Infectious Diseases in Resource-poor Areas of the World

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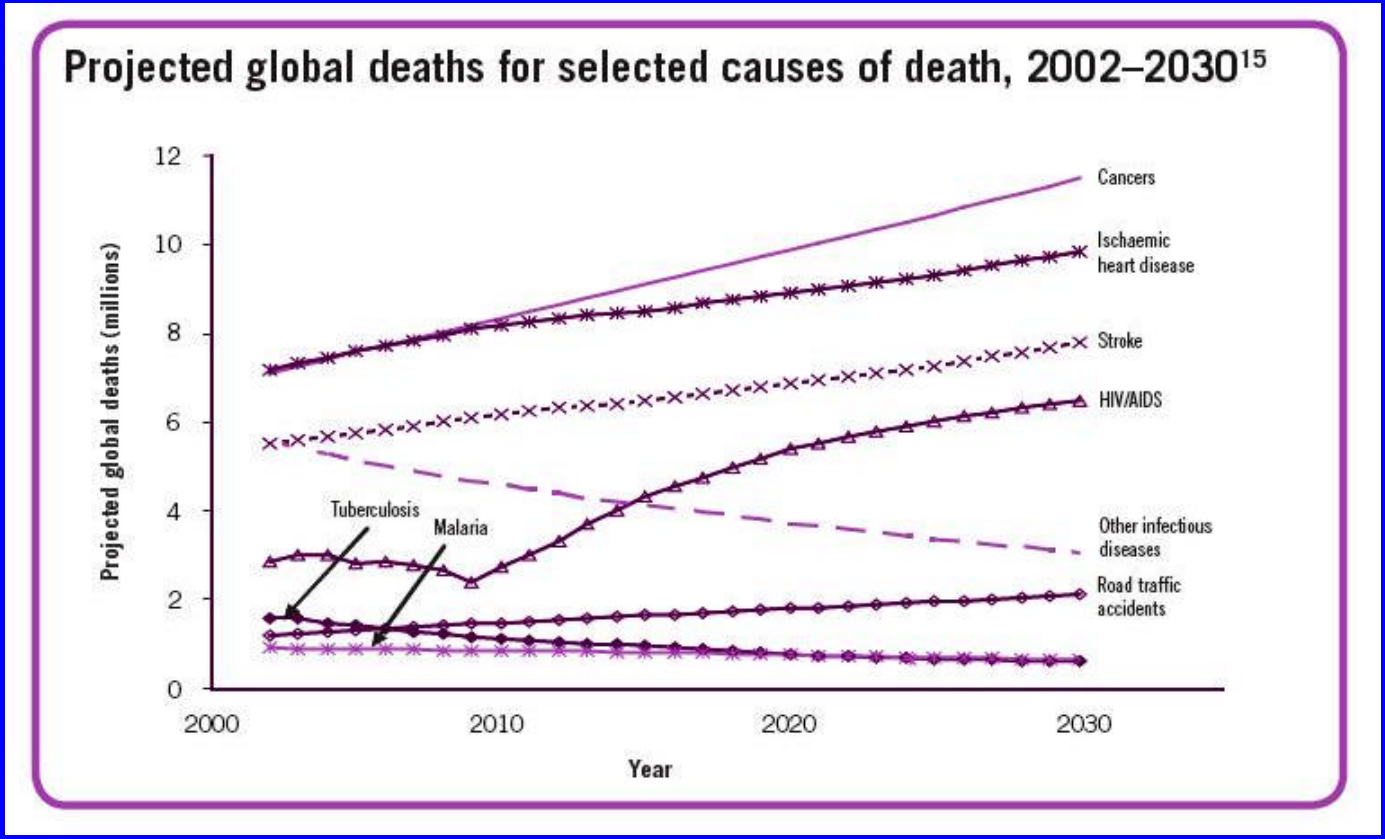
Some of the Issues

- **Burden of Disease**
- **Specific Pathogens/ Conditions:**
  - **Acute Respiratory Disease**
  - **Acute Diarrheal Disease**
  - **Tuberculosis**
  - **Malaria**
  - **Measles**
  - **HIV**
  - ***Immunizations***
  - ***Additional Resources***
- **Summary**

WHO *Projections* for Selected Causes of Death



Mathers CD, Loncar D. Projections of global mortality and burden of disease from 2002 to 2030. *PLoS Medicine* [online journal], 2006, 3(11):e442 (http://medicine.plosjournals.org/perlserv/?request=get-document&doi=10.1371/journal.pmed.0030442).

- Shift in deaths from ***younger to older ages*** & from ***communicable to non-communicable*** diseases (reflective of shift to an older population)
- ***Large declines in mortality projected*** for all principal communicable, maternal, perinatal and nutritional causes, ***except*** HIV/AIDS.
  - Global HIV deaths projected to rise from 2.8 million in 2002 to 6.5 million in 2030 (assumes ART coverage of 80% by 2012).

Changes in Ranking for Leading Causes of Death 2002 ® 2030

Table 2. Changes in Rankings for 15 Leading Causes of Death, 2002 and 2030 (Baseline Scenario)

Category	Disease or Injury	2002 Rank	2030 Ranks	Change in Rank
Within top 15	Ischaemic heart disease	1	1	0
	Cerebrovascular disease	2	2	0
	Lower respiratory infections	3	5	−2
	HIV/AIDS	4	3	+1
	COPD	5	4	+1
	Perinatal conditions	6	9	−3
	Diarrhoeal diseases	7	16	−9
	Tuberculosis	8	23	−15
	Trachea, bronchus, lung cancers	9	6	+3
	Road traffic accidents	10	8	+2
	Diabetes mellitus	11	7	+4
	Malaria	12	22	−10
	Hypertensive heart disease	13	11	+2
	Self-inflicted injuries	14	12	+2
	Stomach cancer	15	10	+5
Outside top 15	Nephritis and nephrosis	17	13	+4
	Colon and rectum cancers	18	15	+3
	Liver cancers	19	14	+5

doi: 10.1371/journal.pmed.0030442.t002

Mathers, Loncar, Projections of Global Mortality & Burden of Disease from 2002 to 2030. PLoS Medicine, 3(11), Nov., 2006

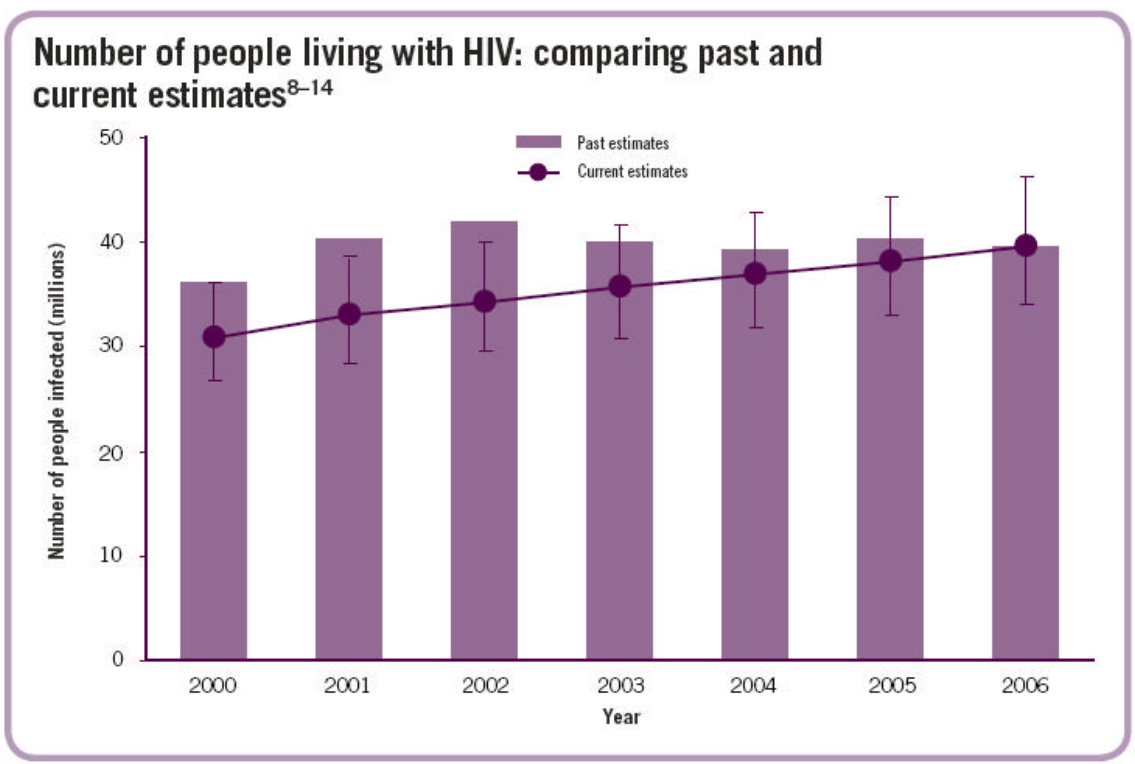
Ten leading Causes of Death by Income Group, 2030

Table 3. Ten Leading Causes of Death, by Income Group, 2030 (Baseline Scenario)

Income Group	Rank	Disease or Injury	Percent of Total Deaths
World	1	Ischaemic heart disease	13.4
	2	Cerebrovascular disease	10.6
	3	HIV/AIDS	8.9
	4	COPD	7.8
	5	Lower respiratory infections	3.5
	6	Trachea, bronchus, lung cancers	3.1
	7	Diabetes mellitus	3.0
	8	Road traffic accidents	2.9
	9	Perinatal conditions	2.2
	10	Stomach cancer	1.9
High-income countries	1	Ischaemic heart disease	15.8
	2	Cerebrovascular disease	9.0
	3	Trachea, bronchus, lung cancers	5.1
	4	Diabetes mellitus	4.8
	5	COPD	4.1
	6	Lower respiratory infections	3.6
	7	Alzheimer and other dementias	3.6
	8	Colon and rectum cancers	3.3
	9	Stomach cancer	1.9
	10	Prostate cancer	1.8
Middle-income countries	1	Cerebrovascular disease	14.4
	2	Ischaemic heart disease	12.7
	3	COPD	12.0
	4	HIV/AIDS	6.2
	5	Trachea, bronchus, lung cancers	4.3
	6	Diabetes mellitus	3.7
	7	Stomach cancer	3.4
	8	Hypertensive heart disease	2.7
	9	Road traffic accidents	2.5
	10	Liver cancer	2.2
Low-income countries	1	Ischaemic heart disease	13.4
	2	HIV/AIDS	13.2
	3	Cerebrovascular disease	8.2
	4	COPD	5.5
	5	Lower respiratory infections	5.1
	6	Perinatal conditions	3.9
	7	Road traffic accidents	3.7
	8	Diarrhoeal diseases	2.3
	9	Diabetes mellitus	2.1
	10	Malaria	1.8

Mathers, Loncar, Projections of Global Mortality & Burden of Disease from 2002 to 2030. PLoS Medicine, 3(11), Nov., 2006

- **Better statistics for monitoring progress:**
  - Current reliance on predicted rather than corrected numbers



- Estimates improve as more countries adopt standardized methods
- Epidemic was overestimated, but it's still growing
- Must use corrected data to compare years
- There's still substantial uncertainty

World Health Statistics 2007; Ten Statistical Highlights in Global Public Health. WHO, 2007

Global Burden of Disease and Risk Factors in 2001
The World Bank, 2006

Table 1.1 Deaths and Burden of Disease by Cause—Low- and Middle-Income Countries, High-Income Countries, and World, 2001

	Low- and middle-income		High-income		World	
	Deaths	DALYs(3,0)[a]	Deaths	DALYs(3,0)[a]	Deaths	DALYs(3,0)[a]
All causes						
Total number (thousands)	**48,351**	**1,386,709**	**7,891**	**149,161**	**56,242**	**1,535 871**
Rate per 1,000 population	**9.3**	**265.7**	**8.5**	**160.6**	**9.1**	**249.8**
Age-standardized rate per 1,000[b]	**11.4**	**281.7**	**5.0**	**128.2**	**10.0**	**256.5**
Selected cause groups:			*Number in thousands (percent)*			
I. COMMUNICABLE DISEASES, MATERNAL AND PERINATAL CONDITIONS AND NUTRITIONAL DEFICIENCIES	**17,613 (36.4)**	**552,376 (39.8)**	**552 (7.0)**	**8,561 (5.7)**	**18,166 (32.3)**	**560,937 (36.5)**
#5 Tuberculosis	1,590 (3.3)	35,874 (2.6)	16 (0.2)	219 (0.1)	1,606 (2.9)	36,093 (2.3)
#2 HIV/AIDS	2,552 (5.3)	70,796 (5.1)	22 (0.3)	665 (0.4)	2,574 (4.6)	71,461 (4.7)
#4 Diarrheal diseases	1,777 (3.7)	58,697 (4.2)	6 (<.1)	444 (0.3)	1,783 (3.2)	59,141 (3.9)
Measles	762 (1.6)	23,091 (1.7)	1 (<.1)	23 (<.1)	763 (1.4)	23,113 (1.5)
#6 Malaria	1,207 (2.5)	39,961 (2.9)	0 (0.0)	9 (<.1)	1,208 (2.1)	39,970 (2.6)
#1 Lower respiratory infections	3,408 (7.0)	83,606 (6.0)	345 (4.4)	2,314 (1.6)	3,753 (6.7)	85,920 (5.6)
#3 Perinatal conditions	2,489 (5.1)	89,068 (6.4)	32 (0.4)	1,408 (0.9)	2,522 (4.5)	90,477 (5.9)
Protein-energy malnutrition	241 (0.5)	15,449 (1.1)	9 (0.1)	130 (<.1)	250 (0.4)	15,578 (1.0)
II. NONCOMMUNICABLE CONDITIONS	**26,023 (53.8)**	**678,483 (48.9)**	**6,868 (87.0)**	**129,356 (86.7)**	**32,891 (58.5)**	**807,839 (52.6)**
III. INJURIES	**4,715 (9.8)**	**155,850 (11.2)**	**471 (6.0)**	**11,244 (7.5)**	**5,186 (9.2)**	**167,094 (10.9)**

a. DALYs (3,0): Disability Adjusted Life Years based on a 3% annual discount rate and uniform age weights.

Death in Children, 2001

Table 3.8 The 10 Leading Causes of Death in Children Ages 0–14, by Broad Income Group, 2001

Low- and middle-income countries			High-income countries		
Cause	Deaths (millions)	Percentage of total deaths	Cause	Deaths (millions)	Percentage of total deaths
1 Perinatal conditions	2.49	20.7	1 Perinatal conditions	0.03	33.9
2 Lower respiratory infections	2.04	17.0	2 Congenital anomalies	0.02	20.0
3 Diarrheal diseases	1.61	13.4	3 Road traffic accidents	0.01	5.9
4 Malaria	1.10	9.2	4 Lower respiratory infections	0.00	2.5
5 Measles	0.74	6.2	5 Endocrine disorders	0.00	2.4
6 HIV/AIDS	0.44	3.7	6 Drownings	0.00	2.4
7 Congenital anomalies	0.44	3.7	7 Leukemia	0.00	1.9
8 Whooping cough	0.30	2.5	8 Violence	0.00	1.8
9 Tetanus	0.22	1.9	9 Fires	0.00	1.2
10 Road traffic accidents	0.18	1.5	10 Meningitis	0.00	1.2

Source: Authors' calculations.

In Global Burden of Disease and Risk Factors, ed. Lopez, et. al. Chapter 2, p.29. Oxford University Press & The World Bank, 2006

Mortality, Children = 5 years by Cause, 1990 & 2001

Table 2.4 Mortality in Children Under Five by Cause, 1990 and 2001

	Low- and middle-income countries		East Asia and Pacific		Europe and Central Asia		Latin America and the Caribbean		Middle East and North Africa		South Asia		Sub-Saharan Africa		High-income countries		World	
Disease and indicator	**1990**	**2001**	**1990**	**2001**	**1990**	**2001**	**1990**	**2001**	**1990**	**2001**	**1990**	**2001**	**1990**	**2001**	**1990**	**2001**	**1990**	**2001**
Acute respiratory infections																		
Deaths (thousands)	2,521	1,943	492	197	68	36	83	44	138	76	1,027	833	713	757	13	2	2,533	1,944
% of childhood deaths	21.0	18.4	23.8	14.0	19.5	20.6	14.1	10.9	20.6	17.7	23.2	23.1	18.3	16.8	11.1	2.3	20.9	18.3
Probability of dying before age 5 per 1,000 live births	20	16	13	6	8	6	7	4	16	9	29	22	33	29	1	0	19	15
Congenital anomalies																		
Deaths (thousands)	421	421	118	115	25	24	30	41	22	41	186	142	41	58	19	18	440	439
% of childhood deaths	3.5	4.0	5.7	8.2	7.1	13.5	5.1	10.1	3.3	9.5	4.2	3.9	1.0	1.3	16.3	24.6	3.6	4.1
Probability of dying before age 5 per 1,000 live births	3	3	3	4	3	4	3	4	3	5	5	4	2	2	2	2	3	3
Diarrheal diseases																		
Deaths (thousands)	2,362	1,599	274	201	61	12	108	46	144	66	991	631	784	643	11	0	2,374	1,600
% of childhood deaths	19.7	15.2	13.2	14.3	17.4	6.9	18.3	11.4	21.6	15.3	22.4	17.5	20.1	14.3	9.9	0.6	19.6	15.1
Probability of dying before age 5 per 1,000 live births	19	13	7	6	7	2	9	4	17	8	28	17	36	25	1	0	17	12
HIV/AIDS																		
Deaths (thousands)	62	340	—	5	—	0	2	6	0	1	—	14	60	313	0	0	62	340
% of childhood deaths	0.5	3.2	0.0	0.4	0.0	0.2	0.3	1.4	0.0	0.1	0.0	0.4	1.5	7.0	0.0	0.1	0.5	3.2
Probability of dying before age 5 per 1,000 live births	0	3	0	0	0	0	0	1	0	0	0	0	3	12	0	0	0	3
Injuries																		
Deaths (thousands)	647	302	206	82	25	11	28	19	32	24	188	79	169	87	9	7	656	309
% of childhood deaths	5.4	2.9	9.9	5.8	7.0	6.6	4.7	4.6	4.8	5.6	4.2	2.2	4.3	1.9	7.8	9.8	5.4	2.9
Probability of dying before age 5 per 1,000 live births	5	2	5	2	3	2	2	2	4	3	5	2	8	3	1	1	5	2
Malaria																		
Deaths (thousands)	588	1,086	7	27	0	0	2	1	1	17	9	57	570	984	0	0	588	1,086
% of childhood deaths	4.9	10.3	0.3	1.9	0.1	0.0	0.3	0.3	0.1	3.9	0.2	1.6	14.6	21.8	0.2	0.1	4.8	10.2
Probability of dying before age 5 per 1,000 live births	5	9	0	1	0	0	0	0	0	2	0	2	26	38	0	0	4	8

(Continues on the following page.)

In Global Burden of Disease and Risk Factors, ed. Lopez, et. al. Chapter 2, p.29. Oxford University Press & The World Bank, 2006

Mortality, Children = 5 years by Cause, 1990 & 2001

Table 2.4 Continued

Disease and indicator	Low- and middle-income countries		East Asia and Pacific		Europe and Central Asia		Latin America and the Caribbean		Middle East and North Africa		South Asia		Sub-Saharan Africa		High-income countries		World	
	1990	2001	1990	2001	1990	2001	1990	2001	1990	2001	1990	2001	1990	2001	1990	2001	1990	200
Measles																		
Deaths (thousands)	869	556	75	45	12	5	38	—	30	10	239	145	474	351	3	0	872	556
% of childhood deaths	7.2	5.3	3.6	3.2	3.5	2.9	6.5	0.0	4.5	2.3	5.4	4.0	12.2	7.8	2.5	0.1	7.2	5.2
Probability of dying before age 5 per 1,000 live births	7	5	2	1	1	1	3	0	4	1	7	4	22	13	0	0	6	4
Perinatal conditions																		
Deaths (thousands)	2,261	2,492	480	506	83	57	162	164	141	106	906	1,086	487	573	38	32	2,298	2,524
% of childhood deaths	18.8	23.7	23.2	36.0	23.6	32.9	27.6	40.3	21.2	24.7	20.4	30.1	12.5	12.7	33.0	44.5	18.9	23.8
Probability of dying before age 5 per 1,000 live births	18	20	12	15	10	10	14	14	17	13	26	29	22	22	3	3	17	19
Other causes																		
Deaths (thousands)	2,288	1,792	420	228	77	28	137	85	159	90	888	625	607	737	22	13	2,309	1,805
% of childhood deaths	19.0	17.0	20.3	16.2	21.9	16.3	23.2	21.0	23.8	20.9	20.0	17.3	15.5	16.4	19.1	17.9	19.0	17.0
Probability of dying before age 5 per 1,000 live births	18	15	11	7	9	5	12	7	19	11	25	17	28	28	2	1	17	14
Total																		
Deaths (thousands)	12,019	10,532	2,072	1,407	352	174	588	407	668	429	4,434	3,612	3,904	4,504	115	73	12,134	10,605
% of childhood deaths	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Probability of dying before age 5 per 1,000 live births	97	86	54	43	41	29	51	35	80	53	127	97	180	172	10	7	89	80

Sources: Estimates for 1990 are based on Murray and Lopez 1996, weighted to World Bank regions using population under five years old. Estimates for 2001 are from chapter 3 in this volume.
Note: — = not available or not applicable. Estimates of child mortality are rounded to the nearest whole number.

- Relative contribution of childhood malnutrition ?

In Global Burden of Disease and Risk Factors, ed. Lopez, et. al. Chapter 2, p.30. Oxford University Press & The World Bank, 2006

Acute Respiratory Infections, Children <5 yrs.

- About 20% of all deaths in children <5 years:
  - Pneumonia, bronchiolitis and bronchitis
  - 90% of deaths due to pneumonia
    - Delays in recognition/ treatment of pneumonia increase mortality.
- Bacterial (S. pneumoniae & H. influenzae) or viral
- Not possible to differentiate between bacterial and viral ARIs based on clinical signs or radiology
- Risk factors for higher risk of pneumonia/death:
  - Low birth weight, malnourished and non-breastfed
  - living in overcrowded conditions

http://www.who.int/fch/depts/cah/resp_infections/en/

Management of Acute Respiratory Infection(ARI) in Children <5 yrs.

- Assess children with cough or difficult breathing with case management charts
  - Also assess for signs of severe malnutrition, visible severe wasting & edema of both feet ® refer to hospital (very high risk of death from pneumonia).
  - Children with danger signs should be referred to a hospital after a dose of IM chloramphenicol.
    - If not possible, BID IM chloramphenicol for 5 days, then PO antibiotic for another 5 days.

http://www.who.int/fch/depts/cah/resp_infections/en/

Management of Acute Respiratory Infection(ARI) in Children < 5 yrs.

- **Severe pneumonia:**
  - Give 1st dose Amoxicillin
  - Refer to hospital for IM ampicillin/penicillin
    - If not possible, PO amoxicillin for 7 days
- **Non-severe pneumonia;**
  - PO co-trimoxazole or amoxicillin for 5 days
- **Supportive measures:**
  - -oral fluids to avoid dehydration, continued feeding to avoid malnutrition and antipyretics to reduce high fever

http://www.who.int/fch/depts/cah/resp_infections/en/

A.R.I. Case Management Chart

ACUTE RESPIRATORY ILLNESS
CHILD AGED 2 MONTHS UP TO 5 YEARS

CHECK FOR GENERAL DANGER SIGNS

ASK:	*LOOK:*
• Is the child able to drink or breastfeed? • Does the child vomit everything? • Has the child had convulsions?	• See if the child is lethargic or unconscious.

A child with any general danger sign needs URGENT attention; give first dose of IM chloramphenicol immediately and refer URGENTLY to hospital

If referral is NOT possible:
- **Give IM chloramphenicol for 5 days followed by 5 days of oral antibiotic therapy**

Does the child have cough or difficult breathing?

IF YES, ASK:
- For how long?

LOOK, LISTEN, FEEL:
- Count the breaths in one minute.
- Look for chest indrawing.

CHILD MUST BE CALM

Classify COUGH or DIFFICULT BREATHING

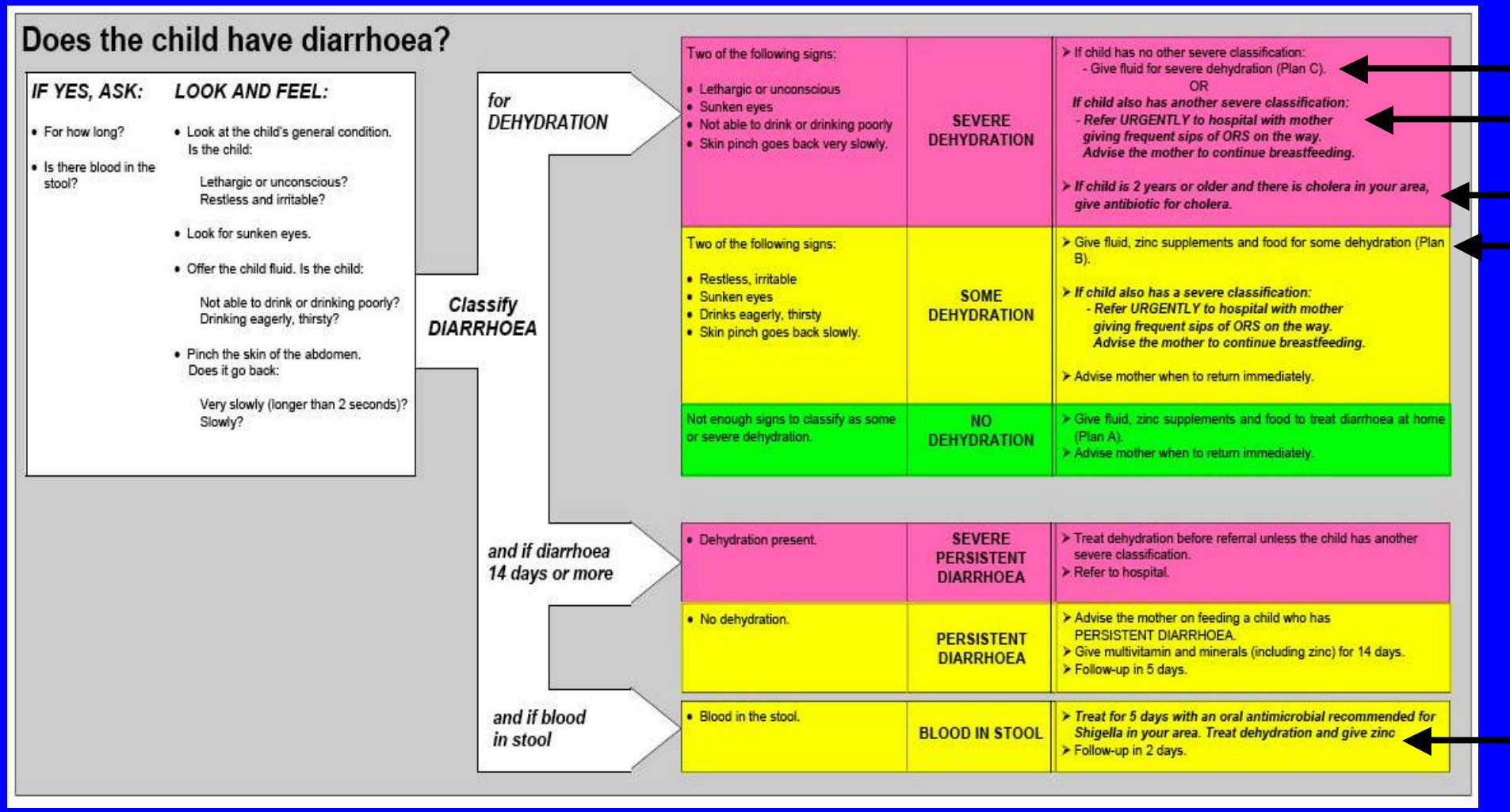
If the child is:	Fast breathing is:
2 months up to 12 months	**50** breaths per minute or more
12 months up to 5 years	**40** breaths per minute or more

SIGNS	CLASSIFY AS	TREATMENT
• Chest indrawing	**SEVERE PNEUMONIA**	➢ ***Give first dose of amoxicillin*** ➢ ***Refer URGENTLY to hospital.**** **If referral is NOT possible:** ➢ **Give oral amoxicillin thrice daily for 7 days**
• Fast breathing.	**PNEUMONIA**	➢ ***Give oral cotrimoxazole twice daily for 5 days.*** ➢ Soothe the throat and relieve the cough with a safe remedy. ➢ Advise mother when to return immediately. ➢ Follow-up in 2 days.
No signs of pneumonia or very severe disease.	**NO PNEUMONIA: COUGH OR COLD**	➢ If coughing more than 30 days, refer for assessment if possible ➢ Soothe the throat and relieve the cough with a safe remedy. ➢ Advise mother when to return immediately.

Acute Diarrhea

- **Bloody Diarrhea:**
  - **Shigella, Salmonella, Campylobacter, enteroinvasive E. coli, Schistosoma, Entamoeba histolytica**
  - **Pus in stool, fever, abdominal cramping, rectal pain**
  - **No vomiting**
  - **1st line: Ciprofloxacin, not cotrimoxazole, check local resistance**
- **Watery, Non-bloody Diarrhea:**
  - **Cholera:**
    - **Associated with rice water stools, cramping, vomiting**
    - **No fever, rectal pain, or pus in the stool**
    - **Antibiotics/severe diarrhea: fluoroquinolone,** check local resistance
  - **Other causes:**
    - **Rotavirus, Norovirus, Adenovirus, Calicivirus, Norwalk, Cryptosporidium, Isosporidium, Microsporidium, Giardia…….**
- **Is this the beginning of an outbreak?**

Diarrhea Case Management Chart



* 1st line: Ciprofloxacin; do not use cotrimoxazole

Preventing Diarrhea

- **Ex*clusive* breastfeeding for up to 6 months**
  - **Continue breastfeeding =2nd year**
  - **Nutritious/hygienically prepared complementary foods starting at 6 months of age**
- **Use cleanest available water, protect from contamination**
  - **Treat water when necessary**
- **Hand washing with soap**
- **Dispose of feces in a latrine or potty**
- **Ensure measles immunization at appropriate age**
- **Specific Vaccines:**
  - **Vibrio cholera; Typhoid; Rotavirus**

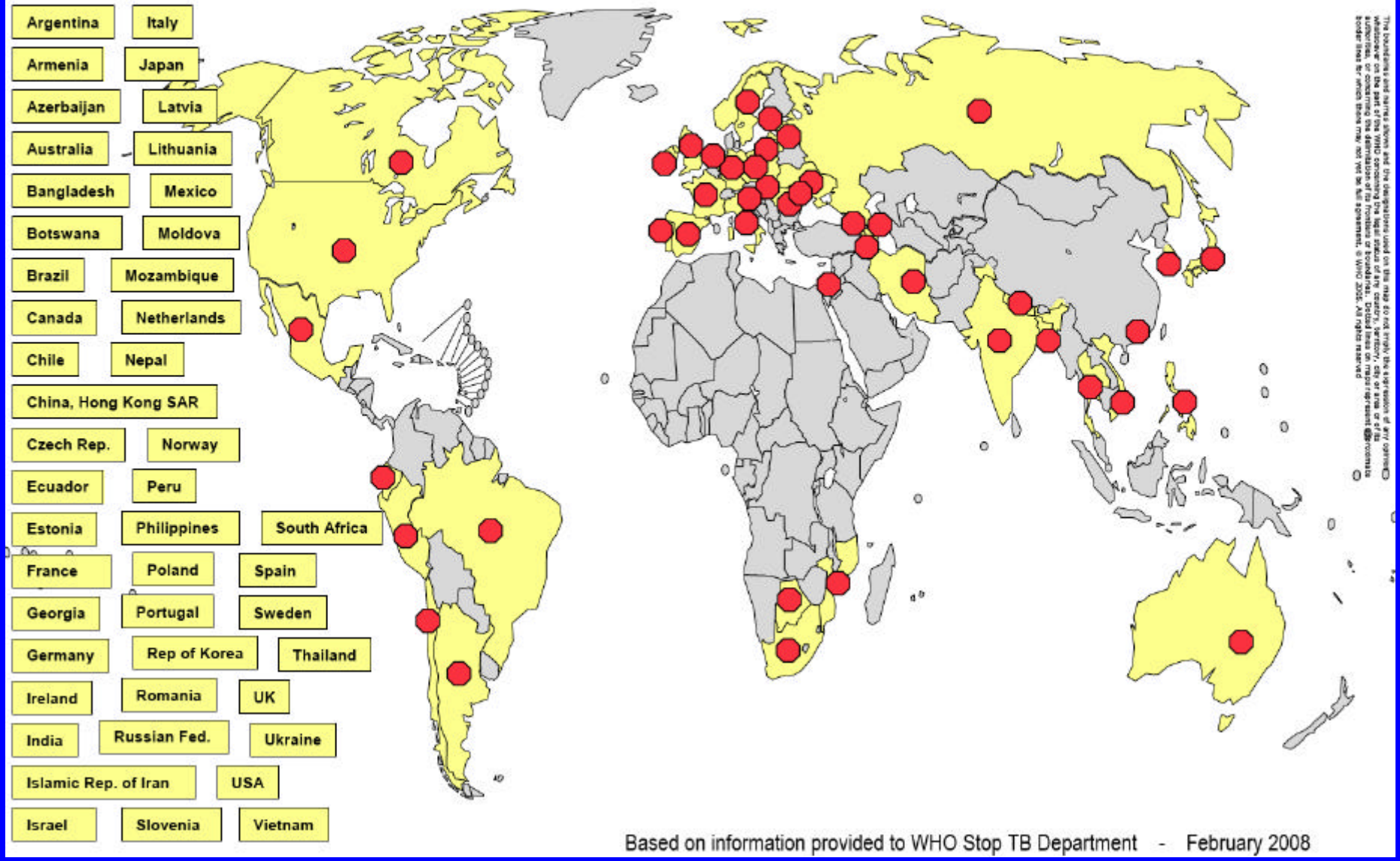
Tuberculosis: The Bad News

- **Estimated 9.2 million new cases in 2006**
  - **83% in Africa, S.E.Asia & Western Pacific regions:**
    - **India> China> Indonesia> South Africa> Nigeria**
  - **1.7 million deaths**
  - **700,000 co-infected with HIV (200,000 deaths)**
  - **Death/ disease burden in children?**
    - **Only smear-positive cases are reported to WHO**
- **XDR-TB: 500,000 cases in 2006**
  - Resistant to at least INH & Rifampicin (i.e. MDR-TB) ***and*** to any fluroquinolones, ***and*** to any of the 2nd line injectables (Amikacin, Kanamycin, Capreomycin).

Global Tuberculosis Control 2008: SURVEILLANCE, PLANNING, FINANCING. WHO 2008

Countries with XDR-TB confirmed cases as of February 2008

WHO THE STOP TB DEPARTMENT



2006 Recommendations W.H.O. Global Task Force on XDR-TB

1 – Strengthen quality of basic TB & HIV/AIDS control
2 - Scale up programatic management of MDR-TB & XDR-TB
3 - Strengthen laboratory services
4 - Expand MDR-TB & XDR-TB surveillance
5 - Develop and implement infection control measures
6 - Strengthen advocacy, communication, social mobilization
7 - Pursue resource mobilization at all levels
8 - Promote research and development of new tools

Actions & Progress Since Oct. 2006

- **2nd WHO Global XDR-TB Task Force meeting in April 2008**
  - XDR-TB country data included in the global TB drug resistance report (2/08)
- **Missions to identify and provide support and technical assistance:**
  - Lesotho, Malawi, Mozambique, Namibia, Swaziland, South Africa and Zambia.
  - International staff deployed in Lesotho and South Africa
  - Rapid surveys completed to assess XDR-TB extent in Botswana and Swaziland.
  - Generic protocols developed for countries.
  - National training courses planned for Botswana, Ivory Coast, Mexico and South Africa by end of 2007.
- **Lesotho National Reference Laboratory restructured**
  - Support from F.I.N.D.[1], Partners In Health and WHO.
- **Green Light Committee strengthened to review and approve ↑ applications for 2nd line anti-TB drugs.**
- **TB partners/ MDR- & XDR-TB management expansion activities**
  - TB C.A.P.[2] in infection control
  - Regional training courses in Africa, Americas, Middle East and South East Asia.

1. Foundation for Innovative New Diagnostics
2. Tuberculosis Control Assistance Program (USAID)

Actions & Progress Since Oct. 2006

- **The Global Plan to Stop TB revised to include:**
  - doubling of the numbers of MDR-TB treatments by 2015 & latest XDR-TB costings.
- **Revised guidelines/ management of resistant TB in preparation:**
  - includes guidance on human rights approach and community-based MDR-TB care.
- **Infection control guidelines/ health care facilities in revision**
  - national level infection control framework is also needed.
- **Develop new approach to recording/ reporting of resistant TB**
- **WHO TB lab reorganized and business plan for expansion drafted.**
- **WHO/PEPFAR consultation:**
  - recommended PEPFAR make immediately available US$50m for TB/HIV, including funds to expand infection control, and strengthen laboratories.
- **Health ministers endorsed XDR-TB emergency actions in 2007 World Health Assembly resolution**
  - European Ministers back XDR-TB actions in 2007 Berlin TB Declaration.

W.H.O. Response

MDR-TB AND XDR-TB RESPONSE PLAN 2007-2008

The lives of 134,000 MDR-TB and XDR-TB patients will be saved in 2007-2008 if the US$ 2.1billion response plan is fully funded and fully implemented.

Global Response Plan	2007	2008	Total
MDR-TB Cases on Treatment	60,000	100,000	160,000
XDR-TB Cases on Treatment	6,000	10,000	16,000
Lives Saved	49,000	85,000	134,000
US$ Total	$882m	$1,273m	$2,155m

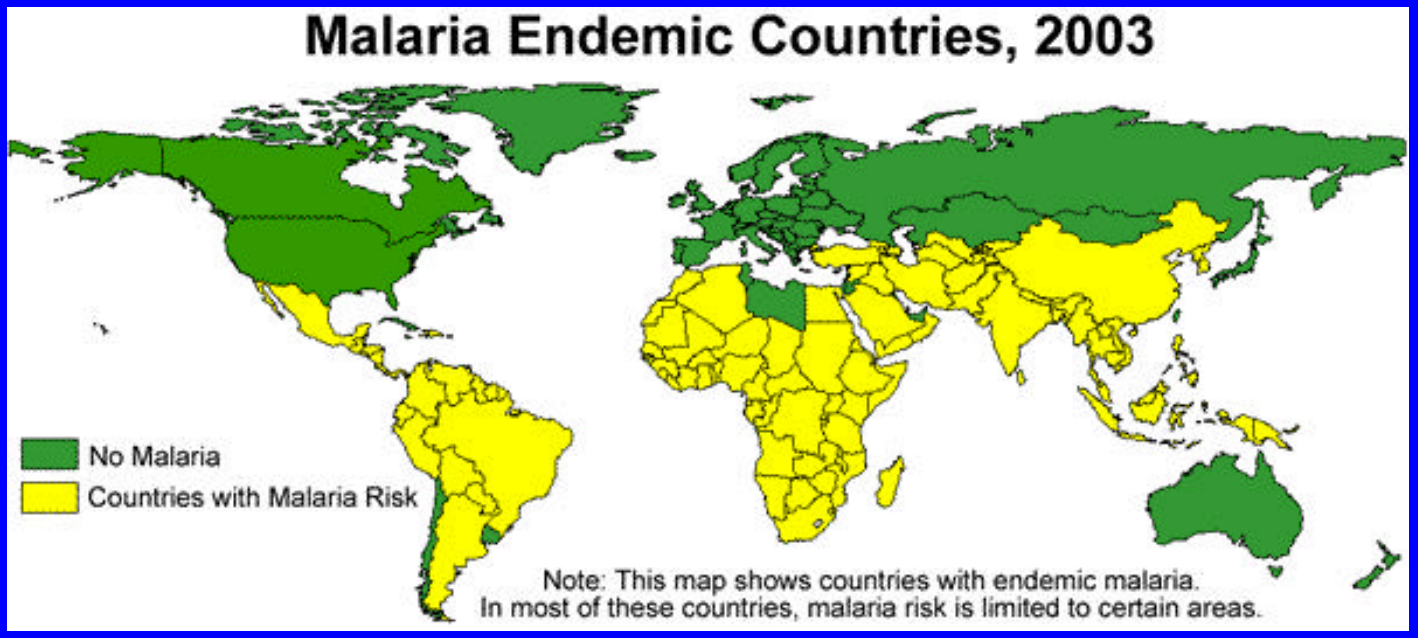
Tuberculosis: The Good News

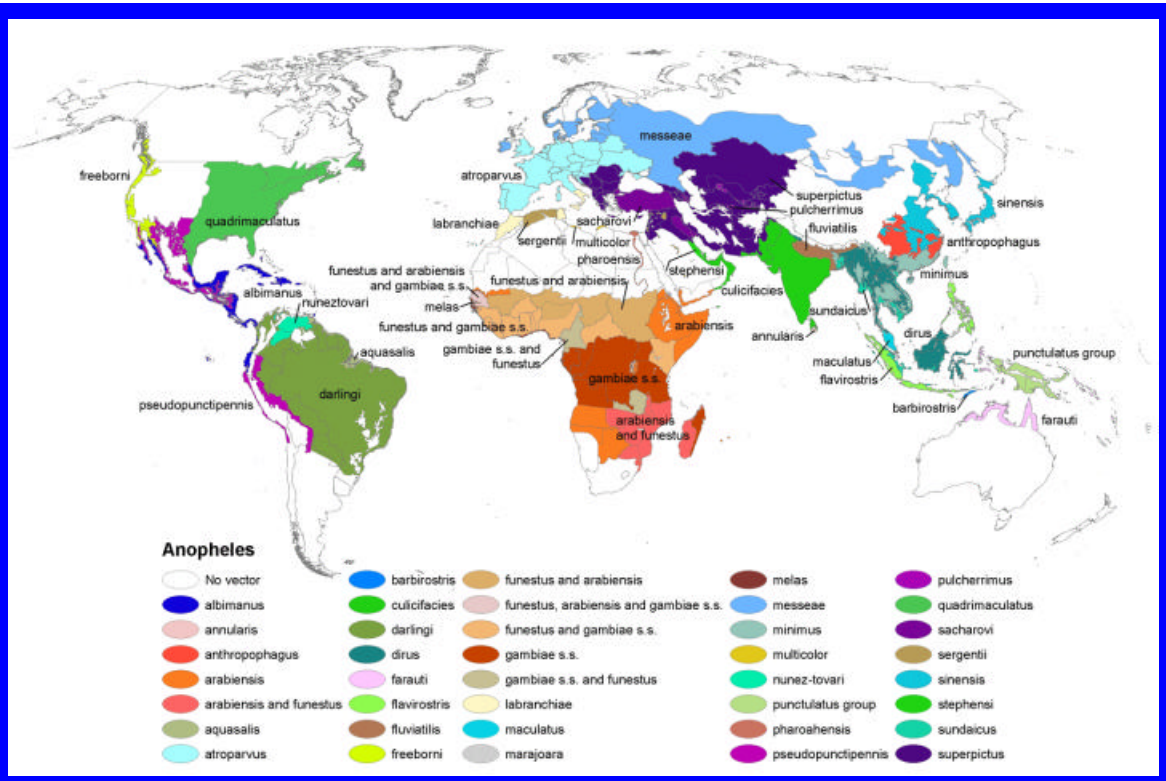
- =26 million treated with WHO DOTS strategy[1]
- 2005 targets for case detection (=70%) & cure (=85%) met in Western Pacific Region & 26 countries[1]
- TB/HIV or MDR-TB cases far fewer than anticipated[1]
- Global TB epidemic …. on the threshold of decline[2]
  - Incidence rate stable/falling in all WHO regions
  - Millennium Development Goal 6 to halt & begun to reverse incidence of TB, will be achieved before target date of 2015
  - 4 regions on track to halve prevalence & death rates by 2015 vs.1990 levels
    - Africa and Europe not on track to reach these targets:
      - » large increases in the incidence of TB during the 1990s.

1. World Health Statistics 2007; Ten Statistical Highlights in Global Public Health. WHO,2007

2. Global Tuberculosis Control 2008: SURVEILLANCE, PLANNING, FINANCING. WHO 2008

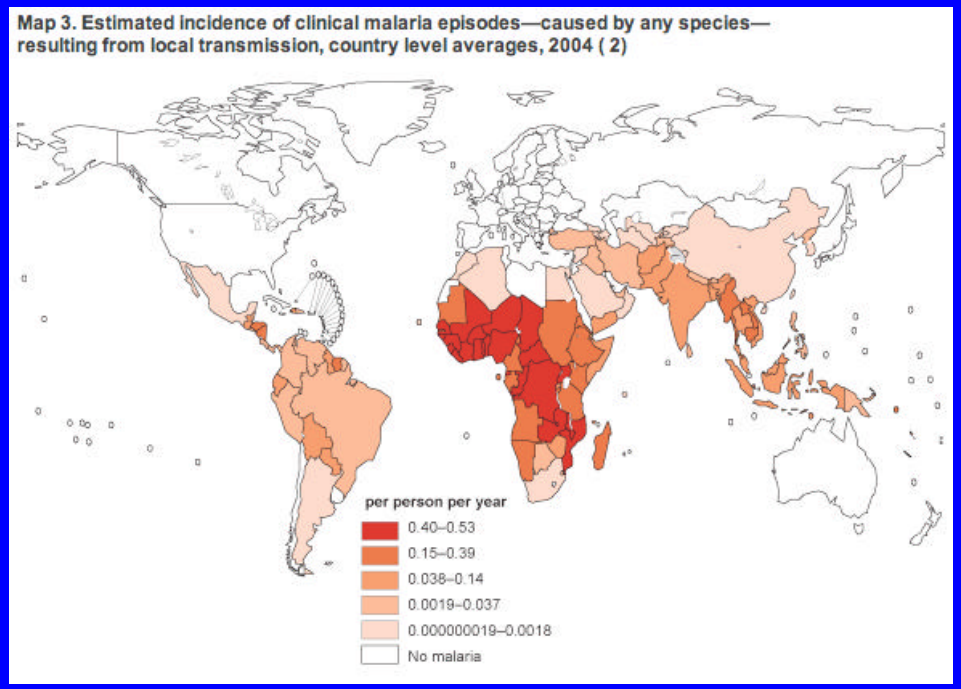
Malaria Endemic Countries, 2003



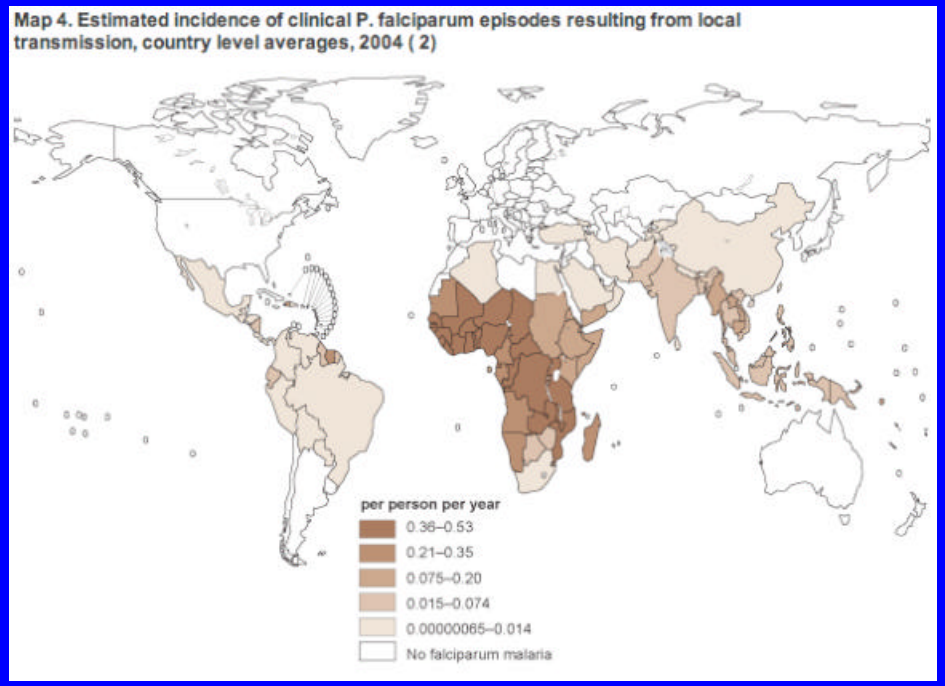


Regional Variation in Incidence of Malaria

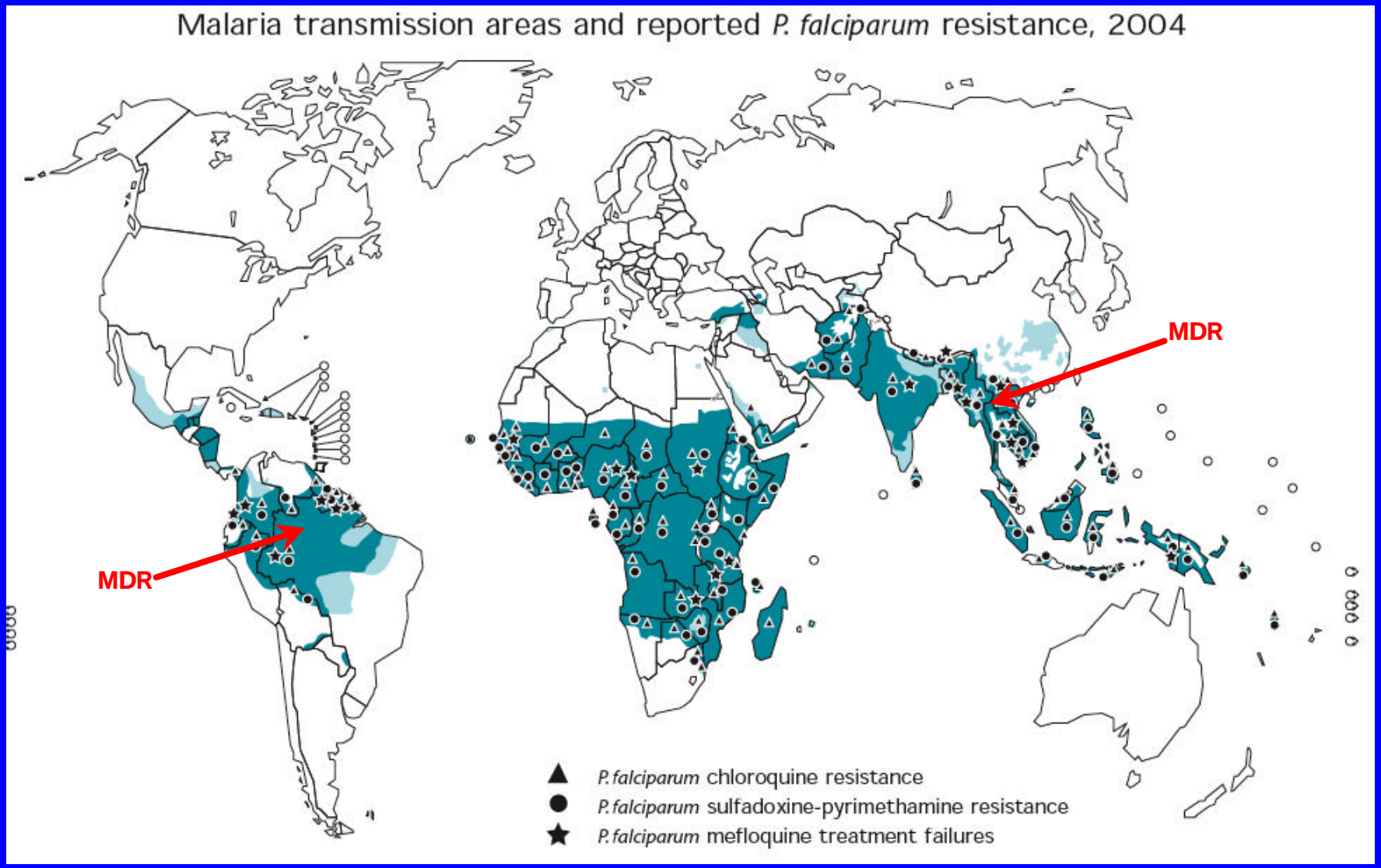
Incidence of Clinical Malaria Episodes



Incidence of P. falciparum Episodes



World Malaria Report, 2005. W.H.O. (http://rbm.who.int/wmr2005/index.html)



P. Vivax resistance:

- Sulfadoxine–pyrimethamine in many areas
- Chloroquine in Indonesia, East Timor, Papua New Guinea and other parts of Oceania and Peru.

P. Malariae:

- Chloroquine resistance in Indonesia

Malaria

- **40% of the world's population still at risk**
- **3 million acute illnesses**
- **1 million deaths/year**
  - **90% of deaths are in Sub-Saharan Africa:**
    - **Most efficient parasite (P.falciparum)**
    - **Most efficient vector (A.gambiae ss)**
    - **Africa's leading cause of under-five mortality (20%)**
    - **Responsible for 10% of Africa's overall disease burden**

Malaria

- In areas with high malaria transmission:
  - 40% of public health expenditures
  - 30-50% of inpatient admissions
  - Up to 50% of outpatient visits
  - Major cause of anaemia/ children & pregnant women, low birth weight, premature birth and infant mortality
- P. vivax & falciparum most common
  - Most deaths are due to falciparum
- Sub-Saharan Africa:
  - 60% of cases of worldwide
  - 75% of falciparum cases
  - =80% of malaria deaths
    - Falciparum → 18% of all deaths in children =5yrs.

Roll Back Malaria Program

- **Goal:**
  - Halve the burden/ endemic countries by 2010
- **Insecticide-treated Nets** for =60% of children = 5 yrs. & to Pregnant Women:
  - Pyrethroid insecticides
  - Africa/ 2001: only 3% of kids = 5yrs. (0.1-63%)
- **Indoor Residual Spraying**
- **Larviciding for vector control:**
  - Oiling of waste water collections
  - Temephos or Insect Development Inhibitors (IDI) for clean waters
  - Larvivorous fish for ornamental waters.

Roll Back Malaria Program

- **Prompt & Effective treatment:**
  - Artemisinin-based combination therapy
    - 10-20 times more expensive than chloroquine
  - Home management for children = 5 yrs
    - Train mothers & provide pre-packaged high-quality meds
- **Intermittent Preventative Therapy** for pregnant women in Sub-Saharan Africa:
  - Sulphadoxine-pyrimethamine x2 after the 1st trimester
    - Consider endemnicity, drug resistance, HIV, P. vivax

Measles

- **Burden of Disease:**
  - **Estimated 30-40 million cases annually?**
    - **Case fatality ratios: 1-5% to 10-30%**
    - **Highly contagious**
    - **In 2002:**
      - **Estimated 610,000 deaths (540,000 in children < 5 yrs)**
- **Complications:**
  - **Severe measles / malnourished, vitamin-A deficient, HIV-infected**
  - **Otitis media, Blindness, Encephalopathy, Diarrhea, Pneumonia & Death**

Measles

- **Measles Initiative, 2001**
  - **Collaborative effort:**
    - **WHO, American Red Cross, CDC, UN Foundation, UNICEF**
  - **Goal: cut deaths due to measles by 90% by 2010 (vs. 2000)**
  - **Global vaccination campaigns in Africa:**
    - **1st dose at 9 months of age or shortly thereafter**
    - **"2nd opportunity for measles vaccination"**
      - **Vaccinate those not yet vaccinated or vaccinated at 6 months**
      - **Vaccinate those in the target population (5-19 yrs) regardless of history of disease or prior vaccination**
      - **Repeat every 3-4 years?**

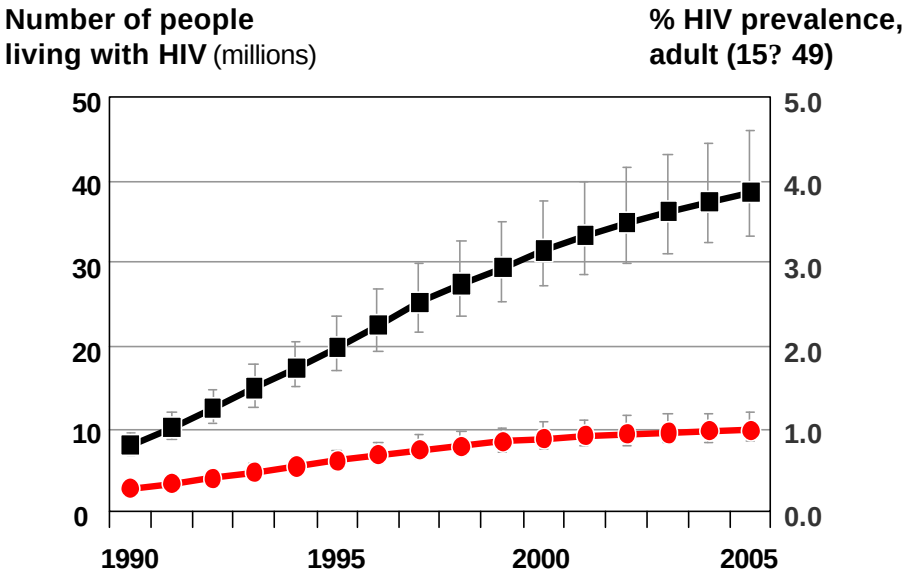
Measles

- **Measles Initiative, 2001**
  - **Progress:**
    - **=217 million African children vaccinated (2001-5)**
    - **75% decrease in deaths in Africa:**
      - **506,000 in 1999 ® 126,000 in 2005**
    - **Expansion to Asia & all 6 WHO regions**
    - **Vitamin A, deworming meds, insecticide-treated bed nets**

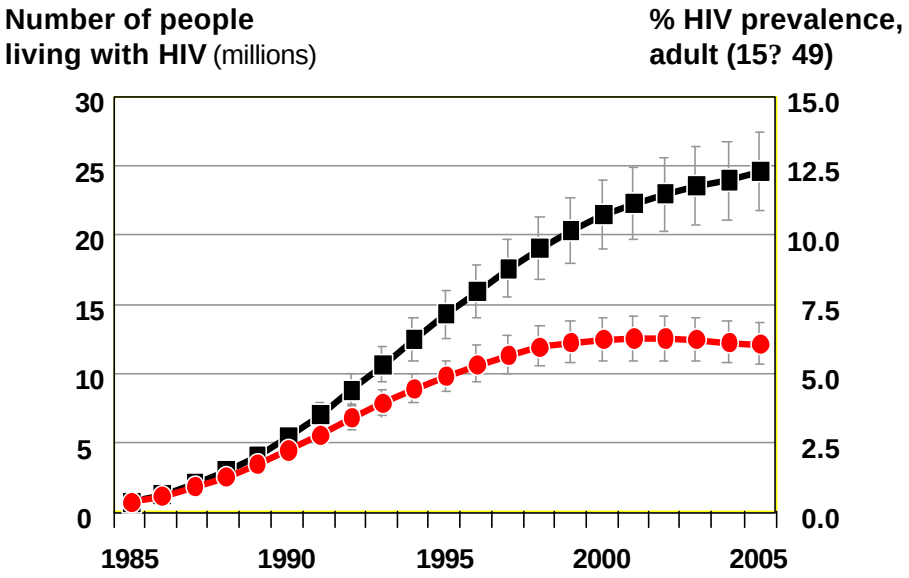
World Health Organization

Estimated number of people living with HIV and adult HIV prevalence

Global HIV epidemic, 1990? 2005*



HIV epidemic, sub-Saharan Africa, 1985? 2005*



Number of people living with HIV

% HIV prevalence, adult (15-49)

This bar indicates the range around the estimate

*Even though the HIV prevalence rates have stabilized in sub-Saharan Africa, the actual number of people infected continues to grow because of population growth. Applying the same prevalence rate to a growing population will result in increasing numbers of people living with HIV.

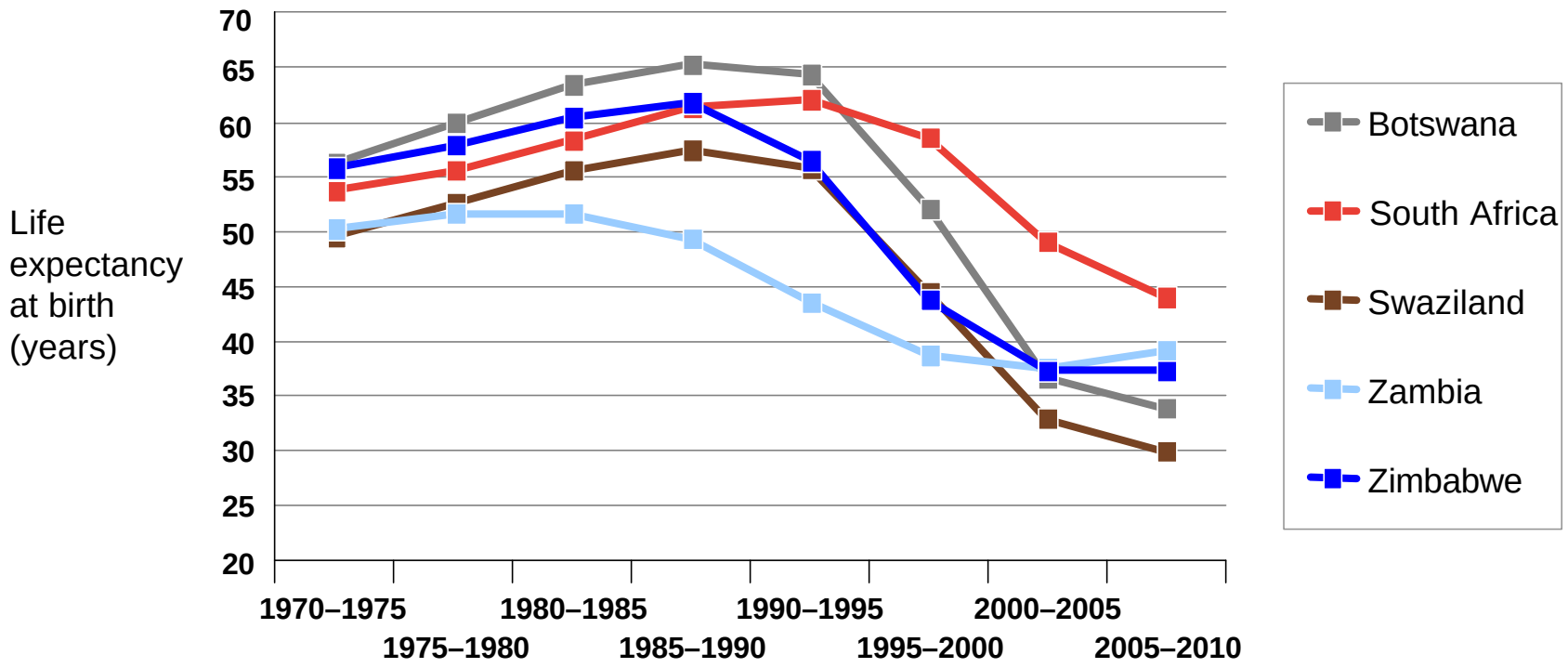
World Health Organization

Regional HIV and AIDS statistics and features, 2003 and 2005

REGION	Adults (15+) and children living with HIV		Adults (15+) and children newly infected with HIV		Adult (15-49) prevalence (%)		Adult (15+) and child deaths due to AIDS	
	2005	2003	2005	2003	2005	2003	2005	2003
Sub-Saharan Africa	24.5 million [21.6? 27.4 million]	23.5 million [20.8? 26.3 million]	2.7 million [2.3? 3.1 million]	2.6 million [2.3? 3.0 million]	6.1 [5.4? 6.8]	6.2 [5.5? 7.0]	2.0 million [1.7? 2.3 million]	1.9 million [1.7? 2.3 million]
North Africa and Middle East	440 000 [250 000? 720 000]	380 000 [220 000? 620 000]	64 000 [38 000? 210 000	54 000 [31 000? 150 000	0.2 [0.1? 0.4]	0.2 [0.1? 0.3]	37 000 [20 000? 62 000]	34 000 [18 000? 57 000]
Asia	8.3 million [5.7? 12.5 million]	7.6 million [5.2? 11.3 million]	930 000 [620 000? 2.4 million]	860 000 [560 000? 2.3 million]	0.4 [0.3? 0.6]	0.4 [0.2? 0.6]	600 000 [400 000? 850 000]	500 000 [340 000? 710 000]
Oceania	78 000 [48 000? 170 000]	66 000 [41 000? 140 000]	7200 [3500? 55 000]	9000 [4300-69 000]	0.3 [0.2? 0.8]	0.3 [0.2? 0.7]	3400 [1900? 5500]	2300 [1300? 3600]
Latin America	1.6 million [1.2? 2.4 million]	1.4 million [1.1? 2.0 million]	140 000 [100 000? 420 000]	130 000 [95 000? 310 000]	0.5 [0.4? 1.2]	0.5 [0.4? 0.7]	59 000 [47 000? 76 000]	51 000 [40 000? 67 000]
Caribbean	330 000 [240 000? 420 000]	310 000 [230 000? 400 000]	37 000 [26 000? 54 000]	34 000 [24 000? 47 000]	1.6 [1.1? 2.2]	1.5 [1.1? 2.0]	27 000 [19 000? 36 000]	28 000 [19 000? 38 000]
Eastern Europe and Central Asia	1.5 million [1.0? 2.3 million]	1.1 million [790 000? 1.7 million]	220 000 [150 000? 650 000]	160 000 [110 000? 440 000]	0.8 [0.6? 1.4]	0.6 [0.4? 1.0]	53 000 [36 000? 75 000]	28 000 [19 000? 39 000]
North America, Western and Central Europe	2.0 million [1.4? 2.9 million]	1.8 million [1.3? 2.7 million]	65 000 [52 000? 98 000]	65 000 [52 000? 98 000]	0.5 [0.4? 0.7]	0.5 [0.3? 0.6]	30 000 [24 000? 45 000]	30 000 [24 000? 45 000]
TOTAL	38.6 million [33.4? 46.0 million]	36.2 million [31.4? 42.9 million]	4.1 million [3.4? 6.2 million]	3.9 million [3.3? 5.8 million]	1.0 [0.9? 1.2]	1.0 [0.8? 1.2]	2.8 million [2.4? 3.3 million]	2.6 million [2.2? 3.1 million]

World Health Organization

Impact of AIDS on life expectancy in five African countries, 1970–2010

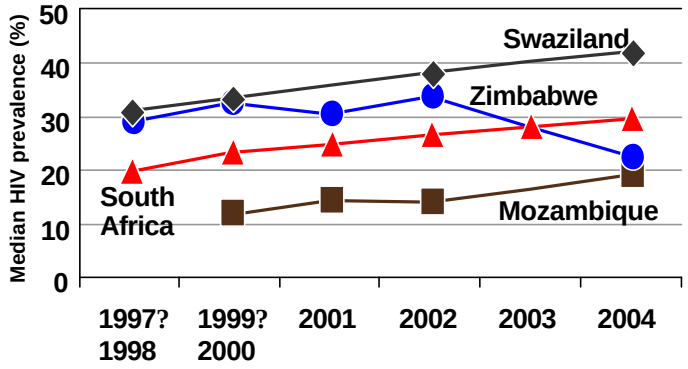


Source: United Nations Population Division (2004). World Population Prospects: The 2004 Revision, database.

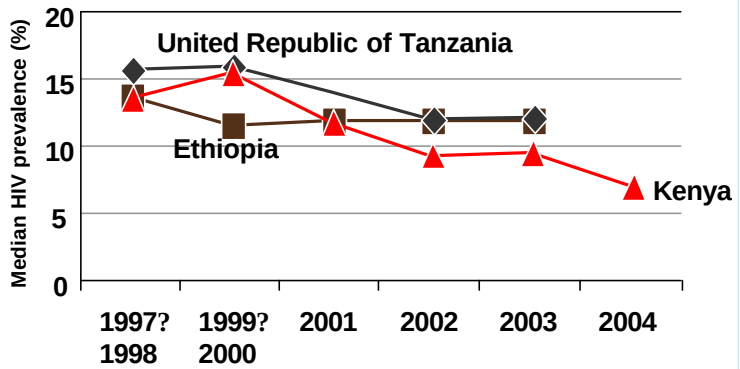
World Health Organization

HIV prevalence (%) among pregnant women attending antenatal clinics in sub-Saharan Africa, 1997/98? 2004

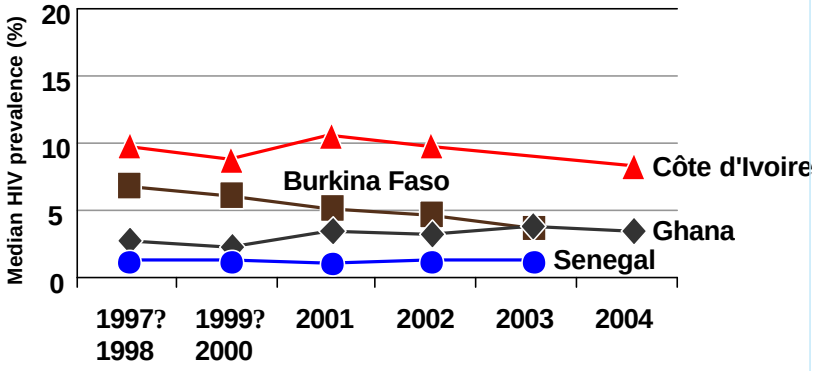
Southern Africa



Eastern Africa



West Africa

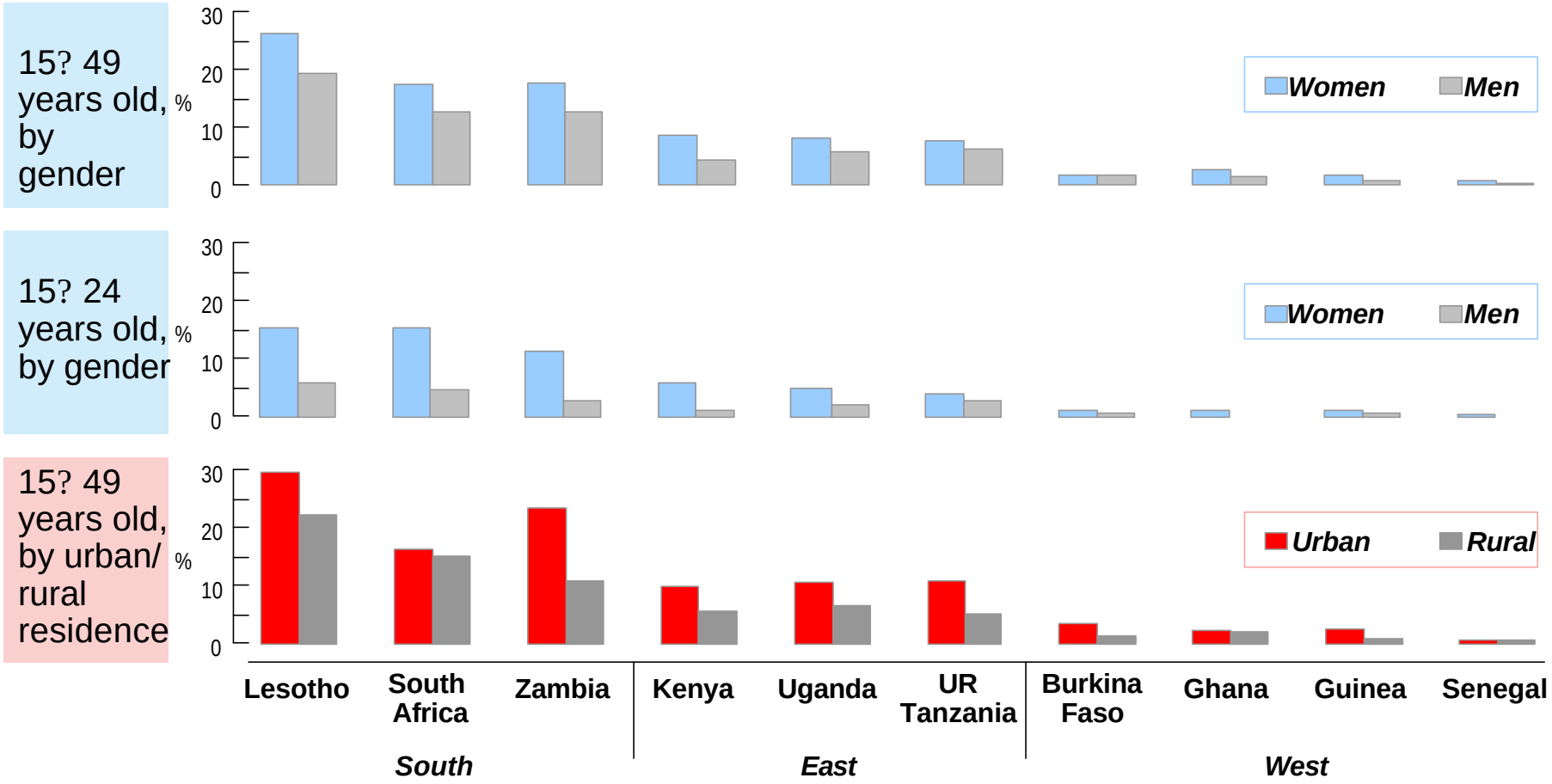


***Note*: Analysis restricted to consistent surveillance sites for all countries except South Africa (by province) and Swaziland (by region)**

Sources: Ministry of Health (Mozambique); Department of Health (South Africa); Ministry of Health and Social Welfare (Swaziland); Ministry of Health and Child Welfare (Zimbabwe); Adapted from Asamoah-Odei, et al. HIV prevalence and trends in sub-Saharan Africa: no decline and large subregional differences. Lancet, 2004 (Ethiopia); Ministry of Health—National AIDS/STD Control Programme (Kenya); Ministry of Health (United Republic of Tanzania); Conseil national de lutte contre le sida et les IST (Burkina Faso); Centers for Disease Control and Prevention (CDC)—GAP—Côte d'Ivoire (Côte d'Ivoire); Ghana Health Service (Ghana); Conseil National de Lutte Contre le SIDA (Senegal).

World Health Organization

HIV prevalence (%) by gender and urban/rural residence, selected sub-Saharan African countries, 2001? 2005

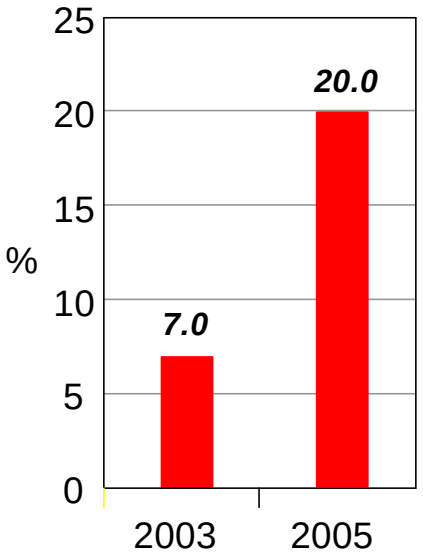


Sources: Demographic and Health Survey reports (Lesotho, Zambia, Kenya, Burkina Faso, Ghana, Guinea and Senegal) (2001–2005). Nelson Mandela Foundation (South Africa) (2005). Ministry of Health (Uganda). Tanzania Commission for AIDS (UR Tanzania) (2005).

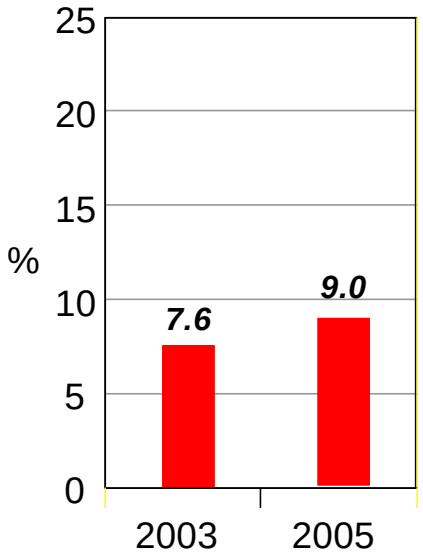
World Health Organization

Comparison of 2003 and 2005 data on the coverage of antiretroviral therapy, access to mother-to-child prevention services and coverage of HIV-infected mothers who received antiretroviral prophylaxis to prevent mother-to-child transmission in low and middle income countries

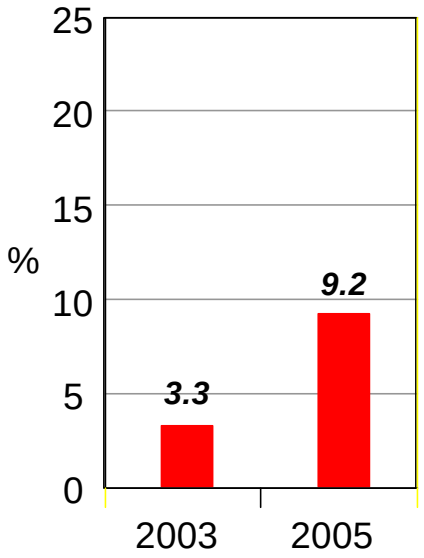
Coverage of antiretroviral therapy



Access to mother-to-child prevention services (all pregnant women)



Coverage of HIV-infected mothers who received antiretroviral prophylaxis

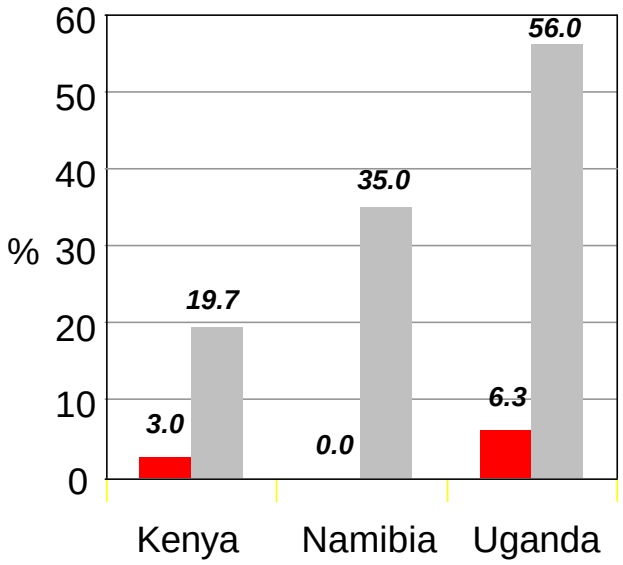


Sources: WHO/UNAIDS (2006). Progress on global access to HIV antiretroviral therapy: a report on "3 by 5" and beyond; USAID et al. (2006).

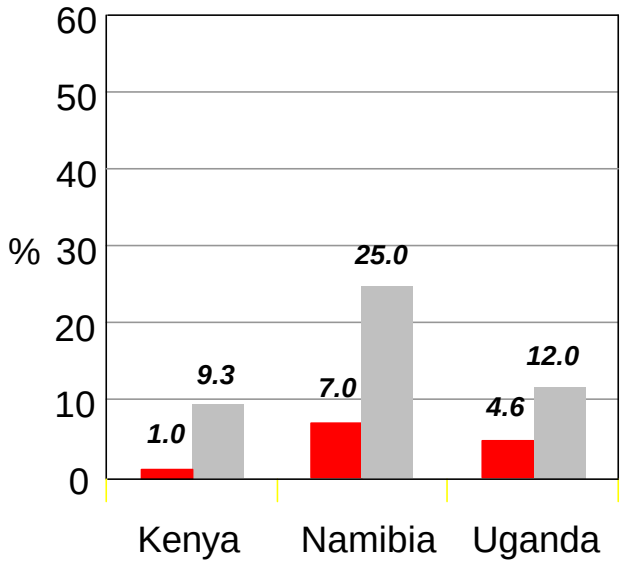
World Health Organization

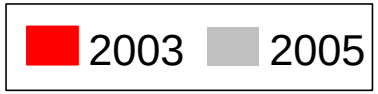
Comparison of 2003 and 2005 data on the expansion of antiretroviral therapy and coverage of HIV-infected mothers who received antiretroviral prophylaxis in three sub-Saharan African countries

Coverage of antiretroviral therapy



Coverage of HIV-infected mothers who received antiretroviral prophylaxis

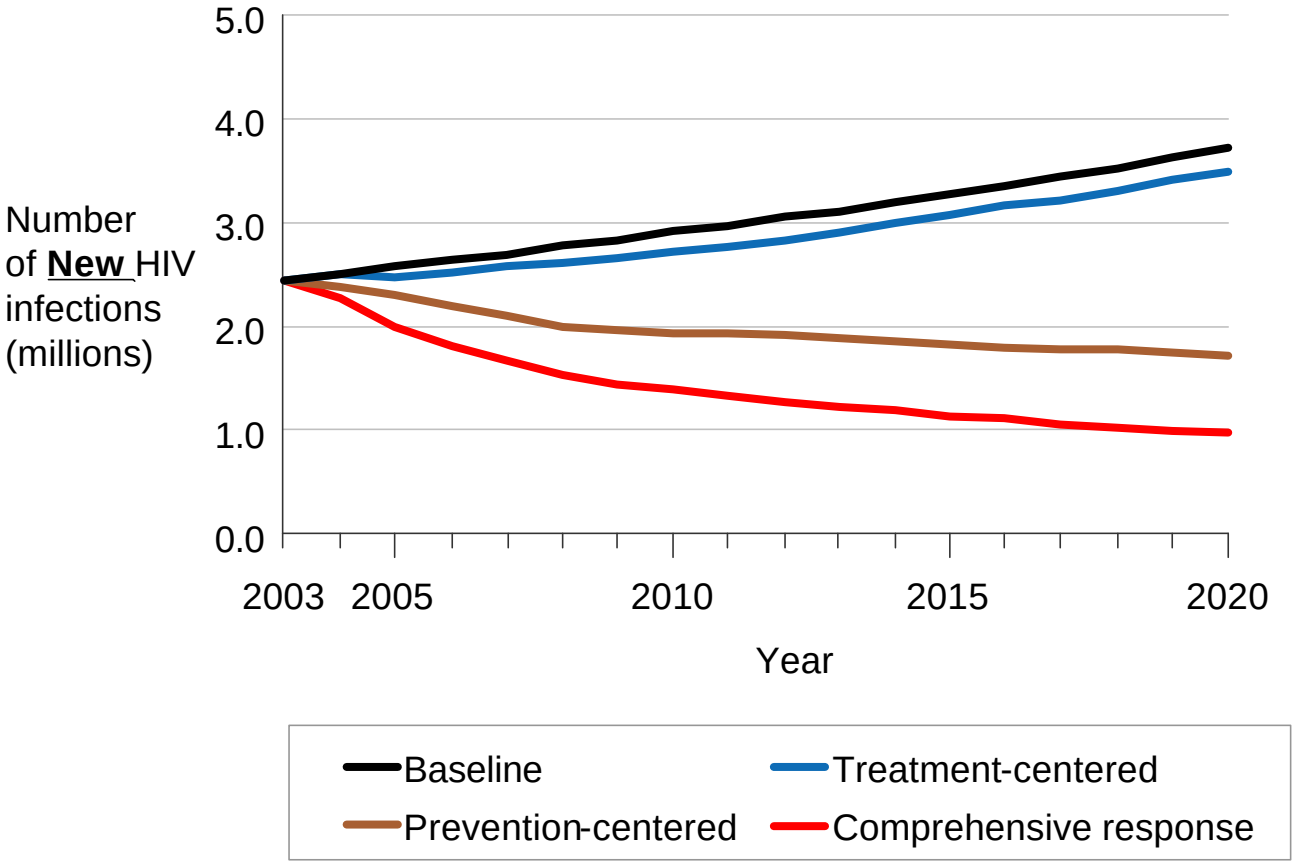




Sources: Individual country reports (2005).

World Health Organization

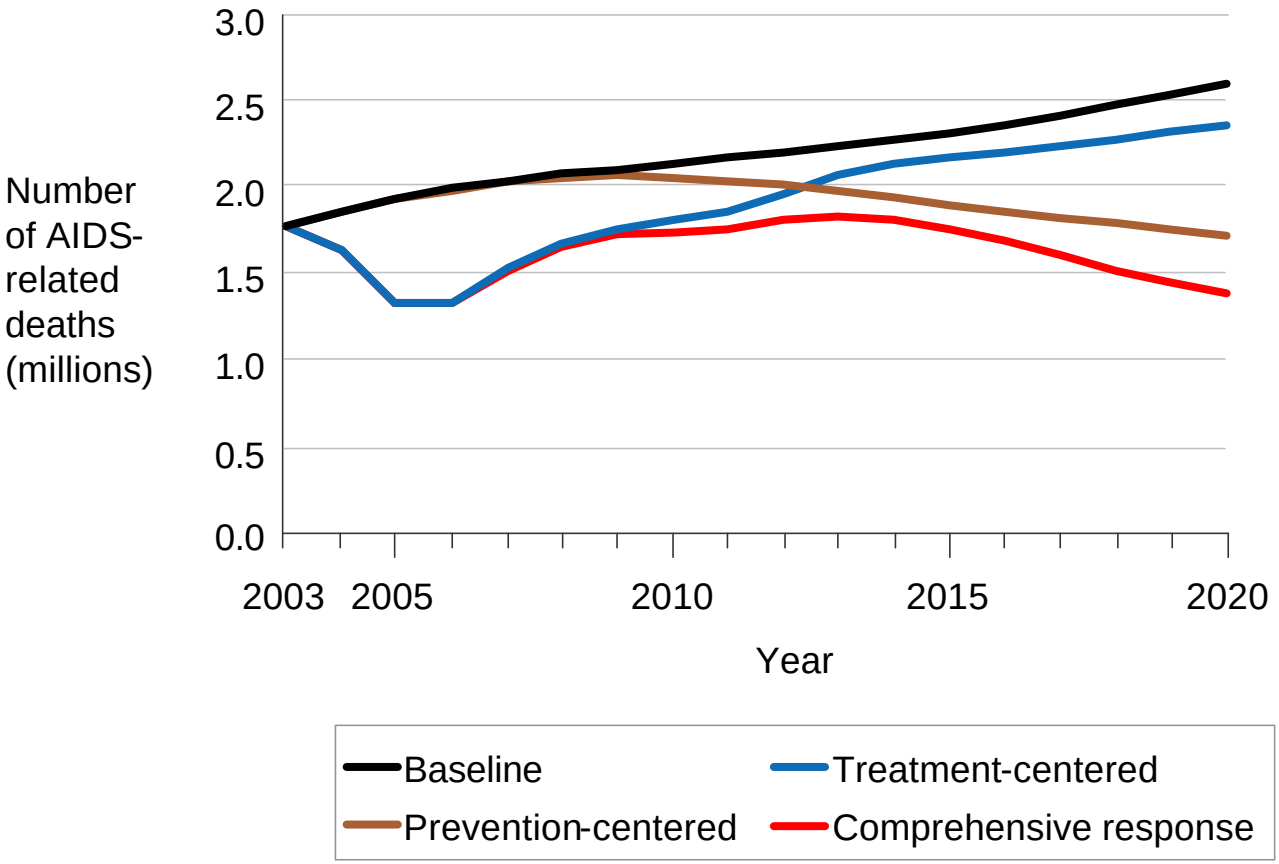
Impact of three scenarios on New HIV infections in sub-Saharan Africa, 2003–2020



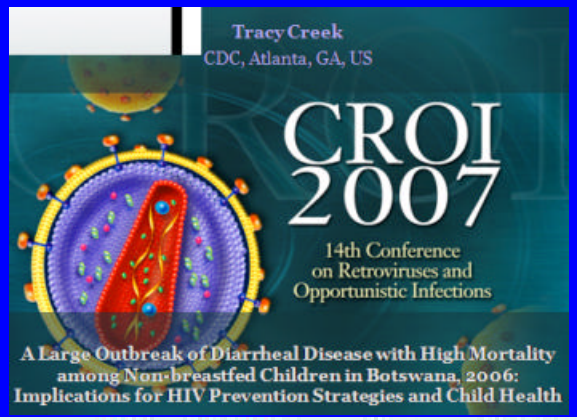
Source: Salomon JA et al. (2005). Integrating HIV prevention and treatment: from slogans to impact

World Health Organization

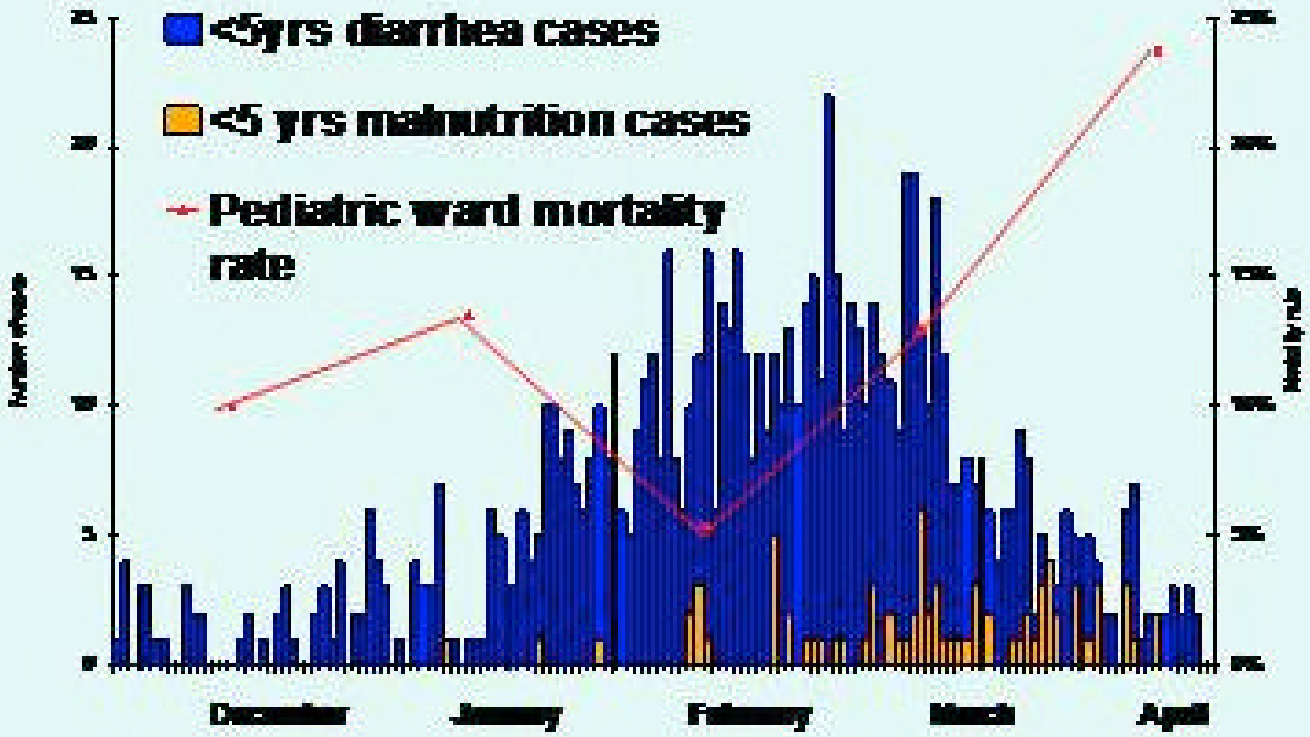
Impact of AIDS-related deaths in sub-Saharan Africa, 2003–2020



Source: Salomon JA et al. (2005). Integrating HIV prevention and treatment: from slogans to impact



Diarrhea, malnutrition, & pediatric mortality Francistown, Botswana, Nov 2005-April 2006



Findings: Stool testing

- Stool samples from inpatient children with diarrhea tested by CDC-Atlanta
  - *Cryptosporidium* – 60%
  - Enteropathogenic *E. coli* (EPEC) – 50%
  - *Salmonella* - 38%
  - *Shigella* - 17%
  - Norovirus - 21%
- Multiple pathogens suggest general contamination of water and environment

Findings: Case-control study

Risk factors for diarrhea

Risk factor	AOR* (95% CI)
Not breastfeeding	50.0 (4.5 – 100)
Storing drinking water	3.7 (1.5 – 9.1)
Overflowing latrines	3.0 (1.1 – 8.6)
Standing water near home	2.6 (1.1 – 6.3)
Caregivers not washing hands	2.5 (1.1 – 5.0)

**adjusted for SES, age, and mother's HIV status (feeding not adjusted for HIV because no HIV+ women BF)*

Findings: Diarrhea inpatients

Feeding of infants <12 months

Milk provided	Mother HIV positive (n=55)	Mother HIV negative (n=26)
Breastfeeding	0	35%
Formula	73%	15%
Cow milk (UHT)	25%	35%
Cow milk (raw)	11%	15%
No milk	2%	8%

Findings: Diarrhea inpatients

Mortality (n=153)

- High mortality: 22% (33/153) died
- Risk factors for death
  - Kwashiorkor RR 2.0, 95% CI 1.1-3.8
  - Only 1/16 (6%) breastfeeding children died (ns)
    - infant age 1 month; also receiving cow milk and formula
- Not associated with death
  - Maternal HIV status
  - Infant HIV status
  - Socioeconomic status
  - Water source
  - Urban vs. rural residence
  - Specific pathogen

•Mortality in formula-fed = 32/137 (23%)?

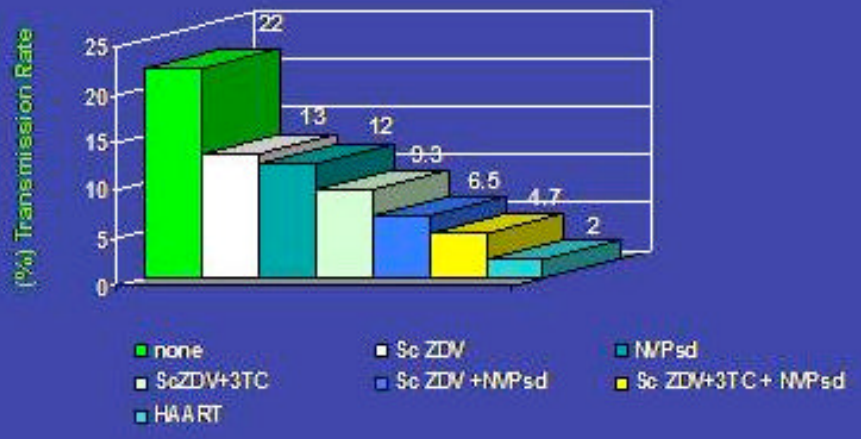
Hoosen Coovadia
Doris Duke Med Res Inst, Univ of KwaZulu Natal, South Africa

CROI 2007

14th Conference on Retroviruses and Opportunistic Infections

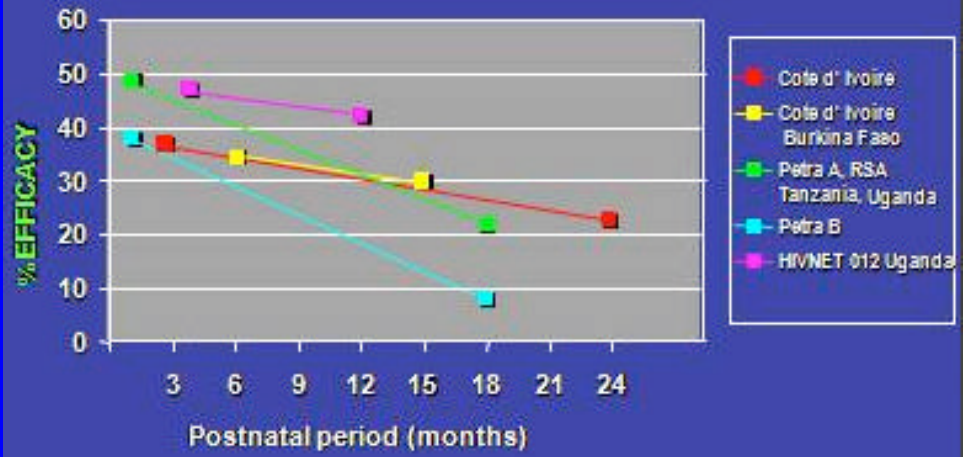
Prevention of HIV Transmission from Breastfeeding

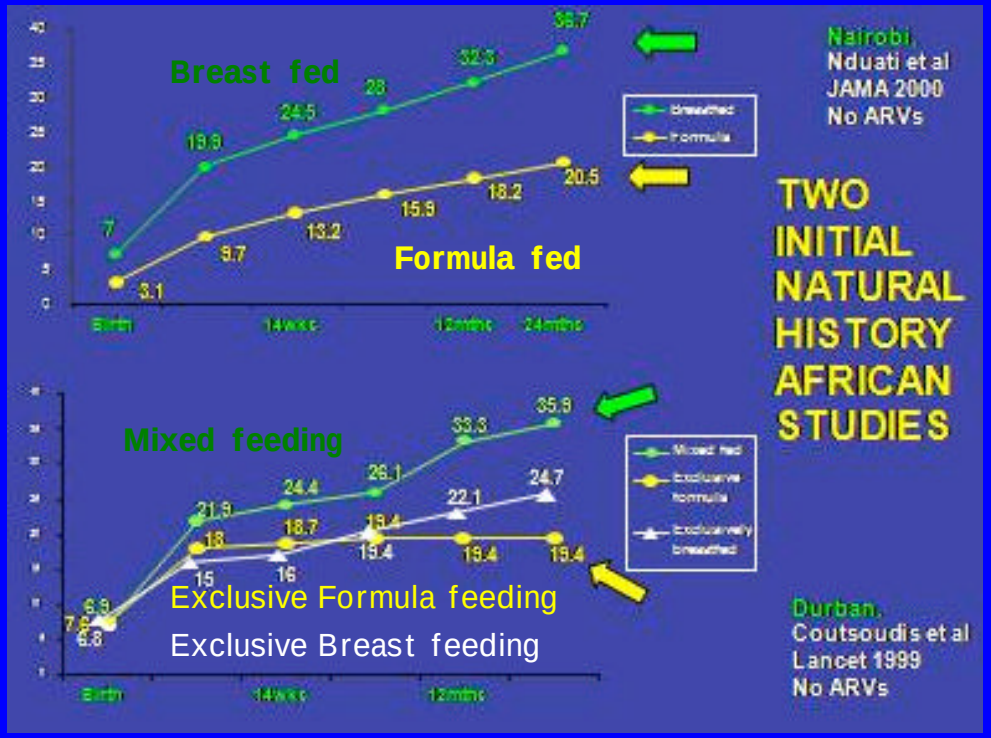
HOW EFFICACIOUS ARE SHORT-COURSE ARVs IN MOTHER-TO-CHILD-TRANSMISSION AT ABOUT 6 WEEKS IN BREASTFEEDING AFRICAN WOMEN. 1995-2005?



LeRoy V, WHO 2006

ATTRITION OF EFFICACY DUE TO BREASTFEEDING



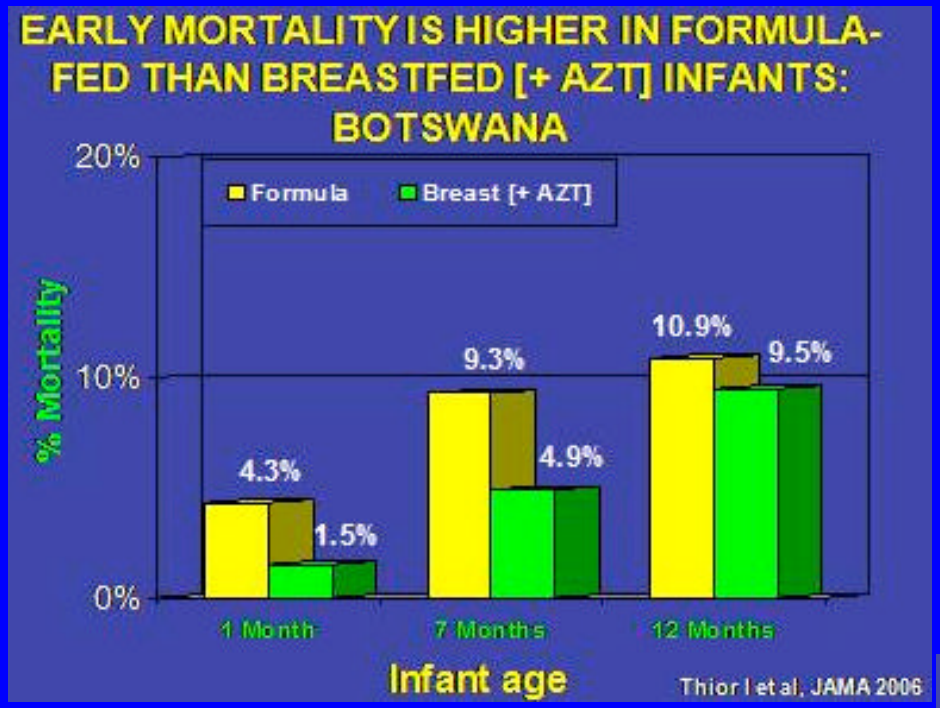


What is the risk of post-natal transmission due to breastfeeding?

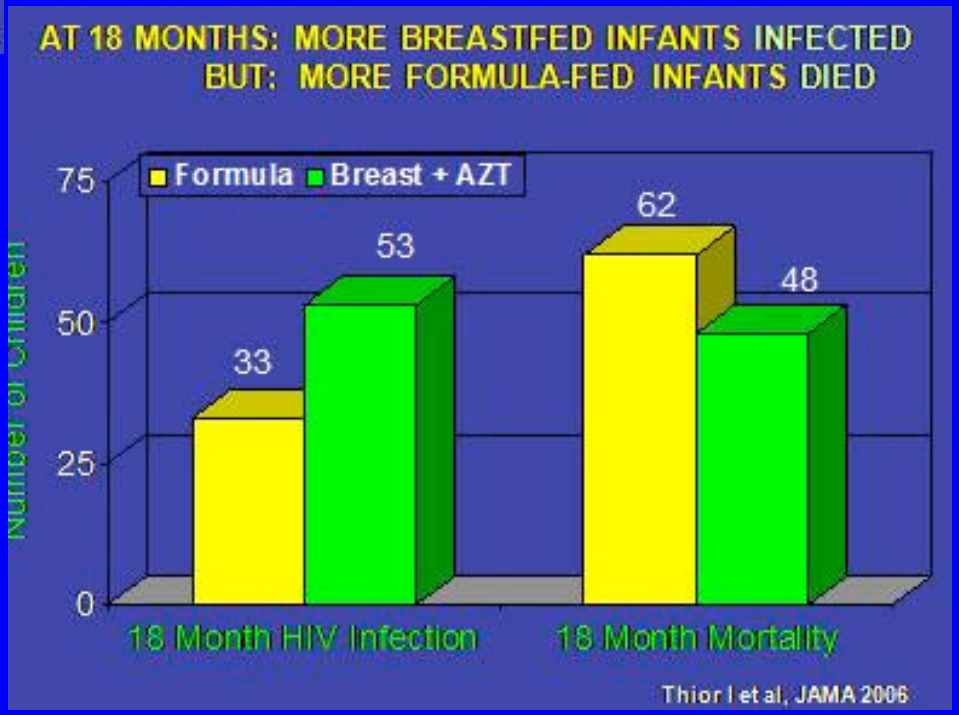
Breastfeeding and HIV International Transmission Study – BHITS

- Estimated rate of breastfeeding transmission was 0.74%/mth
- This risk was roughly constant over the 24 month period
- Carries a risk of about 8.96/100 child years of breastfeeding

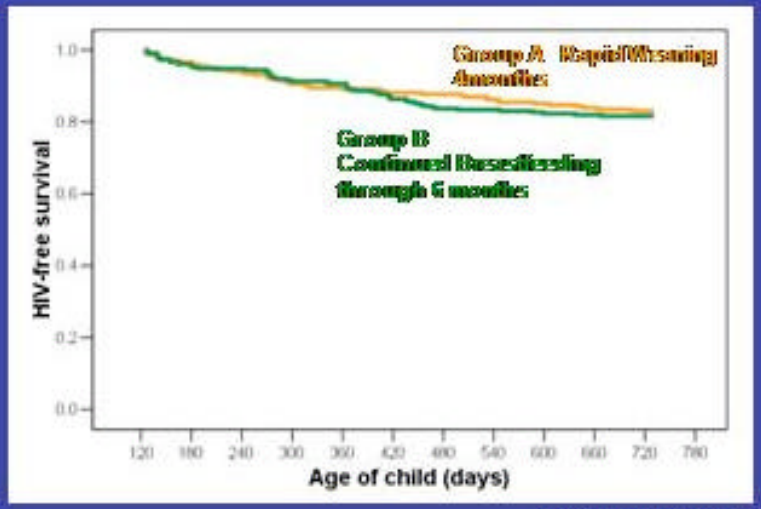
BHITS Study Group, JID 2004



18m:	HIV+	Dead
Breast:	9.5%	8.5%
Formula:	6.0%	10.7%



IS THERE OVERALL BENEFIT TO EARLY BREASTFEEDING CESSATION [GROUP A] VS CONTINUED BREASTFEEDING [GROUP B] ?



Kuhn L, CROI 2007, ZEBS

- **Why not use formula if there's no difference in survival?**
  - **Formula is expensive**
  - **Hard to supply**

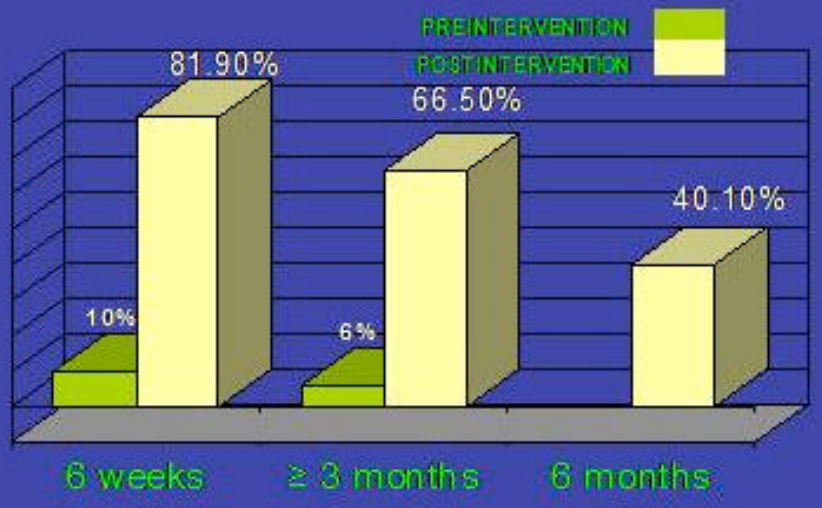
- **6 month Transmission in exclusively Breast fed infants**
  - **Maternal CD4 <200 vs. >200: 34% vs.17%**

RISK FACTORS FOR POSTNATAL TRANSMISSION

- Maternal Factors
  - Low CD4
- Infant Factors
- Breastmilk Factors
  - Non-Exclusive Breastfeeding
  - Duration
- Viral Factors

CAN WE CHANGE BREASTFEEDING BEHAVIOUR?

DURATION OF EXCLUSIVE BREASTFEEDING



Bland R et al, Acta Pediatr 2002 & Coovadia HM et al, VTS 200

3. WHEN TO RECOMMEND EXCLUSIVE BREASTFEEDING OR FORMULA FEEDING

Infant Mortality Rate>25/1000 live births:
Exclusive breastfeeding for 6 months [early cessation].

Infant Mortality Rate<25/1000 live births:
Replacement feeding from birth

Piwoz EG et al, J Nutrition 2005

WHO Recommendations

HIV and Infant Feeding Technical Consultation
Geneva, October 25-27, 2006
CONSENSUS STATEMENT

- The most appropriate infant feeding option for an HIV-infected mother should continue to depend on her individual circumstances, including her health status and the local situation, but should take greater consideration of the health services available and the counselling and support she is likely to receive.
- Exclusive breastfeeding is recommended for HIV-infected women for the first 6 months of life unless replacement feeding is acceptable, feasible, affordable, sustainable and safe for them and their infants before that time.
- When replacement feeding is acceptable, feasible, affordable, sustainable and safe, avoidance of all breastfeeding by HIV-infected women is recommended.

Vaccines in the Pipeline

- HIV ????
- TB ?
- Malaria ??
- Cholera
- Other Diarrheal agents

Unknowns

- Avian Influenza
  - Sporadic → Endemic → Epidemic → Pandemic?
  - W.H.O. 5-year Strategic Plan:
    - Strengthen the early warning system.
    - Intensify rapid containment operations.
    - Build capacity to cope with a pandemic
      - stockpiles of oseltamivir
    - Coordinate global scientific research & development
      - Rapid development/distribution of a pandemic strain vaccine
- SARS

Cumulative Number of Confirmed Human Cases of Avian Influenza A/(H5N1) Reported to WHO

18 March 2008

Country	2003		2004		2005		2006		2007		2008		Total	
	cases	deaths	cases	deaths	cases	deaths	cases	deaths	cases	deaths	cases	deaths	cases	deaths
Azerbaijan	0	0	0	0	0	0	8	5	0	0	0	0	8	5
Cambodia	0	0	0	0	4	4	2	2	1	1	0	0	7	7
China	1	1	0	0	8	5	13	8	5	3	3	3	30	20
Djibouti	0	0	0	0	0	0	1	0	0	0	0	0	1	0
Egypt	0	0	0	0	0	0	18	10	25	9	4	1	47	20
Indonesia	0	0	0	0	20	13	55	45	42	37	12	10	129	105
Iraq	0	0	0	0	0	0	3	2	0	0	0	0	3	2
Lao People's Democratic Republic	0	0	0	0	0	0	0	0	2	2	0	0	2	2
Myanmar	0	0	0	0	0	0	0	0	1	0	0	0	1	0
Nigeria	0	0	0	0	0	0	0	0	1	1	0	0	1	1
Pakistan	0	0	0	0	0	0	0	0	1	1	0	0	1	1
Thailand	0	0	17	12	5	2	3	3	0	0	0	0	25	17
Turkey	0	0	0	0	0	0	12	4	0	0	0	0	12	4
Viet Nam	3	3	29	20	61	19	0	0	8	5	5	5	106	52
Total	4	4	46	32	98	43	115	79	86	59	24	19	373	236
		100%		70%		44%		69%		69%		79%		63%

Total number of cases includes number of deaths.
WHO reports only laboratory-confirmed cases.
All dates refer to onset of illness.

Summary

- Better data to make predictions & direct allocation of resources
- Integrated approach to health care:
  - Emphasis on preventative interventions?
    - Clean water
    - Good nutrition
    - Immunizations:
      - Enteric & Resp. pathogens, Malaria TB, HIV ???
    - Education re risky behavior: sexual, dietary, smoking……
    - Education/Economic Development:
      - Jobs ® better living standards, health care, pay taxes …….
    - Better housing & sanitation
  - Access to adequate treatment for acute illnesses:
    - DOTS for TB; for HIV?

Global and Regional immunization profile

Global

Population data in thousands [1]

	2005	2004	2003	2002	2001	2000	1990
Total population	6'445'633	6'370'429	6'295'235	6'219'879	6'144'133	6'067'816	5'264'584
Live births	133'294	132'800	132'390	132'076	131'875	131'806	135'847
Surviving infants	125'993	125'403	124'893	124'476	124'167	123'983	126'619
Pop. less than 5 years	615'567	613'757	612'543	611'917	611'841	612'267	624'369
Pop. less than 15 years	1'816'346	1'817'504	1'819'715	1'822'126	1'823'611	1'823'303	1'708'411
Female 15-49 years	1'664'988	1'644'088	1'622'582	1'600'518	1'577'934	1'554'874	1'311'452

Number of reported cases

Diphtheria	8'229	9'864	6'781	9'235	10'356	9'594	23'864
Measles	580'287	504'689	677'297	585'957	832'954	836'338	1'374'083
Mumps	619'062	654'216	534'063	477'079	412'341	544'093	-
Pertussis	121'608	236'844	106'584	136'372	168'533	186'151	476'377
Polio	2'296	1'258	784	1'922	498	2'971	23'366
Rubella	267'366	308'219	321'180	631'571	836'349	671'286	-
Rubella (CRS)	37	88	99	75	50	181	-
Tetanus (neonatal)	9'780	9'294	8'999	11'762	14'510	15'335	25'293
Tetanus (total)	15'516	13'347	14'369	18'781	22'894	18'939	64'378
Yellow fever	588	1'344	672	705	620	684	4'336

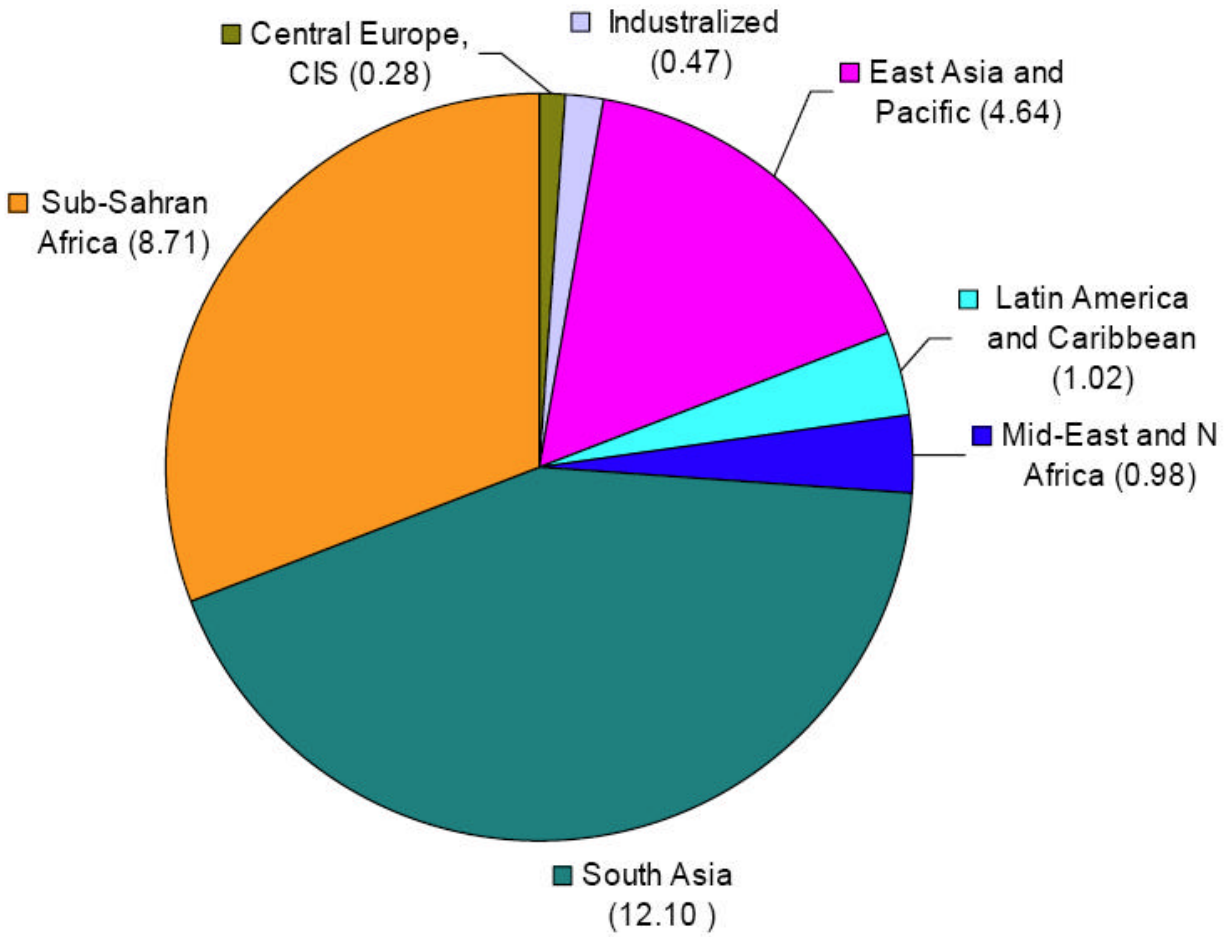
Percentage of target population vaccinated, by antigen

based on WHO-UNICEF estimates [2]
TT2plus and YFV are based on reported coverage

BCG	83	83	82	81	80	80	81
DTP1	88	87	87	86	85	85	88
DTP3	78	77	75	74	74	73	75
HepB3	55	51	46	40	35	33	1
Hib3	21	20	19	17	14	13	-
MCV	77	76	75	74	74	73	73
Pol3	78	77	76	75	74	74	75
TT2plus	57	51	52	54	52	53	43
YFV	43	36	32	30	21	26	4

WHO vaccine-preventable disease monitoring system, 2006 global summary

28 million infants not immunized (DTP3), 2005



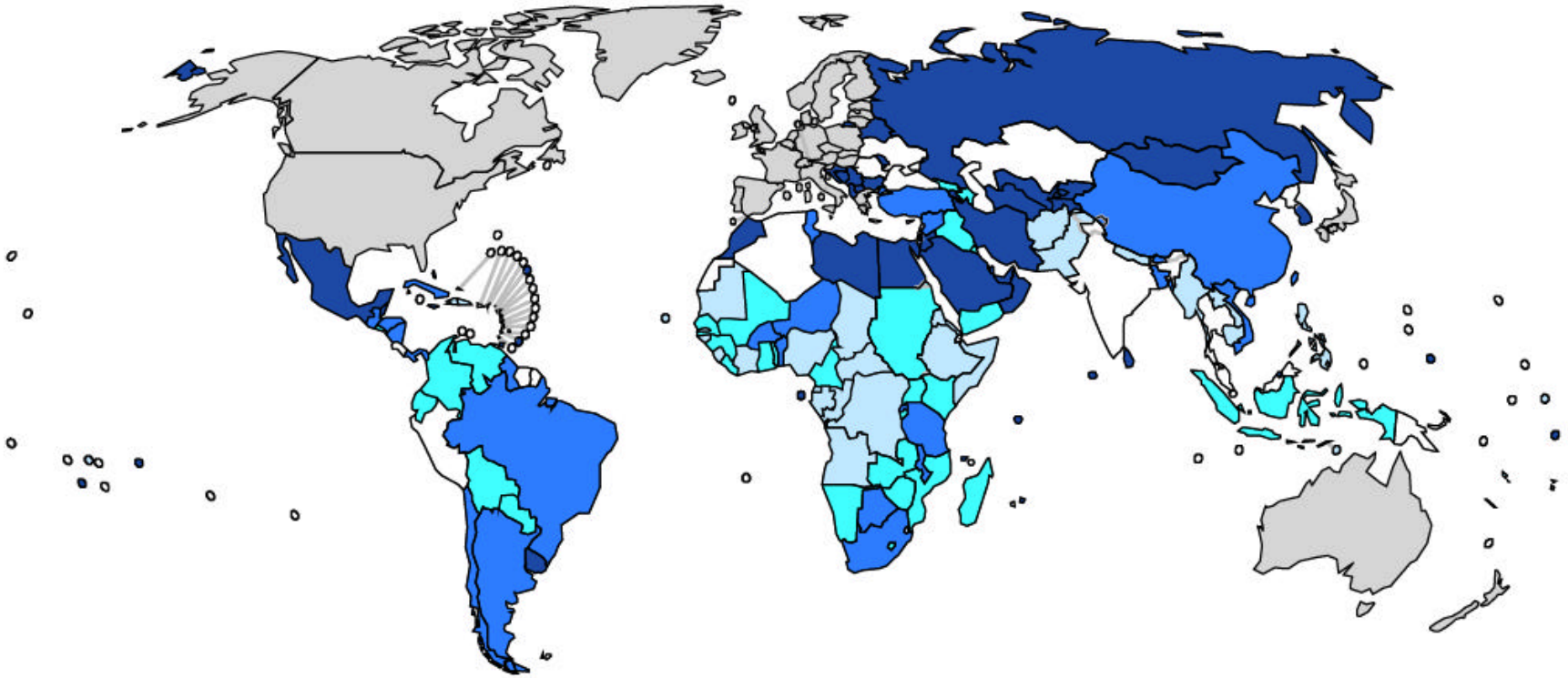
Source: WHO/UNICEF estimates, 1980-2005, as of August 2006

192 WHO Member States.

WHO

Slide Date: October 06

"Developing"* countries with % of districts achieving at least 80% DTP3 coverage, 2005



100 % districts *(43 countries or 28%)*
80-99 % districts *(27 countries or 17%)*
50-79 % districts *(29 countries or 19%)*
0-49 % districts *(31 countries or 20%)*

No data *(26 countries or 16%);*
DTP3 ***estimated*** *coverage for 2005*
14 countries ≥ 90%; 12 countries< 90%

Not applicable *(36 countries)*

* 156 developing countries and economies in transition per *UN World Economic & Social Survey, 2006* classification

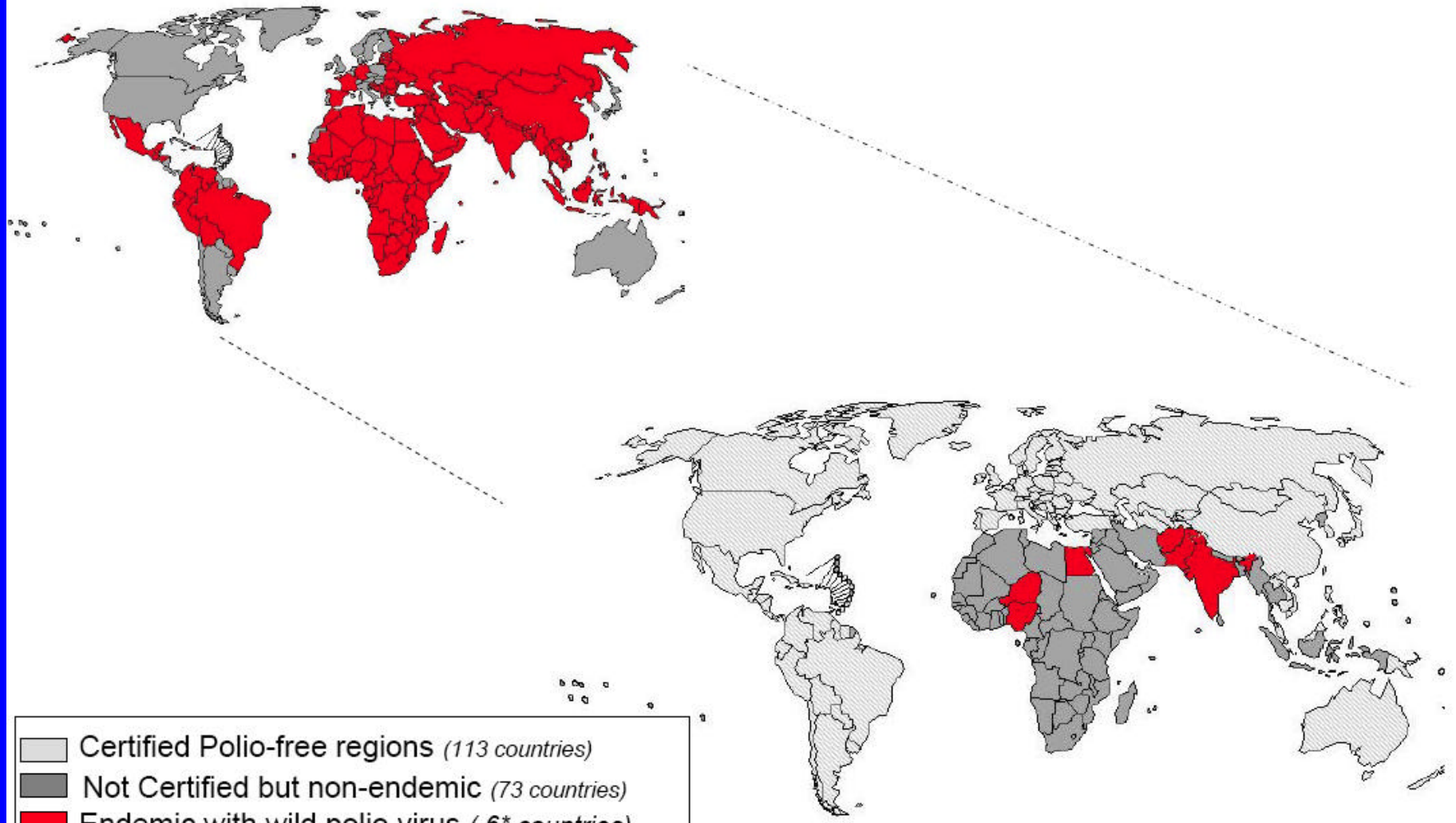
Source: WHO/UNICEF estimates and WHO/IVB database, 2006

192 WHO Member States.

WHO

Slide Date: October 06

Polio Eradication Progress, 1988 - 2005



Certified Polio-free regions *(113 countries)*
Not Certified but non-endemic *(73 countries)*
Endemic with wild polio virus *(6* countries)*

* In 2005, no wild viruses occurred in Egypt, but it's status remained endemic.

Source: WHO AFP surveillance database

Resources

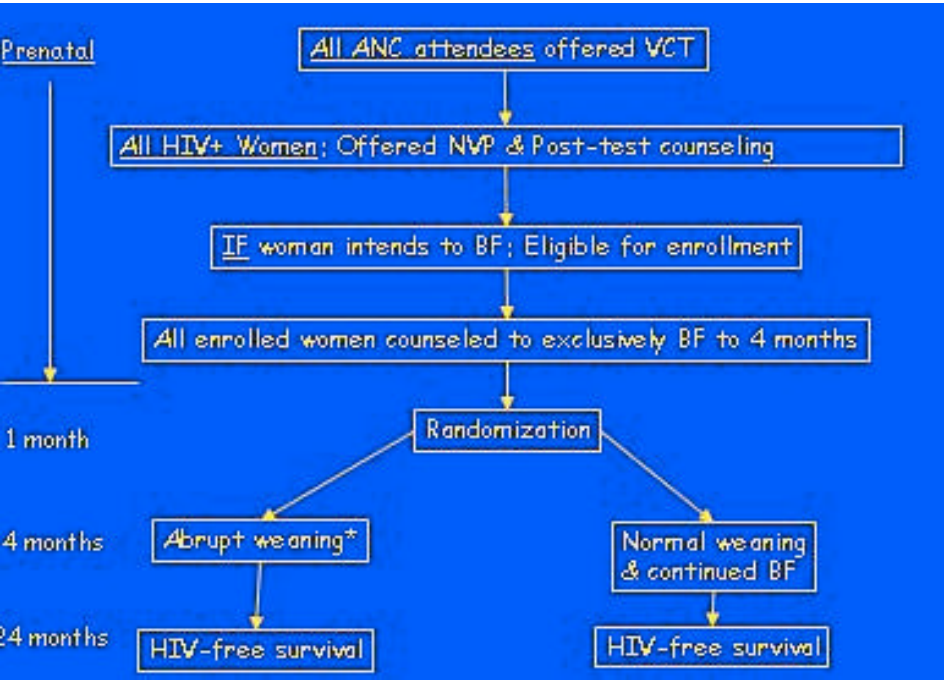
- http://www.who.int/child-adolescent-health/publications/pubemergencies.htm:
  - Acute Respiratory Infections in children
  - ARI - Case management charts
  - Diarrhoea Treatment Guidelines
  - Diarrhoea - Case management charts
  - Guidelines for the control of shigellosis
  - Integrated Management of Childhood Illness (IMCI)

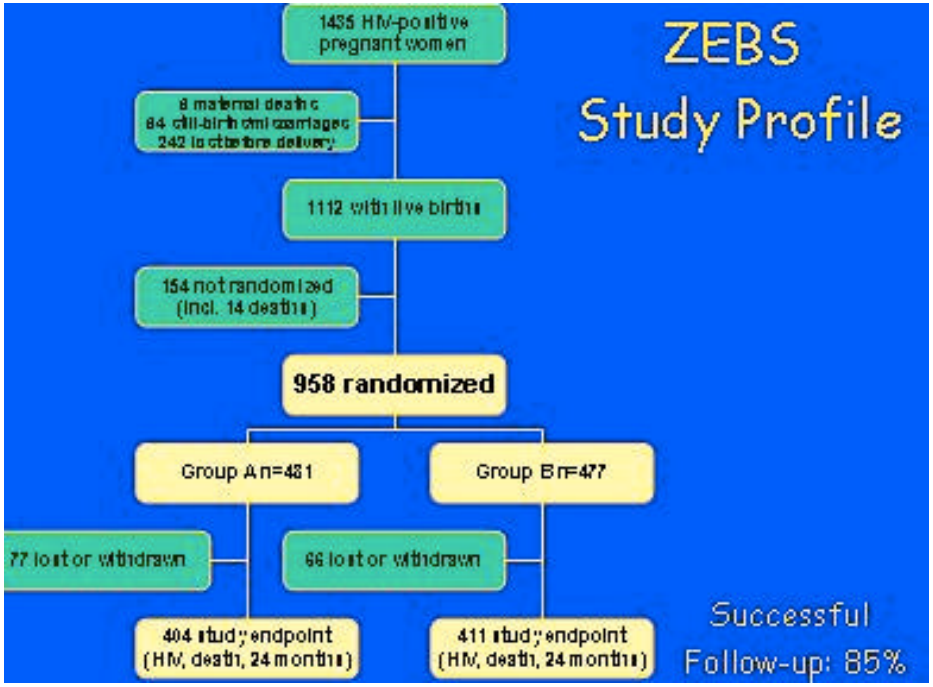
No Benefit of Early Cessation of Breastfeeding at 4 Months on HIV-free Survival of Infants Born to HIV-infected Mothers

Zambia Exclusive Breastfeeding Study

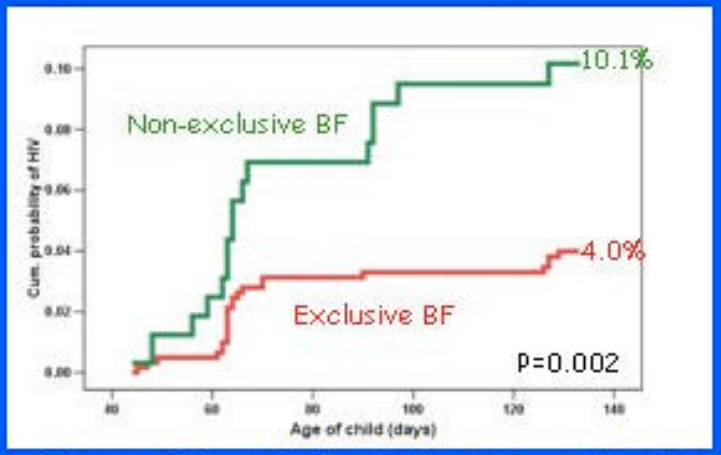
Moses Sinkala, Louise Kuhn, Chipepo Kankasa, Prisca Kasonde, Cheswa Vwalika, Mwiya Mwiya, Nancy Scott, Katherine Semrau, Grace Aldrovandi, Donald M. Thea

Ministry of Health, Zambia
Columbia University, New York
Boston University
Children's Hospital of Los Angeles
UTH, University of Zambia





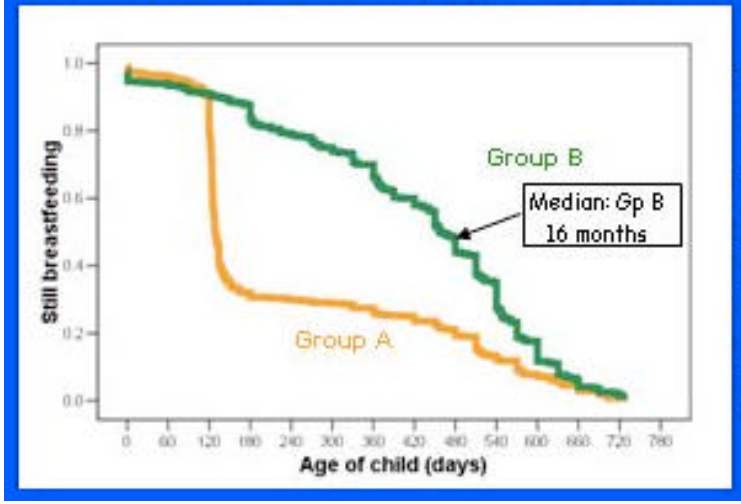
1 Benefits of exclusive breastfeeding on early postnatal transmission through 4 months



Increased transmission due to non-exclusive BF: (as time-dependent) Relative Hazard 3.4 (95% CI: 1.7-7.2)

2 Was Weaning in Group A Successfully Achieved?

Duration of breastfeeding by random group assignment

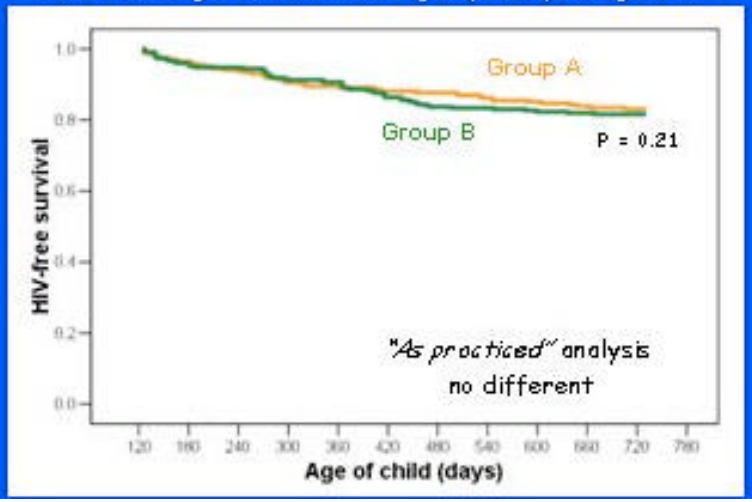


How abrupt?

Stopped within:	Percent
0-2 Days	70
2-7 Days	25
7-14 days	4
15+ days	1

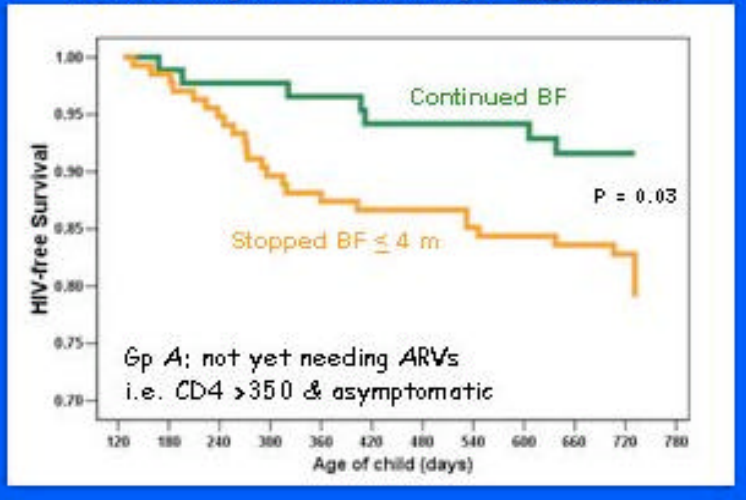
3 Was There Overall Benefit to Early Cessation vs. Continued Breastfeeding?

Overall HIV-free Survival among Children without HIV & still Breastfeeding at 4 Months of Age by Group Assignment



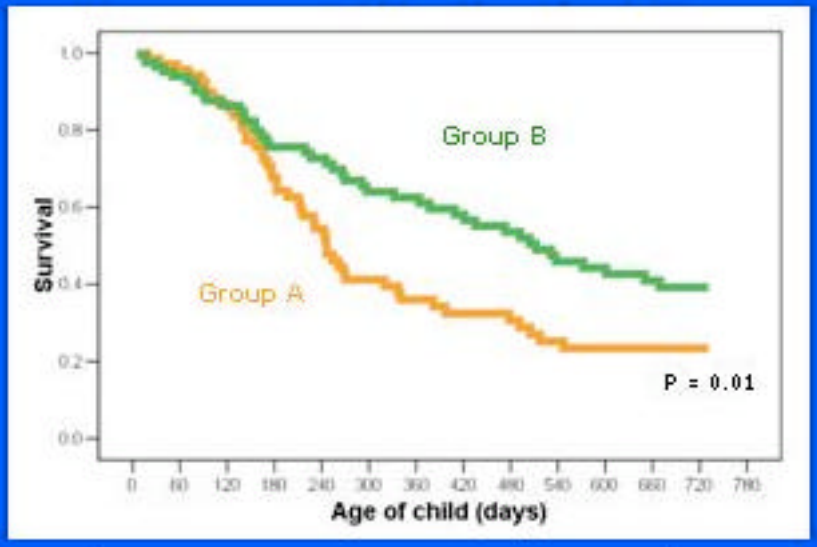
4 In Group A, Was There Benefit to Compliance with Early Cessation of Breastfeeding? Effects differed by stage of maternal disease

HIV-free Survival among Children without HIV & still Breastfeeding at 4 Months of Age - *As Practiced*



Was Early cessation of BF Harmful to HIV-infected Children?

Survival of HIV-infected Children with Positive Results before 4 Months of Age by Group Assignment



Conclusions

1. There is no net benefit to early cessation of breastfeeding among HIV-exposed children living in resource-poor areas.
2. Continued breastfeeding may be more beneficial for children of mothers with high CD4 counts.
3. Exclusive breastfeeding in the first 4 months significantly reduces HIV transmission through breastmilk.
4. Early cessation of breastfeeding is particularly dangerous for children who are HIV-infected prior to 4 months of age.