Shawn Batlivala, MD, FAAP
The Facts

1 in 5 children do not have access to life-saving immunizations

Vaccines prevent 2 to 3 million deaths annually around the world

$20 can fully vaccinate a child against pneumonia, diarrhea, polio and measles

Over 22 million infants remain unimmunized in the world each year
Key Challenges

• Limited resources
• Competing health priorities
• Poor management of health systems
• Inadequate monitoring and supervision
• Political instability

Priority needs to be given to strengthening routine vaccination globally.
Global Vaccine Action Plan (GVAP)

- Framework to prevent millions of deaths by 2020 through more equitable access to existing vaccines for people in all communities
- Endorsed at 2012 World Health Assembly
- Developed by Decade of Vaccines (DoV) Collaboration
GVAP – Six Strategic Objectives

1. All countries commit to immunization as a priority
2. Individuals and communities understand value of vaccines and demand immunization as both their right and responsibility
3. Benefits of immunization equitably extended to all people
4. Strong immunization systems are an integral part of a well functioning health system
5. Immunization programs have sustainable access to predictable funding, quality supply, and innovative technologies
6. Country, regional, and global research and development innovations maximize benefits of immunization
Disease-Specific
Poliomyelitis (Polio)

• Highly infectious viral disease that can cause irreversible paralysis and death
• Primarily affects children under 5
• Launch of Global Polio Eradication Initiative has led to 99% drop in cases since 1988
• 3 countries remain polio-endemic: Afghanistan, Nigeria, Pakistan (vs 125 in 1988)
• Polio Eradication and Endgame Strategic Plan 2013–2018 – aims to eradicate disease by 2018
Polio Eradication and Endgame Strategic Plan 2013–2018

The Plan has four objectives.

1. Detect and interrupt all poliovirus transmission
2. Strengthen immunization systems and withdraw oral polio vaccine
3. Contain poliovirus and certify interruption of transmission
4. Plan polio’s legacy
Endgame challenges

• Insufficient funding
• Inability to recruit/retain right people
• Insufficient vaccine supply
• Inability to operate in areas of insecurity
• Decline in political and/or social will
• Lack of accountability for quality services

Photo courtesy of Global Polio Eradication Initiative
Polio in 2014

- Polio declared *public health emergency of international concern* by WHO
- Because of new outbreaks, **10 countries** have active wild polioviruses; 3 of which are exporting the virus
  - Pakistan → Afghanistan
  - Syria → Iraq
  - Cameroon → Equatorial Guinea
- Poses potential threat to 2018 eradication goal
Pneumonia

• Acute respiratory infection that affects the lungs
• Caused by viruses, bacteria, or fungi
• Leading cause of death in children (global)
  • Kills estimated 1.1 million children under 5 annually (18% of child deaths)
  • More deaths than AIDS, malaria, TB combined
• Common types: *Streptococcus pneumonia*, *Haemophilus influenzae* type b (Hib), respiratory syncytial virus, *Pneumocystis jiroveci*
Pneumonia is a respiratory infection that affects the lungs. 1.4 Million children die every year from pneumonia.

Pneumonia causes 18% of all deaths among children under 5 years old.

Providing pneumococcal vaccines in 40 low-income countries will prevent up to 7 million deaths by 2030.
**Streptococcus pneumoniae**

- *Streptococcus pneumoniae* – primary cause of childhood pneumonia, meningitis, sepsis
- Growing antibiotic resistance underlines urgent need for vaccines to control pneumococcal disease
- Vaccine is most effective tool for prevention
  - 3 pneumococcal conjugate vaccines covering 7, 10 and 13 serotypes (PCV7, 10 and 13)
  - 1 unconjugated polysaccharide vaccine covering 23 serotypes (PPV23)
- WHO recommends the use of PCV in all countries
Haemophilus influenzae type b (Hib)

• Bacteria that causes severe pneumonia, meningitis and other invasive diseases almost exclusively in children under 5
• Transmitted via respiratory tract from infected to susceptible individuals
• Prevented with Hib vaccine
  • WHO recommends Hib conjugate vaccines to be included in all routine infant immunization programs

Photomicrograph of H influenzae using direct immunofluorescence. Courtesy of Centers for Disease Control and Prevention
Rotavirus

• Most common cause of severe diarrheal disease in young children throughout the world
  • Nearly 1.7 billion cases of diarrheal disease annually
  • Diarrheal disease is second leading cause of death in children under 5 (~ 760,000)

• A significant proportion of disease from rotavirus can be prevented with safe drinking-water and adequate sanitation and hygiene

• WHO recommends rotavirus vaccine to be included in all national immunization programs
WE HAVE THE OPPORTUNITY TO SAVE MORE THAN 500,000 CHILDREN EVERY YEAR

ROTAVIRUS

We’ve all heard how diseases like malaria are devastating to the developing world, but you probably haven’t heard of rotavirus, a disease which kills more than half a million children each year. Find out more about this unknown killer and the fight to stop it.

ROTAVIRUS IS TRANSMITTED BY THE ACCIDENTAL INGESTION OF FECAL MATTER. IT THEN DAMAGES THE LINING OF THE SMALL INTESTINE, CAUSING SEVERE DIARRHEA, WHICH CAN LEAD TO DEHYDRATION AND, EVENTUALLY, DEATH.

BECAUSE CHILDREN IN THE DEVELOPING WORLD ARE ROUTINELY IMMUNIZED FOR ROTAVIRUS, IT AFFECTS THEM FAR LESS.

70 CHILD DEATHS PER YEAR
INDUSTRIALIZED NATIONS

511,000 CHILD DEATHS PER YEAR
DEVELOPING NATIONS

VACCINE

THERE IS NOW A VACCINE THAT CAN BE GIVEN TO CHILDREN TO ENTIRELY PREVENT ROTAVIRUS. IT COULD...

SAVE 2,400,000 LIVES BY 2025

SAVE 340,000 LIVES BY 2015

SAVE MORE THAN $500,000,000 IN HEALTH CARE COSTS BY 2025

A COLLABORATION BETWEEN GOOD AND KISS ME IT’S POLIO, IN PARTNERSHIP WITH THE BILL & MELINDA GATES FOUNDATION SOURCES: BILL & MELINDA GATES FOUNDATION AND UNICEF ALLIANCE.
Measles

- Highly contagious disease caused by a virus
- ~ 122,000 deaths from measles in 2012 (mostly children)
- Vaccination led to a 78% drop in measles deaths (2000-2012)
- Since 2000, > 1 billion children in high risk countries were vaccinated via mass vaccination campaigns
- Vaccine often combined with rubella and/or mumps (MR, MMR)
Immunization coverage with measles containing vaccines in infants, 2012

Date of slide: 16 July 2013

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 lines on maps represent approximate border lines for which there was not yet full agreement. © WHO 2013. All rights reserved.

unicef World Health Organization
2014 U.S. Outbreaks

• Majority of the people who contracted measles are unvaccinated

• Since U.S. measles elimination in 2000, annual reported cases have ranged from a low of 37 in 2004 to a high of 220 in 2011

Measles Cases and Outbreaks,
January 1 to June 6, 2014*

397 Case
16 Outbreaks


representing 84% of reported cases this year

*Provisional data reported to CDC’s National Center for Immunization and Respiratory Diseases
Rubella

- Acute, contagious viral infection that occurs most often in children and young adults
- Rubella infection in pregnant women may cause fetal death or congenital defects known as congenital rubella syndrome (CRS)
- Estimated 110,000 babies are born with CRS annually
- Single dose of vaccine > 95% long-lasting immunity
- Often combined with Measles, Mumps, and/or Varicella vaccine
Mumps

- Highly contagious virus
- Causes swelling at the side of the face under the ears, fever, headache and muscle aches
- Can lead to viral meningitis (up to 15% of cases)
- Most often affects 5-9 year olds
- Measles Mumps Rubella (MMR) vaccine most commonly used
2014 U.S. Outbreaks

- From January 1 to May 2, 2014, 464 people in the U.S. have been reported to have mumps
- Outbreaks in 2 major US universities
  - Ohio State University
  - Fordham University
Hepatitis B

- Viral infection that attacks the liver
- Transmitted through contact with the blood or other body fluids of an infected person
- Infects more than 350 million people worldwide
- Can cause chronic infection and liver cancer
- Preventable with Hepatitis B vaccine
Human papillomavirus (HPV)

• Most common viral infection of the reproductive tract (> 100 types)
• Can cause cervical cancer, other types of cancer, and genital warts
• > 85% of cervical cancer deaths are in low- and middle-income countries
• HPV vaccine introduced in 45 countries by end of 2012
GAVI ALLIANCE TACKLES CERVICAL CANCER

Every year, 266,000 women die of cervical cancer. Over 85% of those deaths are in developing countries.

Countries Eligible for GAVI’s HPV Vaccine Funding

Countries with National HPV Vaccine Programmes

Changing the Balance

High-income countries

Developing countries

GAVI’s support for HPV vaccines will help redress the inequity, delivering vaccines to countries with the highest burden.

About HPV Vaccine

Safe and effective, human papillomavirus (HPV) vaccines protect against 70% of cervical cancer.

Lowering the Price

Current lowest public price, circa US$ 13

In wealthy countries, the same vaccines can cost more than US$ 100

Price achieved by GAVI

US$ 4.50

The new low price of US$ 4.50 per dose marks a two-thirds reduction on the current lowest public sector price.

Dramatic Acceleration

By 2020, over 30 million girls in more than 40 countries will be vaccinated against HPV

Since 2013, over 20 countries have been approved to introduce HPV vaccines with GAVI support.
Immunization Key to Cancer Prevention

• Hepatitis B
  • Chronic HepB infection is major cause of liver cancer
  • Prevented via Hepatitis B vaccine
  • Pentavalent vaccine includes Hep B

• Human papillomavirus (HPV)
  • Primary cause of all cervical cancers
  • HPV vaccines prevent two most common strains of HPV
  • Strains 16 & 18 cause 70% of cervical cancer cases
  • Can also cause other types of anogenital cancer, head and neck cancers
Meningitis A

- Infection that can cause severe brain damage and death
- Meningitis belt has highest disease burden (sub-Saharan Africa from Senegal to Ethiopia)
  - Group A meningococcus accounts for ~80–85% of all cases in region
- MenAfriVac vaccine (developed by WHO and PATH) vaccinated > 100 million people in 10 of the 26 African countries affected by disease by end of 2012
Diphtheria

- Caused by the bacterium Corynebacterium diphtheria
- Affects all ages, but most often it strikes unimmunized children
- Transmission through droplets and close physical contact
- Diphtheria toxoid combined with tetanus and pertussis vaccines (DTP) has been part of WHO Expanded Program on Immunization (EPI) since its inception in 1974

Gram-positive asporogenous, rod-shaped, Corynebacterium diphtheriae bacteria
Tetanus

• Caused by a bacterium that grows in the absence of oxygen
• Produces a toxin which can cause serious complications or death
• Prevented with tetanus-toxoid (TT) containing vaccines
• Vaccine introduced in 103 countries by the end of 2012
• Maternal and Neonatal Tetanus (MNT) Elimination Initiative launched by UNICEF, WHO, UNFPA in 1999
• 34 countries eliminated MNT (2000-2013)
Pertussis

• Highly contagious respiratory disease caused by *Bordetella pertussis*

• Known for uncontrollable, violent coughing episodes which often makes it hard to breathe

• Deep breathes after fits of coughs result in "whooping" sound

• In 2008, about 82% of all infants worldwide received 3 doses of pertussis vaccine
  • Vaccine averted ~ 687,000 deaths (WHO 2008 Estimate)

Pertussis pneumonia: Perihilar infiltrate obscures the cardiac borders. © Martha Lepow, MD
Coverage with three doses of DTP containing vaccine (2012)
Yellow Fever

- Acute viral hemorrhagic disease transmitted by infected mosquitoes
- Estimated 200,000 cases of yellow fever, causing 30,000 deaths, worldwide each year, with 90% occurring in Africa
- Increase in cases over past two decades due to declining population immunity to infection, deforestation, urbanization, population movements and climate change
- Most important preventive measure is through vaccination
- Single dose of yellow fever vaccine is sufficient to confer sustained immunity and life-long protection against yellow fever disease
Major Stakeholders
Public-private partnership committed to saving children’s lives and protecting people’s health by increasing access to immunization.

Redefines the traditional donor-recipient relationship as all parties – including implementing countries – invest in the model and are mutually accountable for results.

Global number of under-five children unimmunized with three doses of diphtheria, tetanus and pertussis vaccine (DTP3): GAVI supported vs Non GAVI supported numbers
Revised figures for 2011 (July 2012)

GAVI-supported: 19.6 million
Non GAVI-supported: 3 million

India: 6.9 million
Nigeria: 3.8 million
Indonesia: 1.7 million
Ethiopia: 1.1 million
Pakistan: 0.8 million
DR Congo: 0.7 million
Uganda: 0.3 million
Chad: 0.3 million
Afghanistan: 0.3 million
Kenya: 0.2 million
Somalia: 0.2 million
Mozambique: 0.2 million
Rest of GAVI-supported: 3.0 million
Mission of *Immunization, Vaccines and Biologicals Department* is the attainment of a world in which all individuals and communities enjoy lives free from vaccine-preventable diseases

Priority areas (Strategic Plan: 2010-2015)
- Strengthening routine programs to reach unimmunized populations
- Improving national capacity to introduce new vaccines
- Building synergies for disease control and prevention
- Formulating evidence-based policies for vaccine use
• Primary UN organization defending, promoting and protecting children’s rights

• Immunization programs focus on:
  • Expanding immunization coverage and vaccinating the hard to reach
  • Purchasing vaccines for more than a third of the world’s children
  • Improving the cold chain to keep vaccines at a constant cool temperature
  • Engaging communities to explain the importance of child vaccinations
  • Supporting the eradication of polio
  • Working towards a world without measles, rubella and neonatal tetanus
  • Introducing powerful new vaccines that disproportionately affect children in developing countries
Guided by the belief that every life has equal value, the BMGF works to help all people lead healthy, productive lives. In developing countries, it focuses on improving people’s health and giving them the chance to lift themselves out of hunger and extreme poverty. In the United States, it seeks to ensure that all people—especially those with the fewest resources—have access to the opportunities they need to succeed in school and life.

Provides funding to key immunization stakeholders
• Public-private partnership led by national governments and spearheaded by
  • World Health Organization
  • Rotary International
  • US Centers for Disease Control & Prevention
  • UNICEF
• Launched in 1988 at World Health Assembly

Photo courtesy of Global Polio Eradication Initiative
• Builds public-private partnerships to address the world’s most pressing problems, and broadens support for the United Nations through advocacy and public outreach

• Founded by Ted Turner in 1998

• Major investment in immunizations through Shot@Life
• A global partnership committed to ensuring no child dies from measles or is born with congenital rubella syndrome
• Focused on supporting the goal of reducing global measles mortality by 95 percent by 2015; and eliminating measles and rubella in at least five of the six World Health Organization Regions by 2020
Role of Pediatrician
AAP Global Immunization Priorities

• Foster partnerships which support global immunization initiatives
• Provide resources to help pediatricians and other child health clinicians to be informed, effective global vaccine advocates
• Directly advocate to the U.S. federal government about the importance of immunizations
Advocacy...practice of speaking out on your patients’ behalf

“Child health advocacy will only be effective when a wide range of professionals, community leaders, and families band together to identify crippling inefficiencies and silly bureaucratic barriers, to attack basic injustices, and to dream of the best for all children no matter how young, how vulnerable, or how ill they are.”

~ Judith S. Palfrey, MD, FAAP, past AAP president
Practical Advocacy

Federal
- E-mail/Call Congress
- Attend a Hill Day

State
- Contact State Legislators
- AAP Chapters

Community
- Women’s Clubs, Rotary
- County Health Department

Practice
- Educational Toolkit
- Grand Rounds

Media
- Letters to the editor
- Social media
Local advocacy matters...

- Social media
  - Become a #tweetiatrician
  - Follow AAP’s channels and create your own accounts
    - Twitter: https://twitter.com/AmerAcadPeds
    - Facebook: https://www.facebook.com/AmerAcadPeds
  - Submit Op-Eds, Letters to the Editor, and blogs championing child health
Local advocacy matters

- Raise awareness through grand rounds and lectures at your medical institution –
- Partner with local organizations to host awareness events (Rotary, Lion’s Club, Women’s Club, etc.)
- Schedule an in-district meeting with your Member(s) of Congress and include other health professionals or community leaders
- Educate parents and patients when you see them in your office
Get involved at the AAP State Chapter level

• Reach out to the AAP Division of State Government Affairs to learn about important global child health issues at the state level
• Learn about the Chapter’s current initiatives
• Educate your local colleagues during Chapter meetings by requesting global child health presentations on the agenda
• Submit articles to your Chapter’s newsletter highlight global child health issues
Multimedia
VACCINES SAVE LIVES
AT THE COST OF EVERYDAY SPLURGES

In developing countries, just a few diseases kill millions of children under the age of five. Many of these are preventable with simple vaccines that cost just a few dollars per child.

7+ POLIO DOSES
At 13¢ each = 1 can of soda

7

5 CHOLERA DOSES
At $2 each = 1 music album

5

5 MENINGITIS DOSES
At 50¢ each = 1 soy latte

5

5+ PNEUMOCOCCAL DOSES
At $3.50 each = 2 movie tickets

5+

WE’VE ALREADY SEEN THAT VACCINES CAN MAKE A HUGE DIFFERENCE

99% drop in cases globally

POLIO

90% drop in deaths in Africa

MEASLES

60% drop in deaths in Nicaragua

DIARRHEA

© 2006 IN PARTNERSHIP WITH THE BILL & MELINDA GATES FOUNDATION
DRIVING THE COST OF VACCINES DOWN AS THE NUMBER OF SUPPLIERS INCREASES SOME OF THEM IN DEVELOPING COUNTRIES
Professor Hans Rosling: Immunisation trends and child survival
MEASLES & RUBELLA INITIATIVE
A global partnership to stop measles & rubella

1.1 Billion Vaccinated since 2001

78% FEWER CHILD DEATHS because of measles vaccine

13.8 Million deaths averted 2000 - 2012

1 in 5 child lives saved since 1990

due to measles vaccine

330 children still die of measles every day

that’s 14 every hour

MEASLES MOVES FAST
WE MUST MOVE FASTER

It costs about $1 to protect a child from both measles & rubella

13.8 Million deaths averted 2000-2012
**Saving a life costs very, very little**

Sample pricing in 2013 of vaccines contracted with suppliers by UNICEF, the world’s largest vaccine buyer

<table>
<thead>
<tr>
<th>Vaccine Type</th>
<th>Price 2013</th>
<th>Price 2023</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meningitis</td>
<td>$0.58</td>
<td>$0.07</td>
</tr>
<tr>
<td>Measles</td>
<td>$0.24</td>
<td>$0.16</td>
</tr>
<tr>
<td>Measles, mumps and rubella</td>
<td>$0.97</td>
<td>$0.70</td>
</tr>
<tr>
<td>Rotavirus</td>
<td>$3.50</td>
<td>$0.19</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Vaccine Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCG</td>
</tr>
<tr>
<td>Fights tuberculosis</td>
</tr>
<tr>
<td>Hepatitis B</td>
</tr>
<tr>
<td>Yellow fever</td>
</tr>
<tr>
<td>DTP</td>
</tr>
<tr>
<td>Fights diphtheria, tetanus and pertussis</td>
</tr>
</tbody>
</table>
Missing immunization is deadly
Annual child deaths due to diseases easily prevented by vaccines

- Hemophilus influenza type B
- Pertussis (whooping cough)
- Measles
- Tetanus
- Poliomyelitis
- Diphtheria
- Meningococcal disease
- Meningococcal
- Haemophilus
- Pneumococcal
- Rotavirus

70% of unvaccinated children use in 10 countries

A huge opportunity
If existing vaccines were scaled up in 72 of the world’s poorest countries, over the next decade that could save...

$6.2 BILLION in treatment costs
25 MILLION lives

Vaccines eradicate disease
In 1995, there were 350,000 cases of polio around the world. Today, there are fewer than 500.

A simple process
Vaccines work by introducing a harmless form of virus or bacteria into a person’s immune system. A healthy person’s body recognizes the foreign antigens as unusual and responds by developing a defense (immunity) against it.

Saving a life costs very, very little
Sample pricing in 2013 of vaccines contracted with suppliers by UNICEF, the world’s largest vaccine buyer

- Meningitis: $0.58
- BCG: $0.07
- Measles: $0.24
- Hepatitis B: $0.16
- Measles, mumps, and rubella: $0.97
- Yellow fever: $0.70
- DTP: $3.50
- Rotavirus: $0.19

The world is making progress
The percentage of children receiving three doses of DTP is often used to indicate how well countries provide routine immunization services. DTP refers to the combined diphtheria, tetanus, and pertussis vaccine.

Global coverage for DTP3 quadrupled in the last three decades.
immunization boost

1.1 Billion vaccinated since 2001

because of measles vaccine

78% FEWER CHILD DEATHS
Polio eradication is within our reach. It will save money, it will prevent disability, and it will save lives.

**Polio Cases:**
- 1988: 350,000 cases
- 2010: Less than 1,500 cases

**The History of Polio Eradication:**
- 1953: Jonas Salk develops the inactivated polio vaccine (IPV), the first effective vaccine to protect people from polio.
- 1954: IPV is used worldwide, and many developing countries begin planning for disease control.
- 1988: The World Health Assembly commits to a resolution to eradicate polio.
- 2010: Less than 1,500 cases of polio worldwide.

**Current State of Polio:**
- Countries with universal and near-universal use of IPV
- Countries with improved emergency vaccination campaigns

**Vaccines Prevent Polio:**
Polio can be prevented with four or more doses of a vaccine.
Over five million future deaths prevented with GAVI-funded vaccines
Interactive Map on Vax-Preventable Diseases