Introduction to Public Health/Communicable Diseases/Tuberculosis

Tuberculosis
Old Disease – New Disease
A Re-Emerging Public Health Challenge

Jane Moore, RN, MHSA
VDH/DDP/TB Program
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Tuberculosis – Old Disease

• May have evolved from M bovis; acquired by humans from domesticated animals ~15,000 years ago
• Endemic in humans when stable networks of 200-440 people established (villages) ~ 10,000 years ago; Epidemic in Europe after 1600 (cities)
• 354-322 BC - Aristotle – “When one comes near consumptives… one does contract their disease… The reason is that the breath is bad and heavy…In approaching the consumptive, one breathes this pernicious air. One takes the disease because in this air there is something disease producing.”

Tuberculosis

• 1882 – Robert Koch – “one seventh of all human beings die of tuberculosis and… if one considers only the productive middle-age groups, tuberculosis carries away one-third and often more of these…”

M tuberculosis as causative agent for tuberculosis

Robert Koch

TB in the US – 1882-2010

• 1900-1940 TB rates decreased in the US and Western Europe before TB drugs available
  – Better nutrition, less crowded housing
  – Public health efforts
    • Earlier diagnosis
    • Limit transmission to close contacts
  – TB sanatoria
  – Surgery

• 1940s-1960s TB specific antimicrobial agents
  – Single drugs – use produced resistance
  – Multiple drugs
• 1960s-1980s TB considered a non-problem
  – TB treatment moved to private sector
  – Loss of TB-specific public health infrastructure
TB in the US – 1882-2010

- 1990s: TB re-emerges as a threat
  - TB-HIV co-infection
  - Drug-resistant TB
  - Globalization allows TB to travel
- 1990s: Increased support for TB prevention and control
  - Funding for public health efforts (case management, contact investigation, directly observed therapy)
  - Better diagnostic and patient management tools

TB in the US – 1882-2010

- 2010: Unmet needs
  - Continued support for TB prevention/control especially with health care reform
  - New drugs and/or drug combinations to allow shorter courses of treatment
  - Shorter, simpler, less expensive treatment regimens
  - Vaccine (beyond BCG)
  - Support for global TB prevention and control activities
    - Rapid diagnostic tests for limited resource settings
    - Better co-ordination of TB and HIV prevention/treatment programs
    - Reliable access to TB drugs

TB: Airborne Transmission

TB Invades/Infects the Lung

Effective immune response
Infection limited to small area of lung
Immune response insufficient

TB – A Multi-system Infection

Natural History of TB Infection

Exposure to TB
No infection (70-90%)
Infection (10-30%)
Latent TB (90%)
Never develop Active disease
Die within 2 years
Untreated
Active TB (10%)
Untreated
Die
Treated
Survive
Latent TB vs. Active TB

Latent TB (LTBI) (Goal = prevent future active disease)
- TB Infection
- No Disease
- NOT SICK
- NOT INFECTIONOUS

Active TB (Goal = treat to cure, prevent transmission)
- TB Infection which has progressed to TB Disease
- SICK (usually)
- INFECTIOUS if PULMONARY (usually)
- NOT INFECTIOUS if not PULMONARY (usually)

Treatment

- Most TB is curable, but...
  - Four or more drugs required for the simplest regimen
  - 6-9 or more months of treatment required
  - Person must be isolated until non-infectious
  - Directly observed therapy to assure adherence/completion recommended
  - Side effects and toxicity common
    - May prolong treatment
    - May prolong infectiousness
    - Other medical and psychosocial conditions complicate therapy
      - TB may be more severe
      - Drug-drug interactions common

TB Cases: United States and Virginia, 1980-2009

TB – re-emerging as a public health issue in the United States

- Old public health concepts (isolation of infectious individuals, closely monitored treatment, recognition and preventive treatment for infected contacts,) are still critical, but will not eradicate TB

- Care providers not familiar with signs/symptoms of TB
  - Diagnosis delayed
  - Inappropriate treatment
  - Drug resistance due to improper use of drugs

- Must address both US born and newcomer populations
  - Older, remote exposure
  - Incarcerated, homeless, history of drug, alcohol use
  - Newcomers from high TB prevalence areas

Challenges to Public Health System

- Public health workers must:
  - Educate, coordinate care with private sector
  - Identify support services (food, housing)
  - Treat TB in geriatric populations
  - Treat TB in children
  - Deal with alcohol, drug abusing, incarcerated and/or homeless patients
  - Manage TB in patients with underlying medical conditions
  - Provide culturally appropriate care for non-English speaking/non-literate populations
  - Treat TB cases with drug resistant TB
VA TB Cases: Urban vs. Rural, 2002-2005

- 1150 VA cases Jan 02-June 05
- 1 DOT trip = 6 miles, 20 traffic lights
- 1 DOT trip = 75 miles

Number of Reported TB Cases by Age: VA, 1996-2009

TB Cases by Age: VA, 2000-2009

- 0-14
- 15-24
- 25-44
- 45-64
- 65+

TB Cases by Age: Southwest Region, 2000-2009

- 0-14
- 15-24
- 25-44
- 45-64
- 65+

TB as a Worldwide Public Health Issue
- World population ~ 6 billion
- ~ 1 in 3 people in world infected
- ~ 8 million new cases of active TB/year
- 2+ million deaths/year
- US population 280 million
  - ~ 3.5% infected
  - ~ 12,000 cases/year
  - ~ 5-7% mortality

Number of Reported Foreign-Born vs. US-Born TB Cases, VA 1996-2009

- US Born
- Foreign Born
Foreign-Born TB Cases in Virginia Regions, 2006-2009

- 2006: 0%
- 2007: 40%
- 2008: 43%
- 2009: 53%

Estimated TB Incidence Rates, 2001

- < 10
- 10 - 24
- 25 - 49
- 50 - 99
- 100 - 299
- 300 or more
- No estimate

Have germs, will travel...
Migrating populations in the 1990s

Compared to 1960-75, four-fold increase in migration

Source: Population Action International 1994

Reported TB Cases by Race/Ethnicity: VA, 2000-2006

Reported TB Cases by Race/Ethnicity, Eastern Region, 2000-2009

Reported TB Cases by Race/Ethnicity, Northern Region: 2000-2009
Addressing the Challenges – TB Control in the US - 2009

- Local, state and federal programs have separate but closely related activities
- Guidelines, Laws and Regulations
  - Guidelines – treatment, contact investigation, prevention – data driven/expert opinion
  - Laws – local or state – case reporting, isolation of infectious individuals
  - Regulations - local or state – implement laws
  - Federal laws/regulations – travel restrictions, entry into the US – no interstate restrictions
  - International travel regulations – WHO – limited

Laws, Regulations, Guidelines

- Guidelines
  - Not laws
  - Current PHS TB guidelines
    - Evidence based
    - Extensively reviewed by experts
  - Intended to guide, not dictate
  - Often become standard of care
  - Exceptions may be justified, should be documented
- VA Laws and Regulations
  - VA statute and implementing regulations
    - TB (suspected and confirmed) reportable
    - HCP and laboratory responsible for reporting
    - Treatment plan signed by HD required prior to hospital discharge
    - Antimicrobial sensitivity testing required
    - M.tb isolate must be submitted to state laboratory
    - HD can require patient to appear for examination, counseling
    - Limited ability to require treatment
      - Detention order possible if failure to cooperate puts others at risk
VDH TB Prevention and Control Policies and Procedures

- Based on USPHS/CDC, ATS, IDSA and Pediatric “Red Book” guidelines
- Adapted to address uniquely Virginia issues

Questions?

Jane Moore
Jane.moore@vdh.virginia.gov
804 864 7920

Thank you