Challenges of Rotavirus and Vaccines: Lessons for Global Health

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Associate Director for International Research, NIH

Voices from the Vanguard
University of Georgia
Athens, March 26, 2007
Everyone Poops
The Broad Street Pump - John Snow and the Transmission of cholera- 1854
1893 First cholera vaccines for control of an epidemic
DEATH'S DISPENSARY.
OPEN TO THE POOR, GRATIS, BY PERMISSION OF THE PARISH.
The water pump
Revisited

Bangladesh, 1980
Leading infectious causes of mortality, 2000 estimates

<table>
<thead>
<tr>
<th>Disease</th>
<th>Deaths (millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIDS</td>
<td>2.7</td>
</tr>
<tr>
<td>TB</td>
<td>1.7</td>
</tr>
<tr>
<td>Malaria</td>
<td>1.1</td>
</tr>
<tr>
<td>Diarrhoea</td>
<td>2.2</td>
</tr>
<tr>
<td>ARS</td>
<td>3.5</td>
</tr>
</tbody>
</table>

Source: WHO

Rotavirus causes 25%-45% of diarrheal deaths

O. Levine
Causes of severe acute gastroenteritis among children <5 years

- Developed Countries:
  - Unknown
  - Rotavirus
  - Bacterial
  - Other

- Developing Countries:
  - Unknown
  - Rotavirus
  - Bacterial
  - Other

A. Kapikian
Background on Rotavirus

- Most common cause of severe diarrhea in children
- All children infected by age 5
- “Democratic” virus
- First infections symptomatic
- Natural immunity
- Limited strains in circulation
- Improvements in sanitation won’t prevent infection
The face of rotavirus

Diarrhea
Vomiting
Dehydration
Shock
Death

Tabasco, Mexico
Jan 2005
Fatal Rotavirus Diarrhea
Estimated global distribution of the 600,000 annual deaths caused by rotavirus

Parashar, 2005

1 dot = 1000 deaths
5% of all deaths in children < 5
1 in 285 children will die of RV
Diarrhea-associated hospitalizations by month & age among U.S. children < 5 years, 1979-1997

Number of hospitalizations

- 1 mo - 4 yrs
- 1 mo - 3 mo, 4 mo - 6 mo
- 7 mo - 11 mo, 1 yr
- 2 yr, 3 yr, 4 yr
Burden of Rotavirus in the US

Risk

1 : 10^6
1 : 80
1 : 7
1 : 0.9

Events

20-40 Deaths
60-70,000 Hospitalizations
500,000 Outpatient visits
3.2 Million episodes

Cost: $400 M medical; >$1 B total
Laboratory issues: Rotavirus Structure and Evolution
Summary of P & G Types of Rotavirus
Childhood Diarrhea From 66 Published Studies

N=21,256

Rare or regionally common strains (23 strains total): P[4]G1 (1.3%), P[6]G2 (0.8%), P[6]G1 (0.6%), P[6]G8 (0.6%), P[4], G3 (0.5%)

Gentsch JID 2005
## P and G Types of Human Rotavirus Strains

**P serotype [genotype]**

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>1</td>
<td>Wa</td>
<td>Au64</td>
<td>M37</td>
<td>K8</td>
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<tr>
<td>2</td>
<td>DS-1</td>
<td>1076</td>
<td></td>
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<tr>
<td>3</td>
<td>P</td>
<td>107E1B</td>
<td>McN13</td>
<td>AU-1</td>
<td>HCR3</td>
<td>157C</td>
<td></td>
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</tr>
<tr>
<td>4</td>
<td>Hochi</td>
<td>ST-3</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>5</td>
<td>Br1054</td>
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<td></td>
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<tr>
<td>6</td>
<td></td>
<td></td>
<td>PA151</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>8</td>
<td>MW333</td>
<td>MW023</td>
<td>69M</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>9</td>
<td>WI61</td>
<td>US1205</td>
<td></td>
<td>116E</td>
<td></td>
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<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td>B321</td>
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<td></td>
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<tr>
<td>12</td>
<td></td>
<td></td>
<td>L26</td>
<td>US585</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

- **Globally Common**
- **Regionally Common**
- **Uncommon**
- **Neonates**
Slowly he would cruise the neighborhood, waiting for that occasional careless child who confused him with another vendor.
Development of the Tetravalent Rhesus Rotavirus Vaccine

Vaccine Construction

Figure at right reproduced with permission from Estes MK. J Infect Dis. 1996;174(Suppl 1):S39.
New vaccine may tame common childhood virus

The New York Times

F.D.A. Approves Vaccine for Childhood Diarrhea

By THE ASSOCIATED PRESS

Washington -- The Food and Drug Administration Monday approved the first vaccine against a leading cause of childhood diarrhea, a virus that hospitalizes 55,000 American children a year and kills one million in other countries.

Vaccine offers way to prevent child diarrhea

Rotavirus Vaccine Cuts Diarrhea Hospitalizations

CDC
### Recommended Childhood Immunization Schedule

**United States, January – December 1999**

<table>
<thead>
<tr>
<th>Age</th>
<th>Vaccine</th>
<th>Birth</th>
<th>1 mo</th>
<th>2 mos</th>
<th>4 mos</th>
<th>6 mos</th>
<th>12 mos</th>
<th>15 mos</th>
<th>18 mos</th>
<th>4-6 yrs</th>
<th>11-12 yrs</th>
<th>14-16 yrs</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Hep B</td>
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<td></td>
<td></td>
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<tr>
<td>Hepatitis B</td>
<td></td>
<td></td>
<td>DTaP</td>
<td>Hib</td>
<td>Hib</td>
<td>Hib</td>
<td>Hib</td>
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<td></td>
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<tr>
<td>Diphtheria, Tetanus, Pertussis</td>
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<td></td>
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<tr>
<td>H. influenzae type b</td>
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<tr>
<td>Polio</td>
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<td>Rotavirus</td>
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<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Measles, Mumps, Rubella</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Varicella</td>
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</tbody>
</table>
Intussusception Among Recipients of Rotavirus Vaccine — United States, 1998–1999

On August 31, 1998, a tetravalent rhesus-based rotavirus vaccine (RotaShield®, Wyeth Laboratories, Inc., Marietta, Pennsylvania) (RRV-TV) was licensed in the United States for vaccination of infants. The Advisory Committee on Immunization Practices (ACIP), the American Academy of Pediatrics, and the American Academy of Family Physicians have recommended routine use of RRV-TV for vaccination of healthy infants (1,2). During September 1, 1998–July 7, 1999, 15 cases of intussusception (a bowel obstruction in which one segment of bowel becomes enfolds within another segment) among infants who had received RRV-TV were reported to the Vaccine Adverse Event Reporting System (VAERS). This report summarizes the clinical and epidemiologic features of these cases and preliminary data from ongoing studies of intussusception and rotavirus vaccine.
**Intussusception**

The telescoping of the intestine onto itself usually at the ileal-cecal junction, leading to reversible repair or entrapment with edema, necrosis and perforation.
Interval between Vaccine and Intussusception

Murphy TV, et al, 2001
# Studies of the Risk of Intussusception Following RotaShield®

<table>
<thead>
<tr>
<th>Study</th>
<th>Author</th>
<th>Risk</th>
<th>Excess Cases for US</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preliminary Data</td>
<td>Livengood-NIP</td>
<td>1 in 2500</td>
<td>1600</td>
</tr>
<tr>
<td>Reassessment</td>
<td>Livengood-NIP</td>
<td>1 in 4670</td>
<td>785</td>
</tr>
<tr>
<td>Case Series</td>
<td>Murphy-NIP</td>
<td>1 in 9474</td>
<td>361</td>
</tr>
<tr>
<td>Case Control</td>
<td>Murphy-NIP</td>
<td>1 in 9474</td>
<td>361</td>
</tr>
<tr>
<td>Cohort Study</td>
<td>Kramarz-NIP</td>
<td>1 in 11,073</td>
<td>316</td>
</tr>
<tr>
<td>Ecologic Studies</td>
<td>Chang-NYS</td>
<td>&lt;1 in 17,000</td>
<td>200</td>
</tr>
<tr>
<td></td>
<td>Simonsen-NIH</td>
<td>-11%</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>all infants</td>
<td>1 in 28,000</td>
<td>122</td>
</tr>
<tr>
<td></td>
<td>45-210 days</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Incidence Rates and Numbers of Hospitalized Cases of Intussusception by Age (months) VSD, 1991-1997

80% of the IS were in the 50% of infants >90 days when vaccinated
Let’s reassess the risks and benefits of RV vaccine

Benefits

1 death in 250 children
600,000 deaths/yr
25-50% of D admissions

Risks

1 IS in 30,000 vaccinees
? 3500 severe IS cases
The next generation of rotavirus vaccines

- G1P[8]
- G1 G3
- G2 G4
- Bovine rotavirus with single human rotavirus gene substitution
- G1
- P[8]
- G2
- G3
- G4

GSK Bio

Rotarix

Merck

RotaTeq
2006
An Incredible Year for Rotavirus
Safety and Efficacy of a Pentavalent Human–Bovine (WC3) Reassortant Rotavirus Vaccine

Timo Vesikari, M.D., David O. Matson, M.D., Ph.D., Penelope Dennehy, M.D., Pierre Van Damme, M.D., Ph.D., Mathuram Santosham, M.D., M.P.H., Zoe Rodriguez, M.D., Michael J. Dallas, Ph.D., Joseph F. Heyse, Ph.D., Michelle G. Goveia, M.D., M.P.H., Steven B. Black, M.D., Henry R. Shinefield, M.D., Celia D.C. Christie, M.D., M.P.H., Samuli Ylitalo, M.D., Robbin F. Itzler, Ph.D., Michele L. Coia, B.A., Matthew T. Onorato, B.S., Ben A. Adeyi, M.P.H., Gary S. Marshall, M.D., Leif Gotheffors, M.D., Dirk Campens, M.D., Aino Karvonen, M.D., James P. Watt, M.D., M.P.H., Katherine L. O'Brien, M.D., M.P.H., Mark J. DiNubile, M.D., H Fred Clark, D.V.M., Ph.D., John W. Boslego, M.D., Paul A. Offit, M.D., Penny M. Heaton, M.D., for the Rotavirus Efficacy and Safety Trial (REST) Study Team
Safety and Efficacy of an Attenuated Vaccine against Severe Rotavirus Gastroenteritis

Guillermo M. Ruiz-Palacios, M.D., Irene Pérez-Schael, M.Sc., F. Raúl Velázquez, M.D., Hector Abate, M.D., Thomas Breuer, M.D., SueAnn Costa Clemens, M.D., Brigitte Cheuvart, Ph.D., Felix Espinoza, M.D., Paul Gillard, M.D., Bruce L. Innis, M.D., Yolanda Cervantes, M.D., Alexandre C. Linhares, M.D., Pío López, M.D., Mercedes Macías-Parra, M.D., Eduardo Ortega-Barría, M.D., Vesta Richardson, M.D., Doris Maribel Rivera-Medina, M.D., Luis Rivera, M.D., Belén Salinas, M.D., Noris Pavía-Ruz, M.D., Jorge Salmerón, M.D., Ricardo Rüttimann, M.D., Juan Carlos Tinoco, M.D., Pilar Rubio, M.D., Ernesto Nuñez, M.D., M. Lourdes Guerrero, M.D., Juan Pablo Yarzábal, M.D., Silvia Damaso, M.Sc., Nadia Tornieporth, M.D., Xavier Sáez-Llorens, M.D., Rodrigo F. Vergara, M.D., Timo Vesikari, M.D., Alain Bouckenooche, M.D., Ralf Clemens, M.D., Ph.D., Béatrice De Vos, M.D., Miguel O'Ryan, M.D., for the Human Rotavirus Vaccine Study Group
Human-Bovine Reassortant Rotavirus Vaccine - RotaTeq® (Merck)

- Pentavalent
- Liquid vaccine with buffer, stabilizer
- 3 doses, 2ml/dose,
- easy to administer
- Grows poorly - high dose (10^7-8), low shedding
## Clinical Trials of Rotateq

<table>
<thead>
<tr>
<th>Vac / Placebo</th>
<th>Outcome</th>
<th>Vac Placebo</th>
<th>Efficacy (95%CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S., Finland</td>
<td>2834/2839 Any</td>
<td>83 / 315</td>
<td>74 (67-80)</td>
</tr>
<tr>
<td></td>
<td>Severe</td>
<td>1 / 51</td>
<td>98 (88-100)</td>
</tr>
<tr>
<td>U.S.</td>
<td>650 /650 Any</td>
<td>15 / 54</td>
<td>73 (51-86)</td>
</tr>
<tr>
<td></td>
<td>Mod/sev Severe</td>
<td>10 / 42</td>
<td>76 (52-89)</td>
</tr>
<tr>
<td></td>
<td>Severe</td>
<td>0 / 6</td>
<td>100 (13-100)</td>
</tr>
</tbody>
</table>

From abstracts & presentations
GSK Attenuated Human Rotavirus Vaccine, Rotarix®

- Monovalent
- Lyophilized vaccine, needs reconstitution
- 2 doses, 1 ml/dose
- Grows well - low dose ($10^{5.8}$); high shedding (>50%)
## Clinical Trials of Rotarix

<table>
<thead>
<tr>
<th>Location</th>
<th>Vac/Placebo</th>
<th>Outcome</th>
<th>Vaccine</th>
<th>Efficacy (95%CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finland</td>
<td>245 / 123</td>
<td>Any Severe</td>
<td>13 / 23</td>
<td>72 (42-87)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2 / 10</td>
<td>85 (42-97)</td>
</tr>
<tr>
<td>Brazil, Mexico, Venezuela</td>
<td>464 / 454</td>
<td>Any Severe</td>
<td>15 / 49</td>
<td>70 (46-84)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5 / 3434</td>
<td>86 (63-96)</td>
</tr>
<tr>
<td>Latin America</td>
<td>10,159 / 10,010</td>
<td>Severe Hosp.</td>
<td>NA</td>
<td>85 (72-92)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>85 (77-94)</td>
</tr>
</tbody>
</table>

From abstracts & presentations
First rotavirus immunizations in Panama,
Inaugurated by President Martin Torrijos and his wife, Viven de Torrijos
March 14, 2006
## Current status of licensure and introduction of Rotarix-GSK

### WHO Region | Countries with licenses -Rotarix®(3/06)
--- | ---
**Americas** | 16 Argentina, Brazil, Chile, Colombia, Mexico, Curaçao, Dom. Rep. , Ecuador, El Salvador, Guatemala, Jamaica Mexico, Peru, Panama, Suriname, Trinidad/Tobago, Venezuela
**Africa** | 12 Cameroun, Cent.African Republic, Congo, DR Congo, Ghana, Guinea, Kenya, Malawi, Madagascar, Mali, Mali, Mauritius, Nigeria
**Europe** | 1 Norway, EMEA
**Middle East** | 3 Bahrain, Kuwait, UAE
**S.E. Asia** | 1 Thailand
**West. Pacific** | 3 Australia, Philippines, Singapore
The biggest challenge for live oral rotavirus vaccines today is “will they work for poor children in the developing world!

To date, no live oral vaccine has been successfully tested for efficacy in a poor Country of Africa or Asia!

Preliminary data suggests that they Might not perform as well and we Will need to figure this out soon!
Live oral vaccines – problems in the developing world

- **OPV**
  - Less immunogenic/more doses needed for children in India (*T. Jacob Johns*)

- **Cholera (Oralchol)**
  - Less immunogenic/higher titer needed in Thai/Indonesian studies (*Mike Levine*)

- **Oral RV**
  - RIT
    - Failed in Africa/Peru
  - WC3
    - Failed in Africa
  - RRV
    - Lower efficacy in Peru/Brazil
  - GSK
    - Being tested in S.Africa/Bangladesh

*Rotavirus vaccines have a bad history for the poorest children in the developing world!*
The Rotavirus Vaccine Agenda

**Timelines**

- Merck
- GSK
- China
- NIH/UK
- BIOVIRx/IDT
- Australia
- India

Developement: 2 years
Testing: 3 years
Licensure: 1-2 years
WHO REC: 3-4 years
Where will new vaccines be made?

6 candidate vaccines
12 companies
5 countries

<table>
<thead>
<tr>
<th>Sector/Cities</th>
<th>Hospitals</th>
<th>Specimens screened N</th>
<th>Rotavirus positives N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>North</strong></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Hanoi</td>
<td>National Children’s Hospital</td>
<td>1233</td>
<td>657</td>
<td>53</td>
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<tr>
<td></td>
<td>St. Paul’s Children’s Hospital</td>
<td>390</td>
<td>185</td>
<td>47</td>
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<tr>
<td>Haiphong</td>
<td>Children’s Hospital</td>
<td>886</td>
<td>531</td>
<td>60</td>
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<tr>
<td><strong>South</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Khanh Hoa</td>
<td>General Hospital</td>
<td>589</td>
<td>348</td>
<td>59</td>
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<tr>
<td>Ho Chi Minh City</td>
<td>General Pediatrics N. 1</td>
<td>1724</td>
<td>982</td>
<td>57</td>
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<td></td>
<td>General Pediatrics N. 2</td>
<td>946</td>
<td>544</td>
<td>58</td>
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<td></td>
<td><strong>5768</strong></td>
<td><strong>3247</strong></td>
<td><strong>56</strong></td>
</tr>
</tbody>
</table>

Why are these rates so high? Van Mann, et al, JID, 2001
Rotavirus hospitalizations in the Asian Rotavirus Surveillance Network

China: 41%

Korea

Taiwan: 41%

Malaysia: 56%

Vietnam: 60%

Hong Kong: 29%

Indonesia: 39%

Bresee 2003 EIDJ
Rotavirus Surveillance networks

AFRO

EMRO

PAHO

Asia
Who is interested in supporting rotavirus vaccines today?

The International Finance Facility
Conclusions

“We are beginning a great experiment to see if we can control and perhaps eliminate rotavirus diarrhea through the use of vaccines”
Creative Strategies for future funding

Should we rename it

“Rotaryvirus?”
The Fogarty Mission

• To address global health challenges through innovative and collaborative programs for research and training

• To support and advance the NIH mission through global partnerships

“Science for Global Health”

Rhode Island Congressman John Edward Fogarty

“… a man who, for more than a quarter of a century, worked tirelessly for a healthy America, in a healthier world.”

Congressman Melvin Laird (R-WI) 1967
Fogarty International Center
Major Research and Training Sites

>100 foreign institutions

>60 US institutions

>100 foreign institutions
The Fogarty Portfolio – an Alphabet Soup

Collaborative Research
Global Health Fellowships- U.S.
Development of Institutional Capacity
Research Training- Foreign

2006
$68 million
> 400 grants
AITRP (Aids Int’l Training & Research Program (1988-…)
Investing in Leaders

Pedro Chequer, Director, National STD/AIDS Program, MOH, Brazil
Salim Abdool Karim, Director, CAPRISA S. Africa
Jean Pape, Director, GHESKIO, Haiti
Philippa Musoke, Chair of Pediatrics, Makarere University, Uganda
Glenda Gray, Co-founder/Co-Director, Perinatal HIV Research Unit, Chris Hani Baragwanath Hospital, South Africa

David Serwadda, Director, Institute of Public Health, Makarere University, Uganda

Zunyou Wu, Director, National Center for AIDS/STD Control & Prevention, Chinese CDC, China

Patricia Garcia, Chief, National Institute of Health, Peru

Marcos Espinal, Stop TB Partnership Secretariat, World Health Organization

Ruth Nduati, Faculty of Medicine, College of Health Sciences, University of Nairobi
America’s leaders in global health have early overseas training

Bill Foege
CDC
Nigeria

Tom Quinn
NIAID
Zaire

Palmer Beasley
Taiwan

Jeff Koplan
CDC/Emory
Bangladesh

Mike Merson
Duke
Bangladesh

Al Sommer
Hopkins
Bangladesh

Gerry Keusch
BU/Thailand

Helene Gayle
Care/Uganda

Alan Rosenfield
Columbia
Nigeria, Thailand

Barry Bloom
Harvard
India

Bob Black
Hopkins
Bangladesh

Dick Guerrant
U. Va
Brazil

Alan Rosenfield
Columbia
Nigeria, Thailand
24 “pairs” of trainees going to 16 medical centers in the developing world
Framework Program 2005-2006

Source: Fogarty International Center, Nov. 2006

“Glues” multiple schools within a university or universities around the topic of global health

~19 US Programs
The Uganda Cancer Institute, Mulago Hospital

1. Described “African Lymphoma”
2. Identified first viral cause of cancer (with Ebstein & Barr)
3. Described co-factors for cancer (immune suppression)
4. Identified first successful chemotherapy with anti-mitotic agents (with Burchenal, & Oettgen, Sloan Kettering)
Funding (NIH/Other)

Collaborative Long Term Relationships

Human and Institutional Capacity building

FIC
Investing in Global Health
“Best Buys” and Priorities for Action in Developing Countries”
Fogarty International Center, the World Bank, the World Health Organization, and the Population Reference Bureau, 2006

The Question: Can the world tackle its most challenging health problems?
Changes in Life Expectancy in the past 500 years

Source: Deppen 1999.
10 Best Buys for Health

1. Prevent neonatal mortality
2. Ensure healthier mothers and children
3. Promote good nutrition
4. Reduce deaths from cardiovascular disease
5. Stop the AIDS pandemic
6. Stop the spread of tuberculosis
7. Control malaria
8. Combat tobacco Use
9. Reduce fatal and disabling injuries
10. Ensure equal access to high-quality health care

*Items in red have an infectious basis*
Feature Story:
Taking Prosperity to Heart

Rising cardiovascular disease rates accompany economic development around the world, but cost-effective prevention and treatment can save countless lives.

Learn More | Past Features

About DCPP

The Disease Control Priorities Project (DCPP) is an ongoing effort to assess disease control priorities and produce evidence-based analysis and resource materials to inform health policymaking in developing countries. DCPP has produced three volumes providing technical resources that can assist developing countries in improving their health systems and ultimately, the health of their people. More

DCPP Publications

Disease Control Priorities in Developing Countries
The second edition of this seminal work (DCP2), written by more than 350 specialists in diverse fields from around the world, provides the results of indepth research, offers insightful analyses, and proposes context-sensitive policy recommendations to significantly reduce the burden of disease in developing countries and to improve the quality of life for all people.

Priorities in Health
This companion volume distills the essence of DCP2 into a succinct and readable format, providing information on how to devise better strategies, policies, and choices among health interventions; how to put those decisions into practice; and how to

Website: DCP2.ORG
Health Diplomacy

“Health is now the most important foreign policy issue of our time.”

See Comment page 1195
Presidential Initiatives in Africa

Presidents Emergency Program For Aids Research PEPFAR
$15 B – 5 years

Efforts to control avian flu and emerging infections

Presidents Malaria Initiative - PMI
$1.2 B – 5 years

“Implementation Science”
International Collaborations

Professor M.K. Bhan, Secretary of the Department of Biotechnology negotiating agreements with NIH on HIV, child health, eye disease, Vaccines, emerging infections, biotechnology, ....
New Advocates for Global Health
Potential Partners for Global Health

U.S. Government Agencies

Private Sector

Foundations e.g. Gates, Wellcome, etc

NGOs

Universities, Medical Research Groups

WHO
World Bank
Unicef

Developing World Medical Research Councils

NIAID, NICHD, NIMH, NIDCR, NCCAM
“Now more than ever, an informed, proactive, and unified strategy will be key to advancing the science needed to improve the health of the world.”
Bangladesh - 1980

- <5 mortality > 120/1000
- Family size - 6+
- Family planning - unsuccessful
- Immunization coverage <5%
- Malnutrition – vit A, zinc, iodine
- Causes of death – ARI/ Diarrhea
Bangladesh- 2005

- <5 mortality, 75/1000
- Family size - 2.6
- Women in workplace – garment industry
- Immunization coverage 75%
- Diarrheal deaths - decreased
- Causes of death – neonatal deaths 50%, arsenic, infections, smoking, accidents
Summary
Key concepts in our strategic plan

Train the next generation of U.S. and foreign global health researchers (Early childhood education!)

Build sustainable capacity for health science research, through institutional partnerships and research collaborations’ (Build centers of excellence!)

Advance implementation science as a tool for accelerating the application of research knowledge on a global scale.
Building Sustainable Research Capacity

- Providing re-entry support for foreign scientists returning home
- Strengthen institutional capacity through twinning programs and research collaborations.
- Provide leadership for global health
GLOBAL EXAMPLES OF ENDURING ENVIRONMENTAL DISASTERS

GLOBAL WARMING
- Love Canal
- Spanish waste water spill (1998)
- Seveso-Italian dioxin crisis (1976)
- Chernobyl disaster (1986)
- Baia Mare cyanide spill (2000)

Water pollution
- London Smog (1952)

Desertification
- Radiation effects

Mustard gas exposure
- Minimata Disease-methyl-mercury poisoning
- Bhopal-Union Carbide gas leak (1984)

Mining
- Asbestosis, silicosis

Indoor air pollution
- Chronic arsenic poisoning

Deforestation

Pesticide poisoning

Cholera

Alaska oil spill (1989)

Lead smelters

Mercury poisoning

Air pollution
GLOBAL EXAMPLES OF PEDIATRIC AND ADULT CANCERS

- Lung
- Nasopharyngeal
- Wilm's tumor
- Skin
- Stomach
- Oral cavity
- Liver
- Oral cavity
- Skin
- Lip
- Oesophagus
- Burkitt's lymphoma (area shaded in red)
- Bladder
- Kaposi sarcoma
- Adrenocortical carcinoma
- Colon and Rectum
- Testis
- Prostate
- Cervix uteri

Legend:
- Red: Pediatric
- Blue: Adult
1997 IOM Report

“The United States is currently the global leader in biomedical research...

The failure to engage in the fight to anticipate, prevent, and ameliorate global health problems would diminish America's stature in the realm of health and jeopardize our own health, economy, and national security”
Has Global Health reached “the tipping point?”

The tipping point is that magic moment when an idea, trend, or social behavior crosses a threshold, tips, and spreads like wildfire. Just as a single sick person can start an epidemic of the flu, so too can a small but precisely targeted push cause a fashion trend, the popularity of a new product, or a drop in the crime rate.....
Some themes for Fogarty

“Science anywhere helps people everywhere”

“Take science where the problems are”

Science for Global Health
Thanks for the visit!