Detection and Control of Epidemic Meningococcal Disease

Epidemiology
Meningococcal Disease

- Caused by *Neisseria meningitidis*, a Gram-negative bacteria

- Only major form of meningitis that causes epidemics

- Occurs throughout world, but is a severe problem in "meningitis belt"

- Early detection of epidemics saves lives
"Meningitis Belt" in Africa
"Meningitis Belt" Epidemics

- Serogroups A & C *Neisseria meningitidis*

- Begin in dry season
  End when rainy season begins

- Attacks rates can exceed 1% of population

- Children and young adults most affected

- 70% of cases die (without treatment)
  10% of cases die (with treatment)
Clinical Disease
Due to *Neisseria Meningitidis*

- **Meningitis** is most common presentation
  - fever, headache, stiff neck
    - bulging fontanelle in infants
  - cloudy cerebrospinal fluid (CSF)
  - responds well to antibiotics

- **Septicemia** occurs in 10-20% of cases
  - fever, petechial or purpural rash, hypotension
  - seizures, coma possible
  - CSF may be cloudy or clear (normal appearing)
  - progresses rapidly
  - 30% die - responds poorly to antibiotics
Carriage and Transmission of *N. Meningitidis*

- Only humans carry *N. meningitidis*
- Bacteria live in mucosa of nose and throat
- Spread in oral secretions or respiratory droplets
- Most persons who carry *N. meningitidis* have no symptoms of disease
- Not clear why some people develop disease, but humoral immunity is important
Factors Favoring Epidemic Meningococcal Disease

- Environmental Factors
- Host Factors
- Strain Characteristics
Factors Favoring Epidemic Meningococcal Disease

- Environmental Factors
  - low rainfall and humidity
  - dust storms in harmattan?
  - damage to normal mucosal barriers?
Factors Favoring Epidemic Meningococcal Disease

- **Host Factors**
  - Population immunity decreases risk
  - Individual immunity via carriage or immunization decreases risk
  - Concurrent upper respiratory infection (URI) may increase risk
Factors Favoring Epidemic Meningococcal Disease

- **Strain Characteristics**
  - Serogroup A main is the main cause of epidemics in Africa (some C)
  - Enzyme type -- III-1 clone
Risk Factors During Epidemics

- Associated with:
  - crowded living conditions
  - low socio-economic status

- Possible associations?
  - concurrent URI (more studies needed)
  - nutritional status

- Infection with HIV
  - apparently not risk factor for infection during epidemics of serogroup A meningococcal disease
Meningococcal Vaccine

- Mass vaccination is only way to control epidemics
- Effective against serogroups A & C of *N. meningitidis*
- Poorly immunogenic in infants
- Only short term protection in children less than 4-years-old
Weekly Meningococcal Disease Attack Rates Predict Epidemics

- Attack rate exceeding 15 cases / 100,000 per week for two consecutive weeks predicts a large epidemic

- Best applied to populations of 30,000 to 100,000 persons

- Rate of 15 / 100,000 per week for 2 weeks:
  - is low enough to detect an epidemic early, so that vaccination will have impact
  - is high enough to avoid frequent false alarms