Zoonotic: Bovine Tuberculosis

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The Mycobacterium tuberculosis complex (MTBC)



The taxonomy of organisms in the MTBC is in flux. Recent genomic analyses suggest that all MTBC members belong to a single species – *M. tuberculosis*, with *M. africanum*, *M. bovis*, *M. caprae*, *M. microti* and *M. pinnipedii* considered heterotypic synonyms (variants) of *M. tuberculosis*; and *M. canettii*, *M. mungi*, and *M. orygis* recognised as strains of *M tuberculosis*.

Emerg Infect Dis. 2012;18(4):653-655. https://dx.doi.org/10.3201/eid1804.110888

Bovine Tuberculosis



From January 2017 to June 2018, of the 188 countries and territories reporting their bTB situation to the OIE, 82 countries (44%) were affected, which demonstrates a widespread distribution of the disease

https://oiebulletin.com/?panorama=3-01-tb-wahis-en



GLOBAL TB PROGRAMME NewsFlash



WHO and The Union organize landmark consultation to galvanize action against Zoonotic TB





Reduce Transmission at the Human-Animal Interface

- Improve Food Safety
- Reduce TB prevalence in livestock
- Identify key people and risk factors for zoonotic TB

Improve the Scientific Evidence Base

- Surveillance
- Reporting
- Diagnostic Tools
- Research Gaps
 - Epidemiology
 - Diagnostics
 - Vaccines
 - Treatment Regimes



10 PRIORITIES FOR ZOONOTIC TB



Strengthen Intersectional and Collaborative Approaches

- Increase Awareness
- Develop and Implement Empowering Policies
 - Improve Surveillance & Reporting
 - Improve Diagnosis and Treatments
- Identify Community Driven "One-Health" Interventions
- Advocate for Political Commitment and Funding to Address Zoonotic TB on a global scale



Historical and Current Control Measures

- Pasteurization of milk
- Meat inspection
- Tuberculin testing
- Compulsory slaughter of reactors
- Movement restriction
- In many countries test-and-slaughter strategies are not feasible for economic, logistic, social or cultural reasons.

Research Gaps: Human host

- Improve diagnosis in people using tests that differentiate between *M. tuberculosis* and *M. bovis* (and other members of the MTBC)
- Generate a sound evidence base for the global burden and economic impact of Zoonotic TB.
- Rapid point of care tests
- Modified antimicrobial treatment regimes (*M. bovis* is resistant to pyrazinamide) short course treatments.

Research Gaps: Livestock hosts (1)

- Development of a defined tuberculin reagent
- Improved diagnostic tests (including pen-side tests)
 - Immunological tests
 - Biomarkers
 - Direct detection of the organism
 - Tests that distinguish between exposed, infected and infectious animals
- Vaccines that improve or replace BCG
- Diagnostic tests that <u>D</u>ifferentiate <u>Infected from Vaccinated Animals</u> (DIVA)
- Accurate models to inform cost effective vaccine strategies

Research Gaps: Livestock Hosts (2)

- Differences on genetic resistance and transmissibility are largely unknown
- Better understanding of transmission pathways and risk factors for TB transmission (including use of whole genome sequence data)
- Role of environmental persistence in *M. bovis* transmission.
- Therapeutics

Research Gaps: Wildlife hosts

- Better understanding of the role of wildlife hosts in transmission pathways and risk factors for TB transmission
- Improved diagnostic tests for wildlife (including POC tests)
- Vaccines (including the use of oral vaccines for some species)
- Alternative control methods and improved biosecurity (these will depend on the specific epidemiological situation and wildlife species involved)

Fundamental, Underpinning Research Gaps

- Understanding host pathogen interaction throughout the lifecycle of infection including the role of latency.
- Understanding the basis of host preferences within the MTBC
- Defining the nature of protective immunity and the immune responses that cause host pathology and to define biomarkers of immunity and disease progression.
- Defining the role of antibodies in the control of infection and in disease pathology.
- Understanding transmission mechanisms between probable wildlife maintenance hosts and livestock.

STAR-IDAZ DISEASE ROADMAP bTB: Development of candidate vaccines





https://www.star-idaz.net/app/uploads/2019/01/Global-Research-Alliance-for-Bovine-Tuberculosis.pdf

DISCONTOOLS Expert group composition

- Expert group members are included where permission has been given
- Glyn Hewinson, Aberystwyth University, UK [Leader]
- Martin Vordermeier, APHA, UK
- Kevin Kenny, Research Officer Ireland, Ireland
- Tiny Hlokwe, ARC-Onderstepoort Veterinary Institute, South-Africa
- Gunilla Källenius, Karolinska Institutet, Sweden
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