

# **INFECTION CONTROL IN THE WORLD**

**Infectious Disease Epidemiology Section  
Office of Public Health  
Louisiana Dept of Health & Hospitals  
...Your Taxes at Work...**

**800-256-2748**

**[www.infectiousdisease.dhh.louisiana.gov](http://www.infectiousdisease.dhh.louisiana.gov)**



# Objectives

- At the end of this session the listener will understand:
  - Infection control practices outside the US
  - Employees of foreign origin
  - Diseases among travelers
- At the end of this session the sleeper will have had a good rest



# Fifty Patients Die in Brazil as a Result of Hemodialysis with Tainted Water



Bacterial toxins in water used in hemodialysis center in Caruaru, Brazil in 1996. Water trucked to the hemodialysis center from a nearby reservoir during a drought.

Deaths of fifty patients undergoing dialysis. The patients died of acute liver failure within weeks of having exposure.

One hundred and one patients experienced vision trouble, nausea and vomiting soon after hemodialysis.

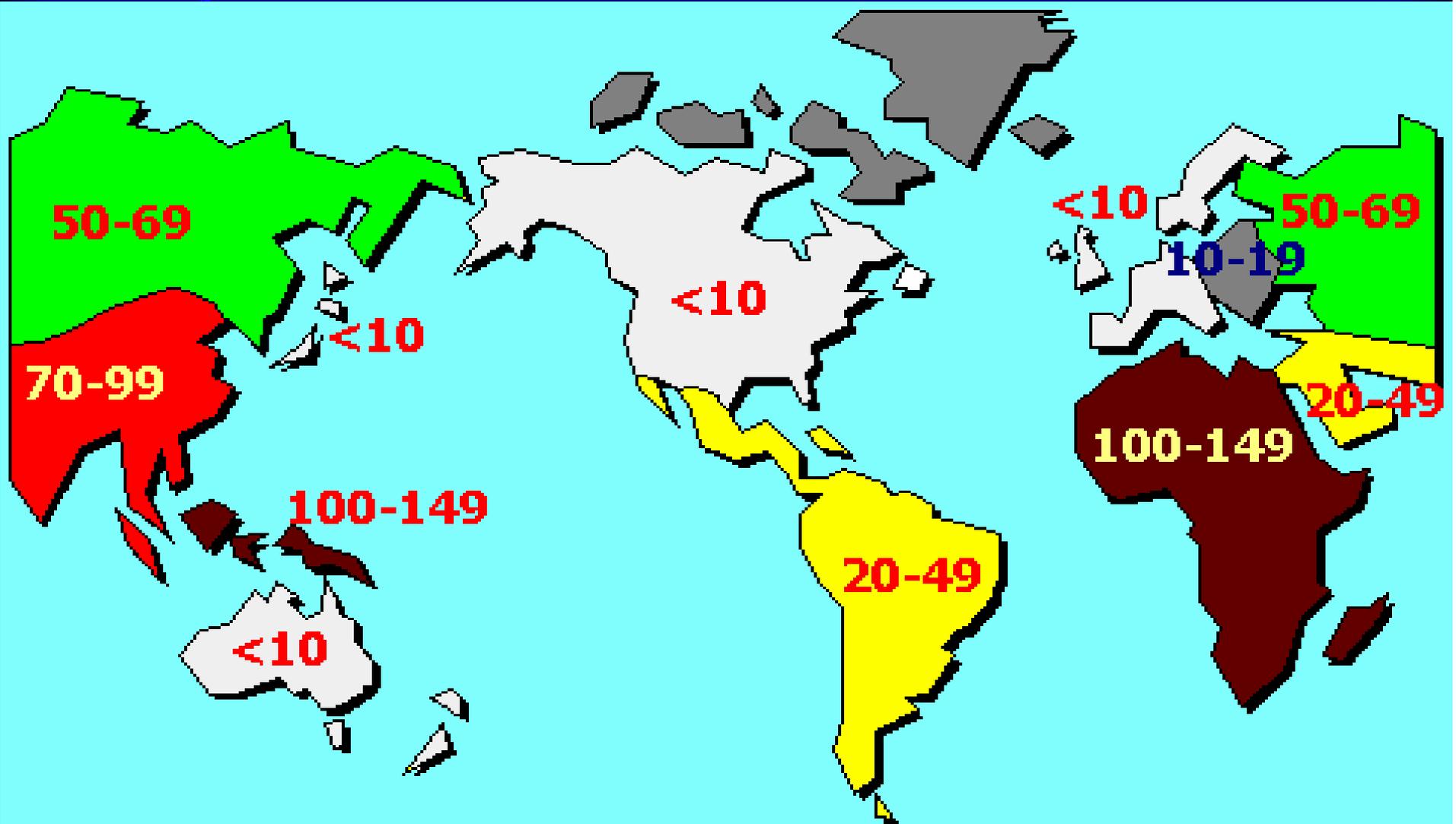


# AIRBORNE & DROPLET

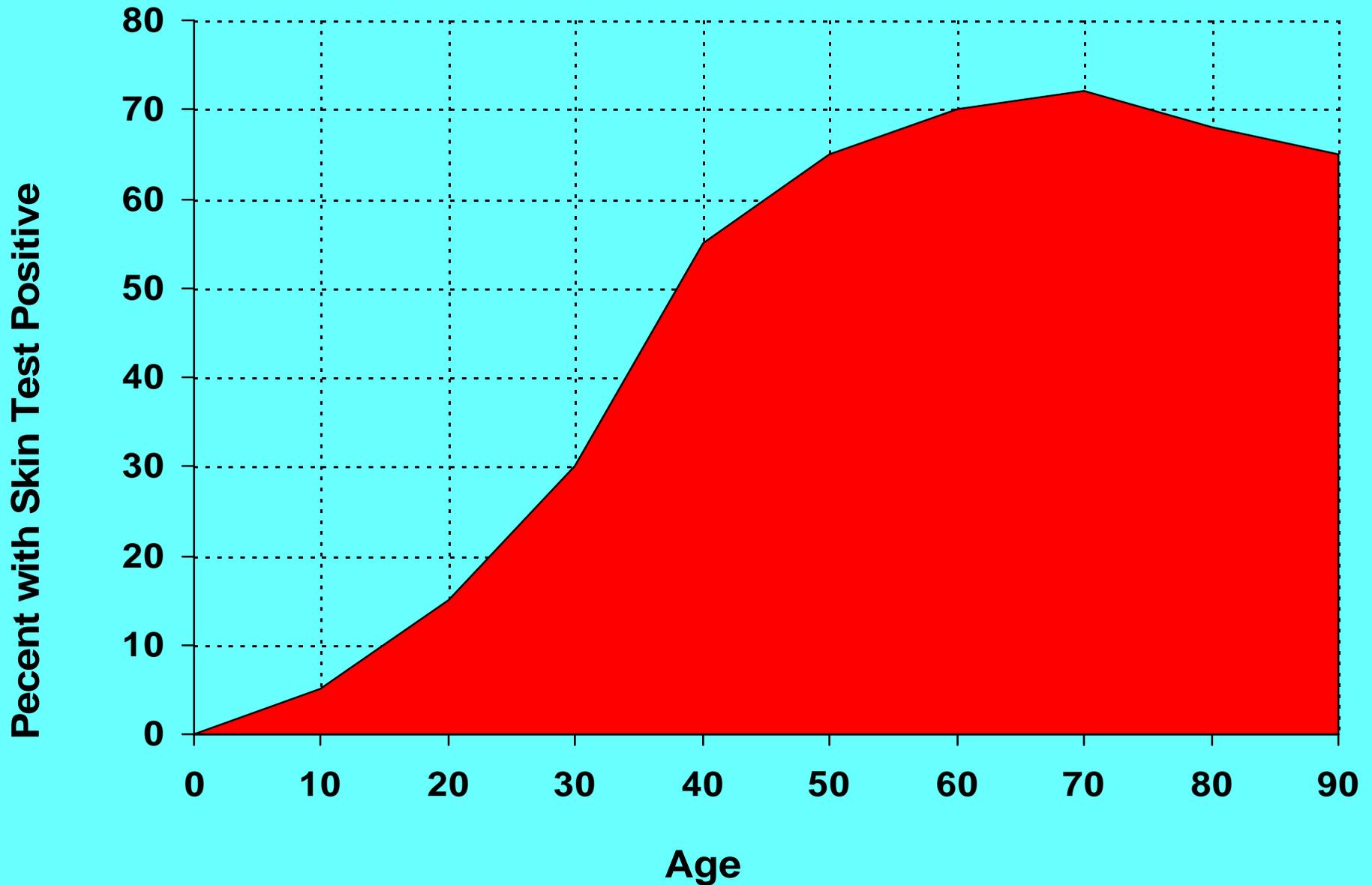


# TB in the World - 1995

Incidence of smear positive pulmonary TB /100,000



# TB Prevalence of Infection by Age



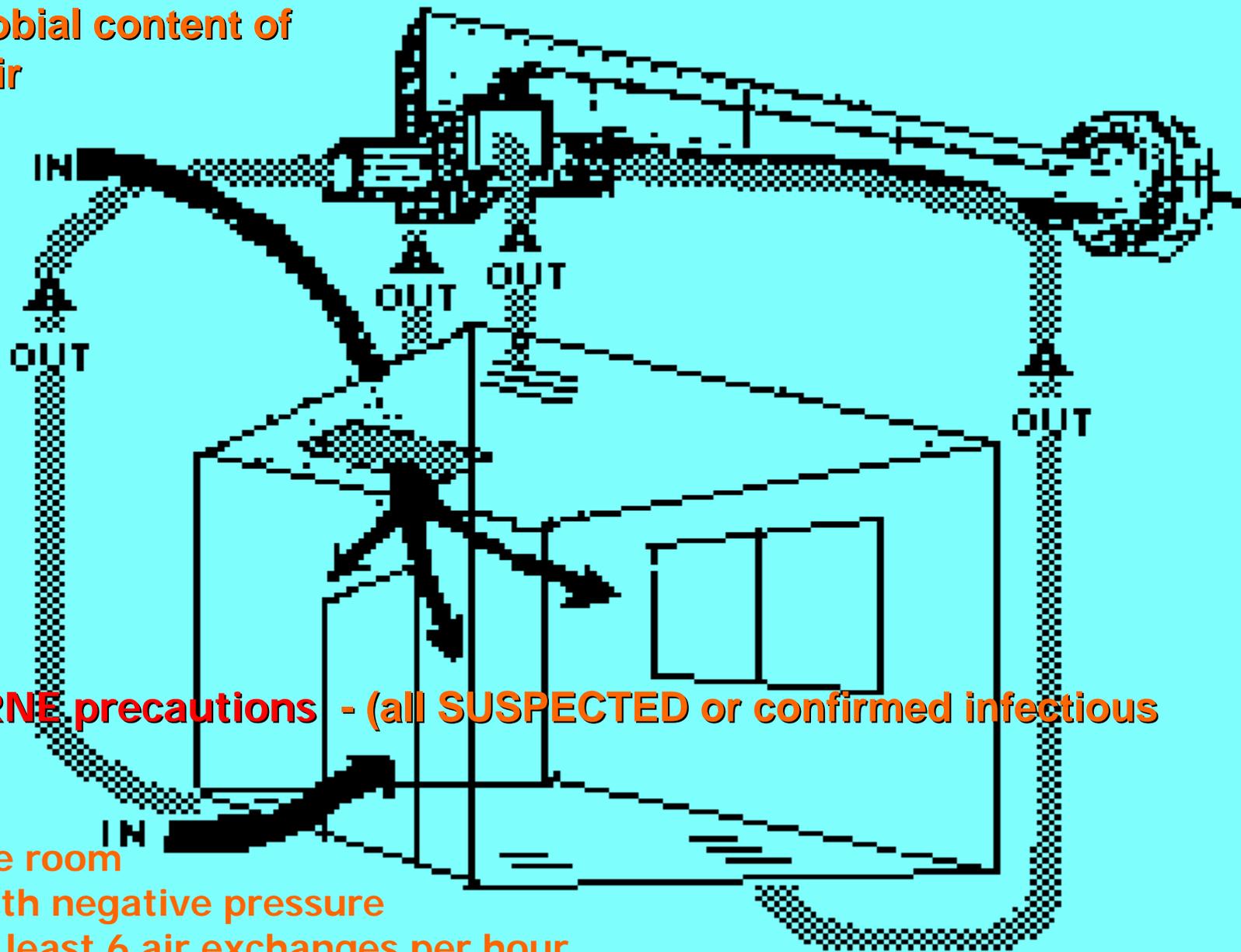
# BCG: WHO Statement on Efficacy

**Statement on BCG revaccination for prevention of tuberculosis. Weekly epidemiological record, 1995, 70(32): 229-231**

BCG vaccine does not appear to prevent primary infection with *M. tuberculosis*, nor does it prevent an appreciable number of infectious pulmonary cases and therefore, does not significantly decrease transmission of tuberculosis within a community. Taken together with the variable efficacy noted above, BCG vaccination has a relatively low impact on the global control of tuberculosis.



# TB Source Control Methods - Reduction of microbial content of the air



**AIRBORNE precautions - (all SUSPECTED or confirmed infectious TB)**

## 1. private room

- with negative pressure
- at least 6 air exchanges per hour
- Air exhausted to the outside

# TB Source Control Methods

## Reduction of Microbial Content of the Air

- 2. Patient wears a mask while symptomatic
- 3. Personnel entering the room
  - wears a disposable particulate respirator
  - snug fit around the face



# Chickenpox



In temperate industrialized countries, 100% get varicella, usually during childhood

## In tropical countries

- large % of children escape infection, become infected as adults
- prevalence of antibodies among Filipino 70%, Indians 80%
- NYC: large % adult cases from Caribbean, Puerto Rico
- India, Sri Lanka: % adult cases  $\approx$  50% - 60%



## Chickenpox Cont.



- India, Sri Lanka: % adult cases  $\approx$  50% - 60%
- numerous reports of outbreaks among adult immigrants from tropical countries to temperate zones
- St Lucia: survey  $\rightarrow$  10% of population have antibodies by age 15
- hypothesis for low transmission:
  - Relative isolation of familial clusters in rural areas
  - Epidemiologic interference with HSV
  - Environmental conditions which impairs the integrity of the virus



# Eruptive Diseases

- Measles, rubeola
- German measles, rubella
- Chickenpox, varicella
- Smallpox, variola

Sarampion, rubeola

Rubella

Varicela

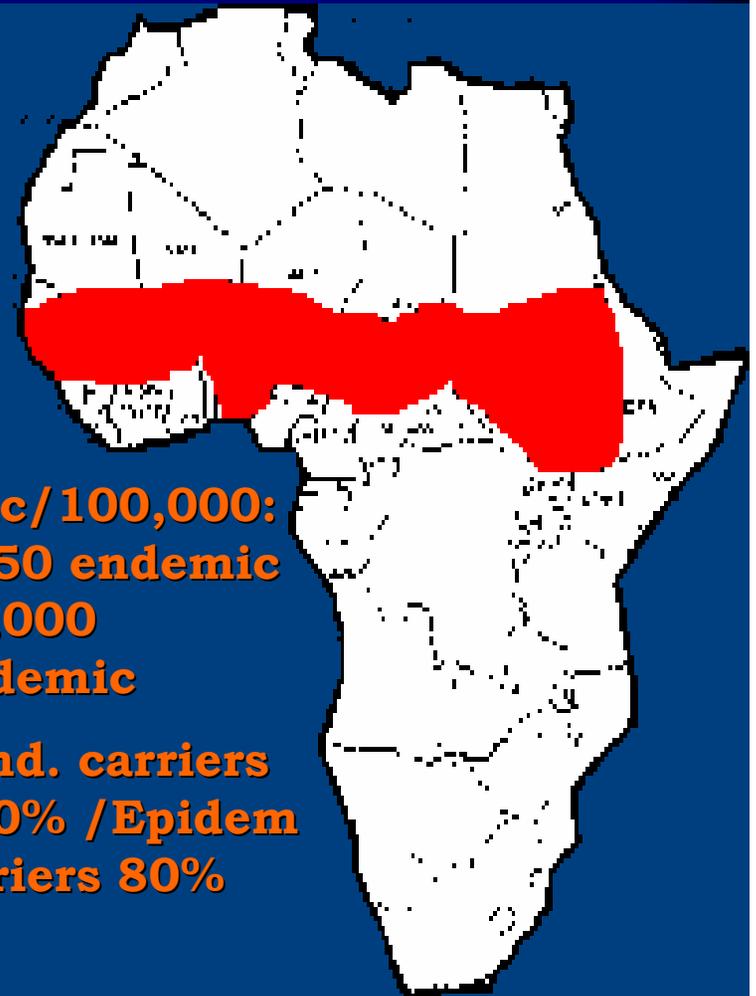
Viruela



# Meningococccemia: Epidemics

- Epidemics unpredictable & infrequent
- Groups:
  - major epidemics caused by group A
  - localized outbreaks may be group B, C W135 or Y
- Major epidemics with attack rates 1%
  - developing countries
  - *meningitis belt* of sub-Saharan Africa
- Mostly children 5-10 years
- More frequent in dry season

- Epidemic q 10 yrs: 1962, 1972-74, 1983 Grp A Other 1988 Grp A Clone III-1



- **Inc/100,000:** 10-50 endemic / 1,000 epidemic
- **End. carriers** 5-10% / Epidem carriers 80%

# 1987 Meningococccemia Epidemic

## USA

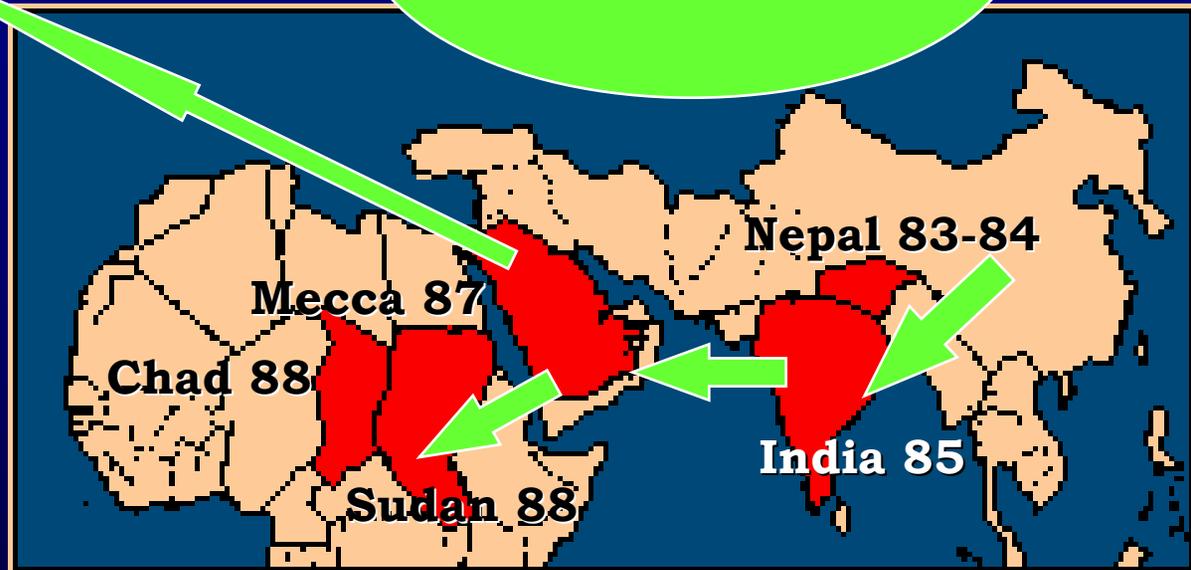
1250 pilgrims

9 cases, 2 deaths,  
640E-5

Moore PS 1988,  
JAMA 260:2687

Moore PS 1989  
Lancet 7/29: 260

1,620,000 Hajjis,  
1841 cases  
12% mortality



## Africa

Low in African  
Hajjis because  
of vaccine  
requirements

*Neisseria meningitidis* clonal complex III-1  
by enzymatic electrophoretic typing

Saudi Pop <<< Other Hajji <<< Asian Hajjis

# Meningococccemia : Epidemic Control

*Chemoprophylaxis is not appropriate for epidemic control.*

*During the 1987 epidemic, carriage rates for those returning to the US were similar among those who did and did not report using rifampin prophylaxis (14% and 10%). A study of chemoprophylaxis during the same outbreak showed substantial acquisition of carriage in the control population, suggesting that a few of the prophylaxis failures were due to recolonization with epidemic strain (Riedo 1991).*



# Meningococccemia: Mass Immunization

- Highly effective to control epidemics
- Start ASAP after initial cases
- Immunization with A antigen does not prevent carriage but it seems to reduce transmission
- The decision to implement mass vaccination to prevent meningococcal disease depends on
  - occurrence of  $>1$  case = outbreak ?
  - determination not easy without evaluation and analysis of the pattern of disease occurrence



# **TRAVELER'S DIARRHEA**

**& Other Enteric Diseases**



# Transmission of Enteric Pathogens



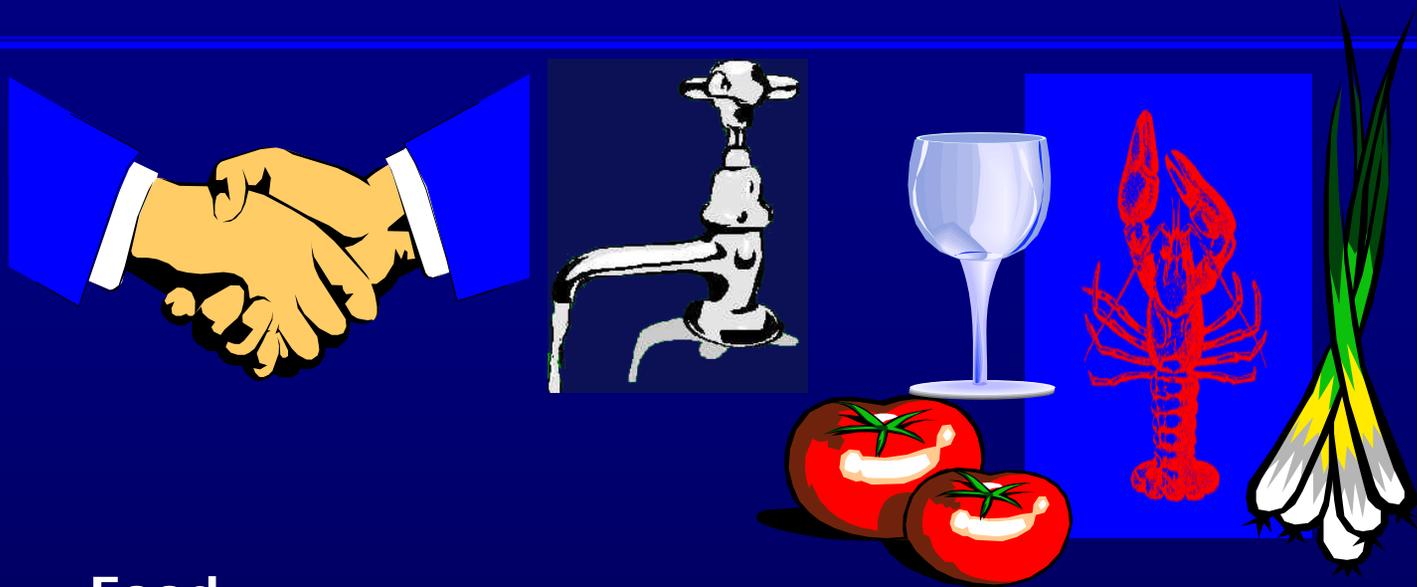
- Fecal oral route:

- Hands

- Water

- Bathing, playing in surface water
- Drinking water from wells pulling from contaminated aquifer
- Piped drinking water from contaminated source, from breaks in water supply and sewage lines

# Transmission of Enteric Pathogens Cont.



- **Food**
  - Food contaminated during preparation with water
  - Shellfish and other seafood from contaminated sources: clams, crabs, shrimps, lobsters
  - Raw vegetables and fruits irrigated with contaminated water
  - Food contamination during display and sales at market
  - Food contamination by carrier during preparation



# Traveler's Diarrhea

**50% of travelers to developing countries**

- Abdominal cramps, bloating, nausea, vomiting, urgency
- Diarrhea: 5-6 loose stools /day
- Fever, malaise
- Usually 3-5 days, 10% >1 week, 1% > 3 months

- ☞ **Bismuth subsalicylate** (Peptobismol™ )
  - 2tsp qid decreases risk by half, safe for < 3 weeks
  - Black tongue & stools, nausea, constipation
  - NO + aspirin allergic, renal insufficiency, gout, anticoagulants, children < 3
- ☞ **Doxycycline, Trimethoprim-sulfa, ciprofloxacin, norfloxacin** 50-90% effective depending on area sensitivity patterns; usually not known
- ☞ Prophylactic use of **difenoxine** (Lomotil) increases incidence of TD

## ☞ BACTERIA:

- Enterotoxigenic *E.coli* (ETEC) (20%): fever is rare
- *Shigella* (10%) : bloody stools
- *Campylobacter jejuni*
- *Vibrio parahemolyticus*: Seafood
- *Vibrio* O1, *Vibrio* O139, *Vibrio* Non O1
- *Vibrio fluvialis*
- *Salmonella*
- *Aeromonas hydrophila*
- *Pleisiomonas shigelloides*

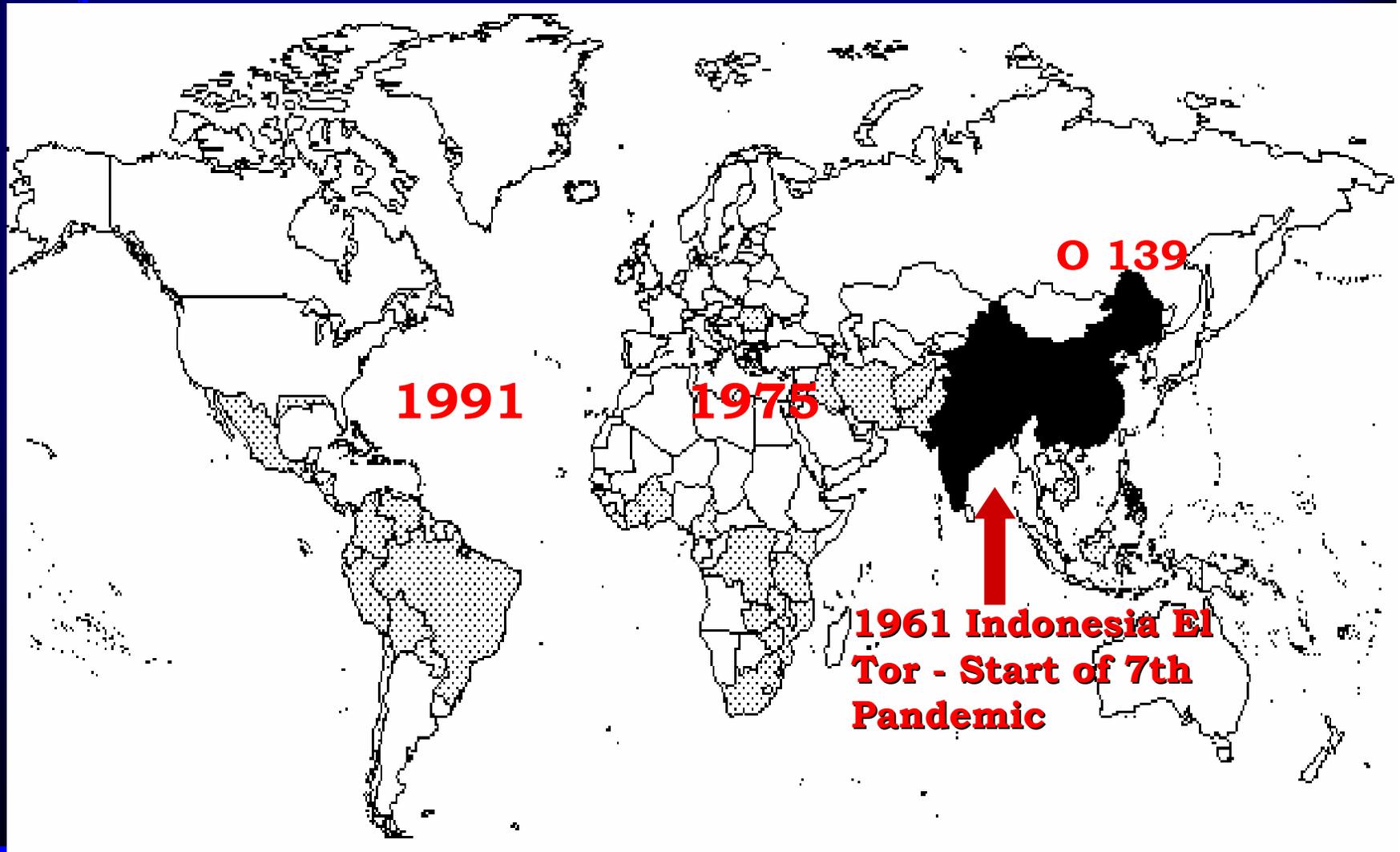
☞ VIRUS (20%): Rotavirus, Norwalk virus

☞ PARASITES (5%): *Giardia*, *Entameba*, *Isospora*, *Balantidium coli*, *Cyclospora*, helminths



# Cholera

**5% of all diarrheas are due to cholera in some countries**



# Cholera

- Asymptomatic infection (after low dose)
- Incubation 2-3 days, few hours – 5 days
- Diarrhea: mild to fulminant
- Dose dependent
  - 1,000 Cfu --- Asymptomatic
  - 10,000 Cfu --- Simple diarrhea (60% Volunteers)
  - 1,000,000 Cfu --- Acute diarrhea, dehydration (50% )
- El Tor produces more asymptomatic cases than classical case/carrier: El Tor 1/36, Classical 1/4
- Convalescent carriers: <50 yrs, months to 1 year
- Chronic carrier: >50 yrs, gallbladder



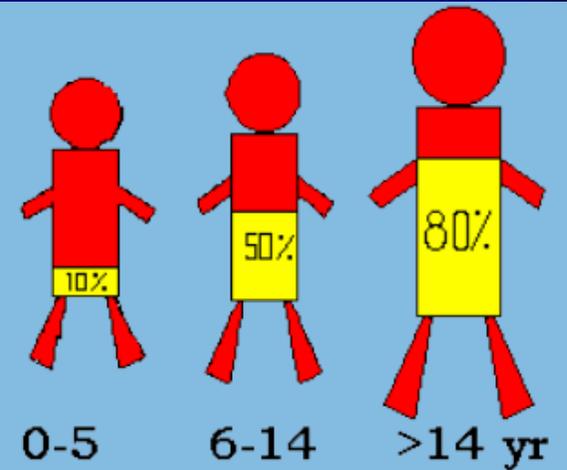
# Typhoid Fever

- Bacterial infection
  - Fever, gastrointestinal infection, sepsis
  - Complications may be severe
  - Treatment with antibiotics
  - Preventable by vaccine
- **Vivotif® capsules: Oral live vaccine**
    - Protection 50-80%
    - 4 Doses: Day 0, 2, 4, 6
    - start one week before travel
    - Booster series every 4 years.
    - Oral vaccines are preferred because they have fewer side effects.
  - **Inactivated vaccine administered subcutaneously**
    - 2 doses 4 weeks apart
    - Booster consists of 0.1ml intradermally every 3 years

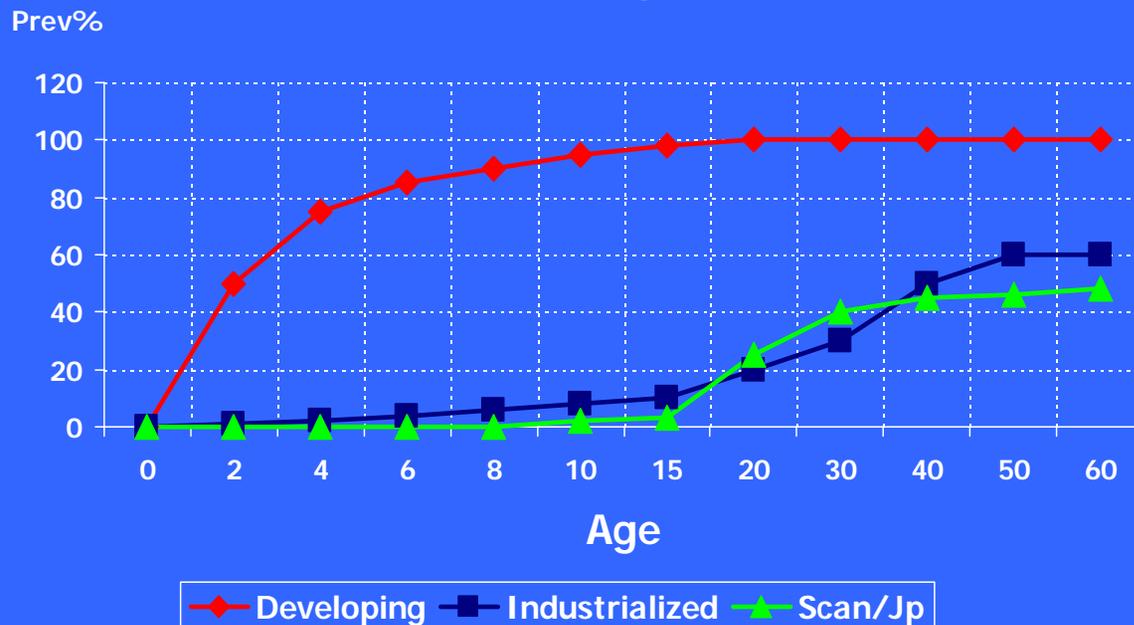


# Hepatitis A

- Virus transmitted by fecal oral route
- Mild gastrointestinal disease, fever and jaundice
- Usually mild, resolves spontaneously
- Preventable by vaccine



Prevalence of HAV past infection



**Symptomatic**  
**Asymptomatic**



# Polio

- Enterovirus
- Transmitted by fecal oral route
- Eradicated from the Americas but still high risk in developing countries
- Preventable by vaccine
- Adequate protection against polio consists of 3 doses
- Those who have received either OPV or IPV may continue with OPV. It is not relevant how long before the last dose was received or the type of vaccine used
- Those who have received 3 doses in the past, would benefit from one dose of OPV or IPV as a booster.
- Adults who have never been immunized should receive IPV



# BLOODBORNE PATHOGENS



# Unsafe Injections

- In poor countries:
  - Annual ratio injections/person = 1.7 to 11.3
  - Proportion administered with equipment reused in absence of sterilization = 1.2% - 75%
  - Reuse highest in South East Asia, Eastern Mediterranean, Western Pacific regions
- Proportion who received injections in 2 weeks prior: (van Staa and Hard, WHO Study)
  - Indonesia 40% (disposable syringes reused)
  - Uganda 30% (Household brings supplies, sterility ???)
  - 6-7 /10 health care visits associated w receiving injection



# Unsafe Injections

- WHO /UNICEF promote "safe injection practices"
- 1 person = 1 needle = 1 syringe → safe disposal
- Each person in developing world receives average of 1.5 injections/year. (Simonson)
- Hospitalized, HIV... ~ 10-100 times as many
- 95% injections therapeutic, majority unnecessary They found 50% unsafe in 14/19 countries
- 18 studies reported link between unsafe injections and transmission of hepatitis B and C, HIV, Ebola and Lassa virus infections and malaria.
- 5 studies attributed 20-80% of all new HBV infections to unsafe injections
- 3 studies attributed unsafe injections as transmission of HCV

Hutin YJF, Hauri AM, Armstrong GL. Use of injections in healthcare settings worldwide, 2000: literature review and regional estimates. *BMJ*. 2003 November 8; 327(7423): 1075.

van Staa AL, Hardon A. Injection practices in the developing world; Results and recommendations from field studies in Uganda and Indonesia. Prepared for the WHO-DAP 1996 <<<http://www.who.int/medicines/library/dap/who-dap-96-4/who-dap-96-4.pdf>>>



## BBFE Risk: From Patient to HCW

- Health care workers with sharps injury or dentists - high risk: 0.6% - 4.5% prevalence  
in all surveys HCW  $\approx$  blood donor rates\*4.5 at same institution
- risk of transmission after parenteral exposure, hollow needle:
  - HBV 30%
  - HCV 1-3%
  - HIV 0.3%
- needlestick injuries probably most important risk
- risk of acquiring irreversible liver injury from needlestick:
  - HCV 3% \* chrHep+cirrhosis 20% =  
Tot/Risk = 0.4% - 1%
  - HBV 30%\* chrHep+cirrhosis 1% =  
Tot/Risk = 0.04% - 1%

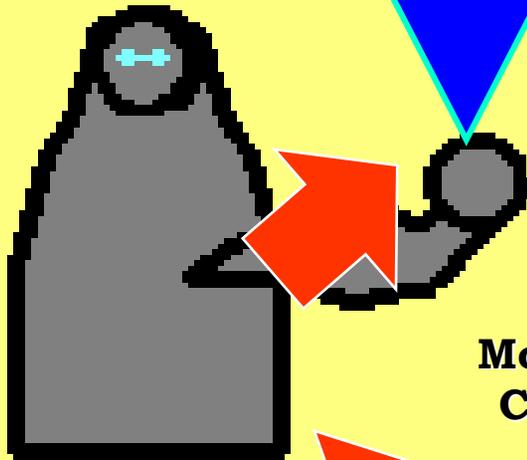


# HBV

## Nosocomial Transmission



**HBV Vaccine to all infants**  
**HBIG to infants of carriers**

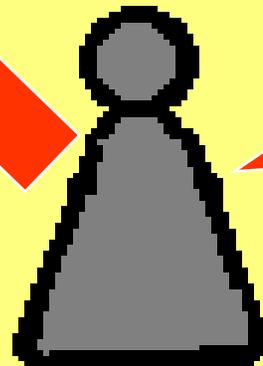


**Mother to Child at birth**

**Among children**



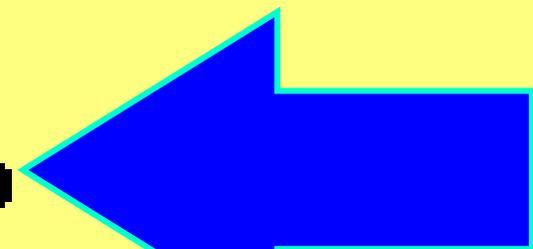
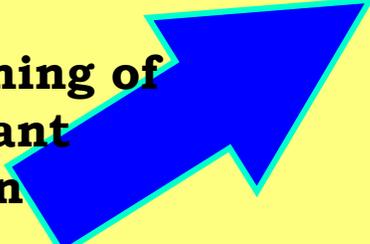
**Sexual Transmission**



**HBV Vaccine to susceptible children**

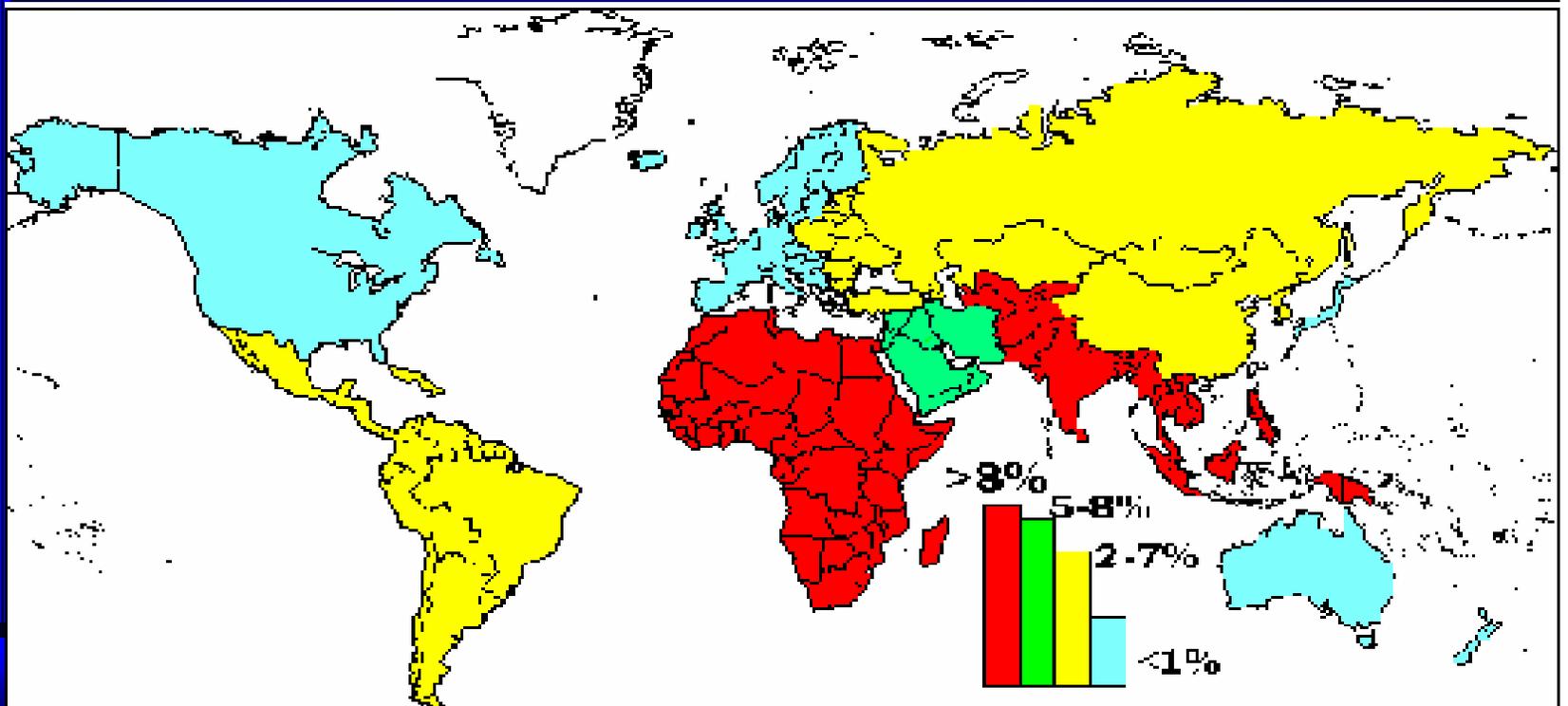
**Screening of pregnant women**

**Vaccine to women**

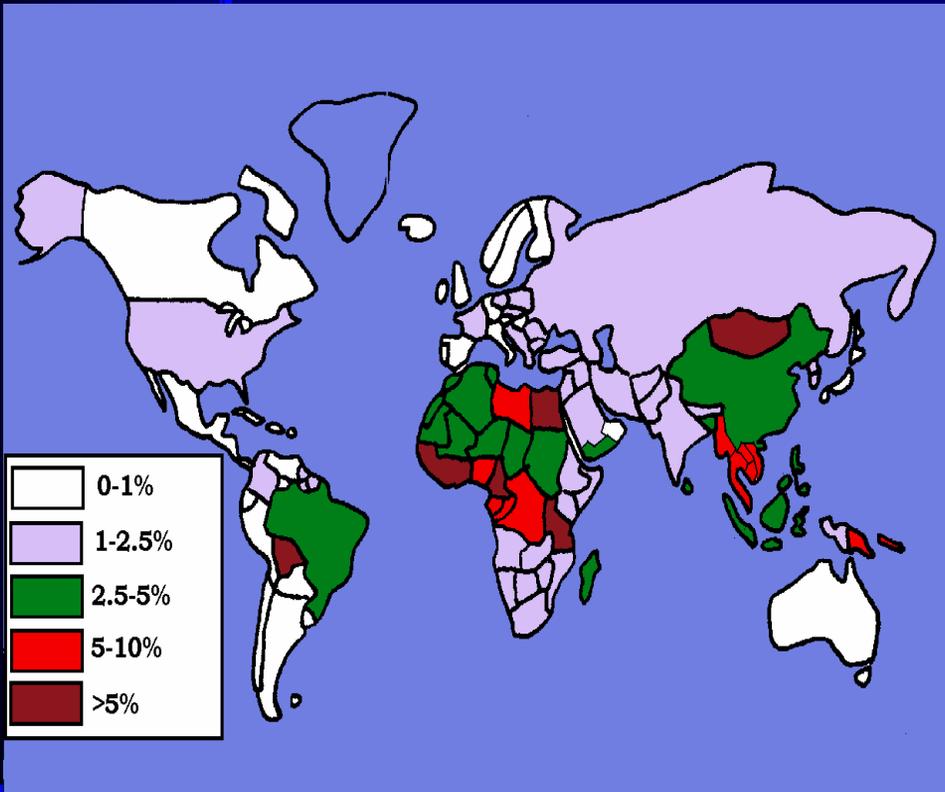


# HBV

- **HBV infection acquired from contact with blood or sexual contact with HBsAg carriers**
- **Risk high for medical, dental procedures with poorly sterilized equipment. Insist on using disposable needles. Beware of dental procedures.**
- **Risk low for travelers**
- **Immunization recommended for travelers staying for months in high endemic countries.**



# HCV

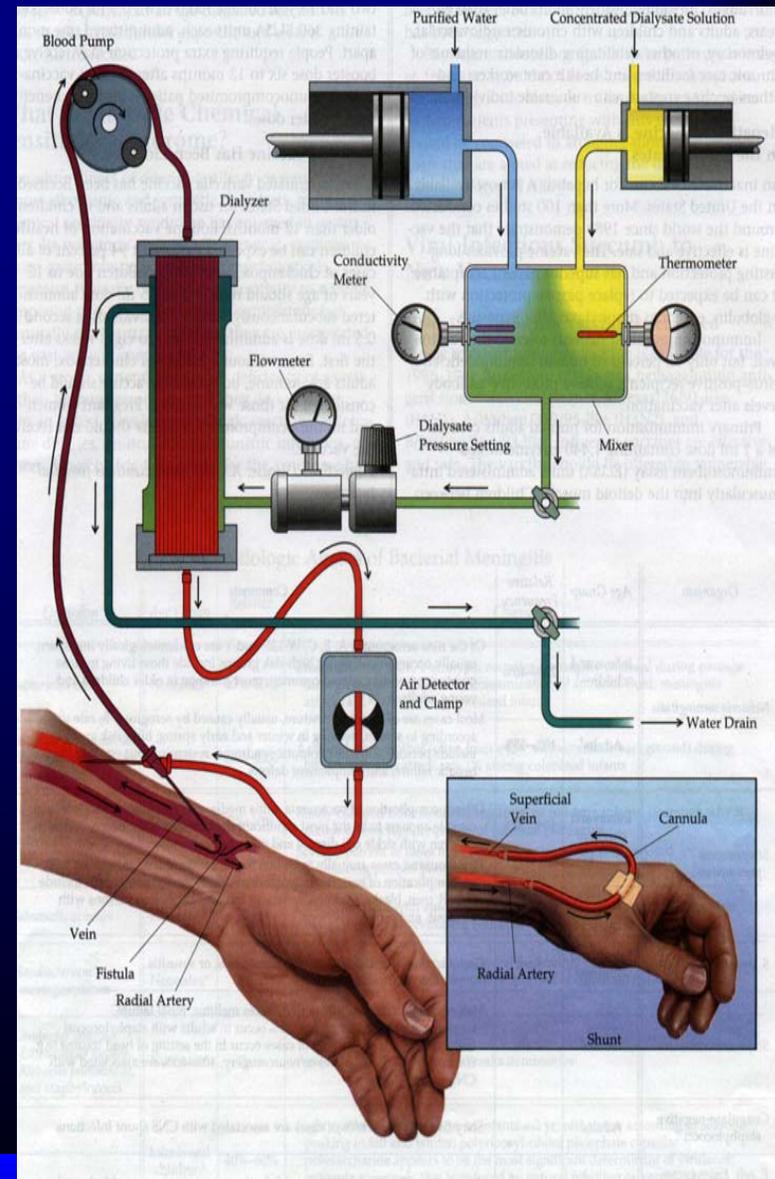


- present in blood for long time, low titers in the blood
- spread by parenteral route:
  - blood transfusion
  - IV drug abuse
  - nosocomial transmission
- Risk high for medical, dental procedures with poorly sterilized equipment
- Insist on using disposable needles
- Beware of dental procedures
- Possibility of sexual transmission, importance not well understood yet



# HCV: Hemodialysis

- Very high risk setting
- Prevalence among hemodialysis patients  $\approx$  20%
- Countries with poor application of standard precautions
  - prevalence of infection  $\approx$  90%
  - annual seroconversion rates 10 to 30%
  - risk of conversion of 3 /1,000 hemodialysis



# HCV: Hemodialysis Cont.

- Transmitted in hemodialysis because of poor infection control practices:
  - cross contamination clean and contaminated spaces,
  - contamination of injection sites
  - infection of patients



# HCV: Hemodialysis

Population: AntiHCV (RIBA+) 1-3%

- Hemodialysis patients in Govt Centers:

- Range among centers: 15%-94%,
- Mean prevalence 66%
- Prev Non-transfused 63% vs 73% transfused
- Annual conversion rate 10-50%

- Hemodialysis patients in SAMSO:

- Prevalence 8% (all from initial session)
- Annual Conversion rate 0%



## Spread of HIV throughout the World

### 1. HIV spreads among a core group of high risk individuals:

- In developing countries: female prostitutes
- In countries with immigration for endemic area: immigrants
- In the industrialized world:
  - 3 original high risk groups:
    - Hemophiliac,
    - Injection drug users,
    - MSM
  - Injection drug users



# Spread of HIV throughout the World Cont.

## 2. HIV moves into the general community:

- Core transmission group well established
- Spread through sexual, parenteral and mother-to-child routes
- Screening of women at prenatal clinics, newborns provide proof for spread of HIV into the general community  
Increase = substantial spread into the community
- High rates among blood donors = broader spread in community
- High rates among TB clinic clients = a maturing of the epidemic as clinical manifestations of immunodeficiency emerge.

## 3. HIV explodes into the community



# Spread of HIV throughout the World

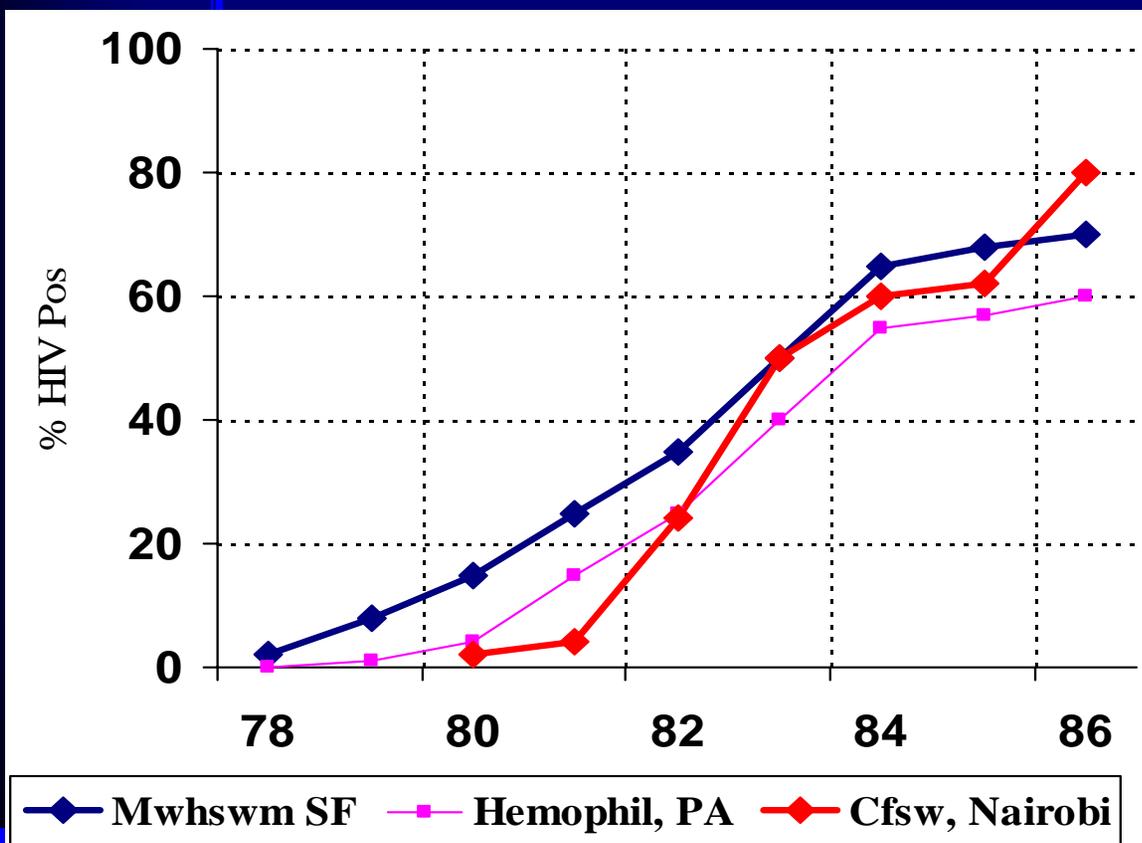
## The progression of HIV in Nairobi, Kenya

	1981	1985	1990
Female prostitutes	4%	60%	75%
Male at STD clinics	3%	18%	40%
Pregnant women	0%	2%	10%

In Haiti and Caribbean -

**Beginning of epidemic:**  
majority = men,  
introduction into  
the homosexual  
groups

**Then shift to female  
population:**  
proportion of  
homosexual men  
were bisexual and  
transmitted HIV  
into sexually  
active female and  
female prostitute  
populations



# HIV in the World



Country	# living with HIV/AIDS 1997	Prevalence in adults/1,000
N.Africa & Mid East	210,000	0.7
<b>Sub Saharan Africa</b>	<b>20,800,000</b>	<b>36</b>
North America	850,000	0.5
Caribbean	310,000	1.8
Latin America,	1,300,000	3.9
West Europe	530,000	0.8
East Europe, CIS	150,000	
<b>South &amp; East Asia</b>	<b>6,000,000</b>	<b>2.9</b>
East Asia	440,000	0.3
Australia /Oceania	12,000	0.4
<b>World</b>	<b>30,800,000</b>	<b>5.3</b>



# HIV - AIDS

- **Extremely high risk for travelers with unprotected sexual contacts and IV drug users**
- **Risk for medical and dental procedures with equipment not properly sterilized. Requires disposable needles**
- **NO RISK from casual contacts, insects, food, drinks, eating utensils, bed linen...**



# WHO Blood Transfusion Guidelines for Travelers

- Systematic screening of blood not done in all countries
- Unexpected emergency blood transfusion is only required in massive blood loss: severe trauma, obstetric emergency, massive gastrointestinal bleeding
- In many cases, plasma expanders may be used as palliative measure while waiting for emergency evacuation
- If transfusion is absolutely necessary make every effort to make sure that blood has been screened. Shop around, consult with Embassy, ask questions, require documentation of tests...



# **OTHER INFECTIOUS DISEASES**



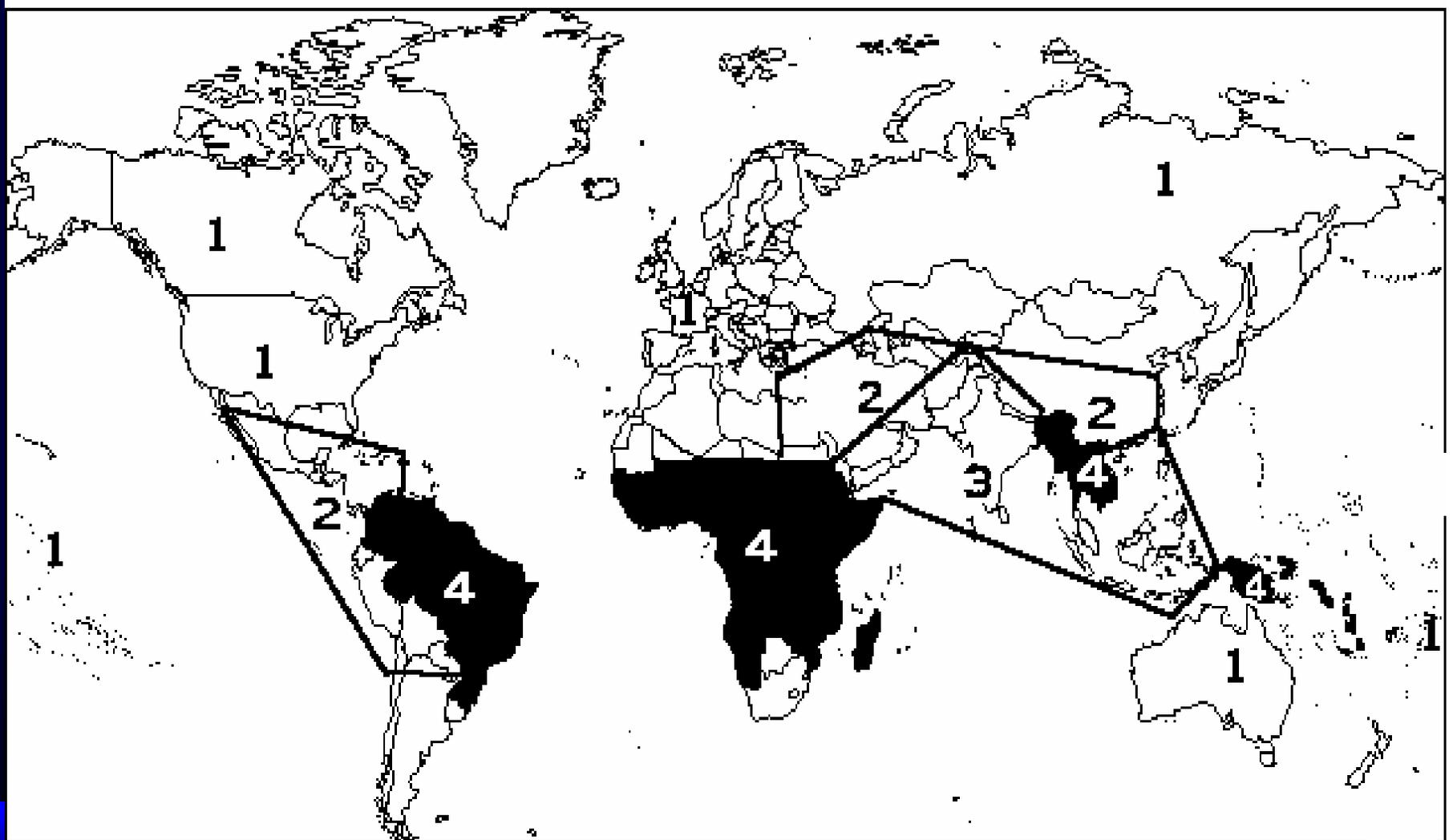
# Malaria

1=No malaria

2=Low risk, no CRPF

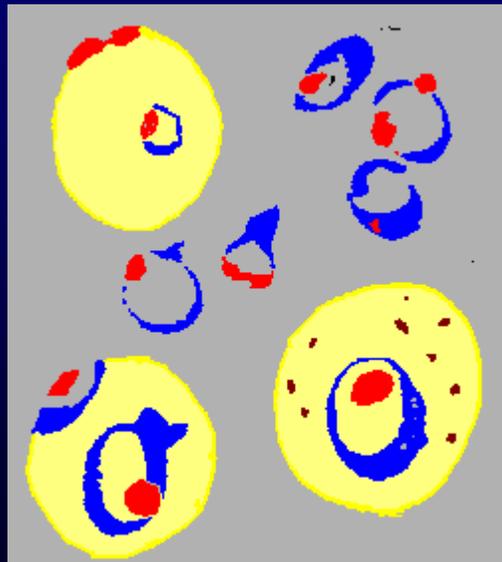
3=Low risk, CRPF

4=Hi risk, CRPF

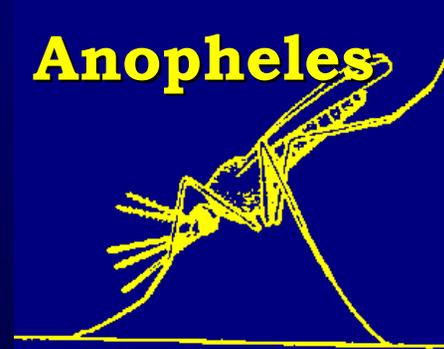


# Malaria

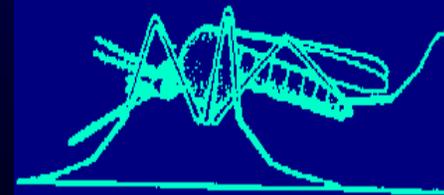
- Disease caused by parasite multiplying in red blood cells
- Carried by Anopheles mosquitoes
- Fever and chills are main symptoms



**Anopheles**



**Other mosquito**



# Diagnose malaria before it is too late

**STAY IN  
MALARIOUS  
AREA**

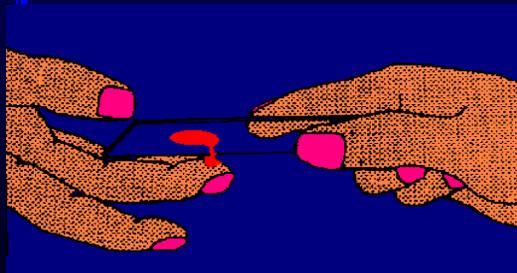
**+**

**HIGH FEVER**



**THINK MALARIA**

- Thin or thick smear
- If fever persists:
  - Get another blood smear
  - Probably not malaria, but mistakes occur
  - Few parasites may be missed



# Yellow Fever



- **Vaccine is a suspension of live attenuated virus prepared from a strain grown in chick embryo**
- **Protection is effective for 10 years**
- **Very few side effects**

- **Acute disease resulting from infection with virus**
- **Transmitted by mosquitoes**



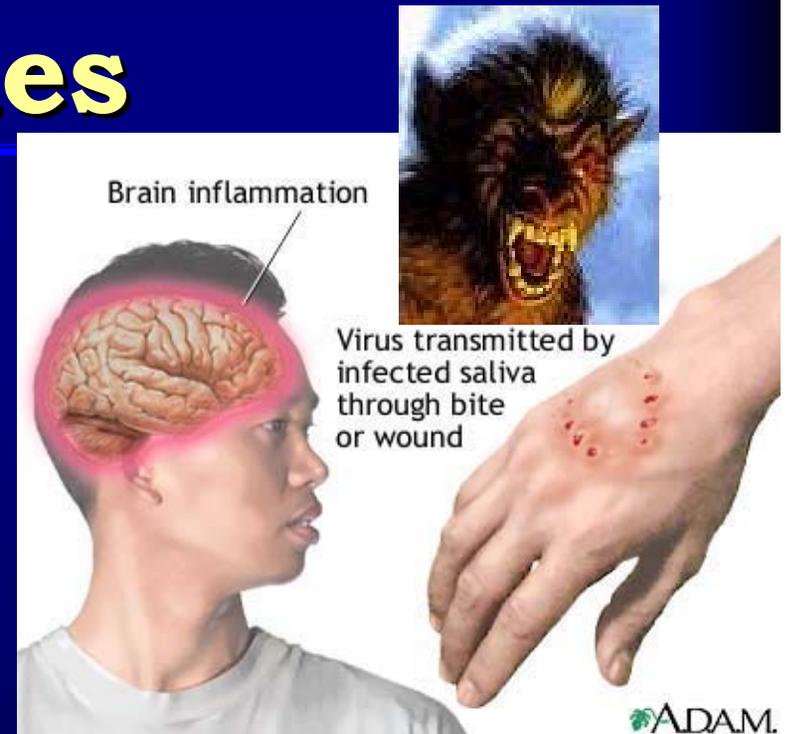
# Yellow Fever Cont.

- ☞ **Disease mild among native population in endemic areas (5% case fatality ratio)**
- ☞ **but is usually severe**
  - **among travelers**
  - **and during epidemics (50% case fatality ratio)**
- ☞ **Starts as a flu like illness with fever, chills, headache and backache, myalgias, nausea and vomiting**
- ☞ **Progress to high fever, slow heart rate, hepatitis (icterus) and renal involvement (albuminuria, leading anuria)**
- ☞ **Severe hemorrhagic syndrome with epistaxis, hematemesis, melena, petechiae and ecchymoses may develop**



# Rabies

- MMWR 46:12 from 3/28/97
- June 7, 1996: US traveler pets a dog in Kathmandu and gets bitten in the left arm
- Dog observed 45 minutes, normal, released
- Could not get post exposure prophylaxis (PEP) for rabies in Kathmandu or in Thailand
- In Australia she cannot get PEP organized in time
- Back in the US she forgets about it
- August 12: pain and paresthesias in the left arm
- Progressive neurological impairment
- August 20: death with confirmed rabies



# Rabies Cont.

- Throughout Asia, Central Europe, Africa and Central and South America
- Rabies endemicity is high
- 20,000 persons die of rabies each year
- 99% after a dog bite



# Viral Hemorrhagic Fevers

Viral Hemorrhagic Fevers are diseases occurring in limited geographical areas

but 4 of them are known to have caused significant outbreaks of disease with person to person transmission:

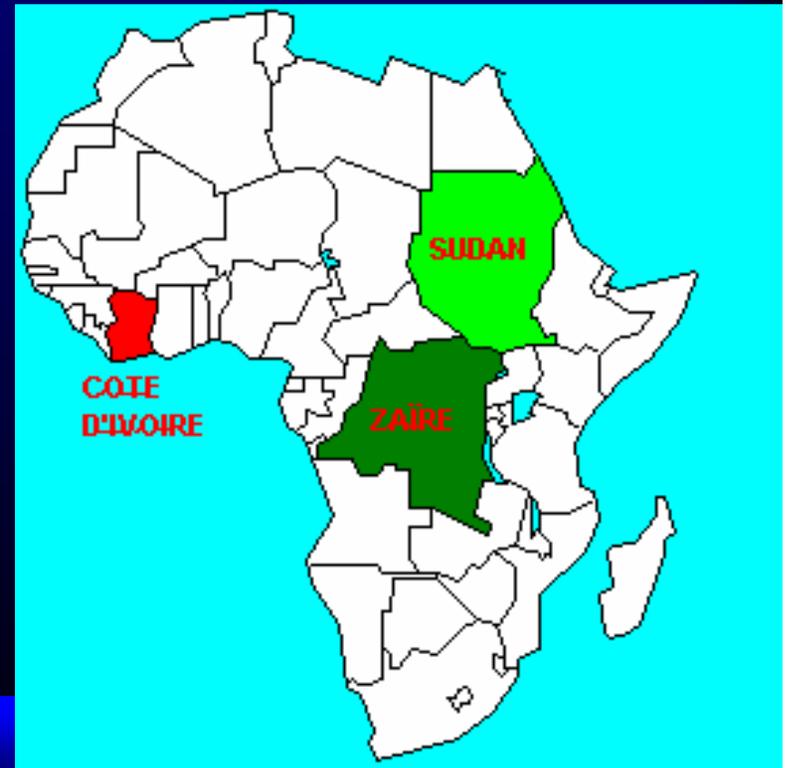
- Lassa (Arenavirus)
- Marburg (Filovirus)
- Ebola (Filovirus)
- Rift Valley Fever (Bunya-Phlebovirus)
- Crimean -Congo (Bunya-Nairoovirus)

These are occurring in Sub Saharan Africa



# FILOVIRIDAE: Ebola & Marburg

- Inactivated at 60° C
  - Sensitive to lipid solvents, formaldehyde, hypochlorite, Q-ammonium, phenolic
- ☞ **Incubation 2-21 days, average 1 week**
  - ☞ **Extremely pathogenic: fulminating febrile hemorrhagic disease**
  - ☞ **Grows fast, kills most cells and infected person bleeds to death, usually within 48 hours of infection**
  - ☞ **Mild to asymptomatic infections occur**
  - ☞ **Onset abrupt**



# FILOVIRIDAE: Ebola & Marburg Cont.

## ☞ MILD CASE:

- **influenza like syndrome: fever, headache, malaise, myalgia, joint pain, sore throat**
- **then diarrhea and abdominal pain**
- **at 7 days morbilliform rash, desquamation**

## ☞ SEVERE: Day 3 hemorrhagic manifestations, petechiae, frank bleeding from many sites

## ☞ Diagnosis:

- **Isolation of virus from blood**
- **IgM**
- **IgG rising titers**



# Marburg

- Reservoir of infection unknown
- Mode of natural transmission unknown
- Transmission from close contact with blood, secretions, excretions
- Original outbreak:
  - primary cases contact with animal blood or tissues
  - sexual transmission ? in one case in Germany
  - virus isolated from seminal fluid
- Central and East Africa are considered to be endemic areas



# Ebola

- **Filovirus**
- **4 strains: Zaire, Sudan, Cote d'Ivoire, Reston**
- **Reservoir of virus unknown**
- **Mode of acquiring natural infection unknown**
  - initial cases in close contact with tropical forest ecosystem
  - close association between primary cases and monkeys
  - BUT transmission between monkeys NOT efficient
- **Secondary transmission**
  - from person to person
  - from contact with blood, secretions & excretions
  - outside of hospital sec attack rates  
5% - 15% insufficient to sustain outbreak
- **No suggestion of transmission by contact or by aerosol**

