Diphtheria Outbreak in KZN

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- 15 March 2015
  o Case 1
  o eThekwini District KZN
- 15 March to 7 April 2015
  o 3 more cases in eThekwini
- 26 April
  o 1st Case in Ugu District

- As of 12 June 2015
  o 15 cases
  o 4 deaths
  o outbreak currently controlled
No identifiable link between cases in Ugu and Durban
Infectious Diseases

• spread linked to:
  — hygiene
  — nutrition
  — access to health care
  — education
  — overcrowding

• vaccines
  — critical in decreasing rates of vaccine preventable illnesses
Diphtheria global annual reported cases and DTP3 coverage, 1980-2014

Source: WHO/IVB database, 2015
WHO Member States
Data as of July 2015

Date of slide: 14 July 2015
Soviet Union Outbreak

• 12,267 cases
  — ~ 75% adult cases
  — 454 deaths; 4% mortality rate

• lessons learned
  — focus on prevention ie: diphtheria immunization programs
    o achieve a high level of childhood immunization
      ➢ coverage at least 90%
    o maintain immunity against diphtheria in older age groups
      ➢ boosters
  — early during outbreak
    ➢ immunisation as a control strategy
Immunity against diphtheria without immunisation

- maternal immunity in 1st 6 mths
- build up of natural immunity through exposure from 6 mths to adolescence
- boosting of immunity by circulating organisms
  - ? skin infections (silent reservoir)
Effect of childhood vaccination

• peak immunity earlier

• decrease in circulating organisms
  — in immunised children
  — in adult population that lost vaccine induced immunity
    ➢ adult population at risk

• re-introduction of toxigenic *C. diphtheriae* strain
  — spread in adult population
    ➢ population density: urban spread
    ➢ low socio-economic populations

• dip in vaccination coverage
  — re-emergence in children
  — spread to unprotected adults
Immunity and diphtheria: unresolved questions

• perceived protection of the adult population by wide vaccination coverage of the paediatric population?

• why the disease shift to older age groups before introduction of vaccine?

• in early 1940s:
  — diphtheria outbreaks in Germany, Denmark and Norway
  — why little or no increase of immunity in population post outbreak?
    ➢ organism not invasive
    ➢ competing organisms at mucosal level
    ➢ skin infections as boosters vs respiratory infections
Why did KZN outbreak occur?

• vulnerable population
  —? low vaccination coverage → ↓ herd immunity
  —introduction of 6 and 12 year booster
    ➔ inadequate catch-up done
  —underlying immunosuppression

• Saajida Mahomed
  —outbreak response and lessons learned
Management of Cases

• most effective treatment for diphtheria
  — early administration of DAT
    ➢ neutralisation of toxin
  — *plus* antibiotic therapy
    ➢ killing of bacteria

• Mo Archary
  — case definition, clinical presentation and management of cases
The Great Race of Mercy (1925)

• children were dying from diphtheria in Nome, Alaska
  — no fresh antitoxin on hand
  — hospital in Anchorage
    ➢ sent 300,000 units by train to Nenana ~ 1100km from Nome

• dog sleighs used to reach the children of Nome
  — 20 teams of mushers and sled dogs
  — 5 day trip
KZN Outbreak: Availability of DAT

• DAT
  — equine immunoglobulin preparation
  — On WHO essential medicines list
    ➢ should be affordable and available in countries at all times

• discontinued production in several countries
  — low economic viability
  — high regulatory requirements

• In SA
  — not manufactured
  — no stock in SA: ??short shelf life
  — Initial patients: no DAT
DAT Alternatives

• human convalescent serum
  — emergencies

• monoclonal antibodies (mAbs)
  — several diphtheria antitoxin mAbs in preclinical studies
  — neutralising human mAb developed by Massachusetts Biologic Laboratories (MBL)
    ➢ completely protected guinea pigs from diphtheria intoxication
DAT in Diagnostics

• essential to prove toxin production by bacterium
  —sourcing DAT again a challenge
  —alternatives now being investigated

• Koleka Mlisana
  —laboratory challenges and successes
KZN Diptheria Outbreak Response

• local and Provincial response teams
• overwhelming support from NICD
• NDoH
• WHO