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Lingering zoonoses with respect to tuberculosis: A challenge to 21st Century

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Abstract
Lingering zoonoses or neglected zoonoses are ancient diseases (NZD) affecting both humans and animals (domestic and wild) which keep re-emerging as public problems for a number of reasons. The term neglected highlights those diseases which affect mainly poor and marginalized populations in low resource settings. Neglected zoonoses is commonly associated with poverty and impacts the lives and livelihoods in periurban slums primarily in developing countries. This is an ancient zoonotic disease which imposes a dual burden on human and animal health. They are distinguished from higher profile zoonotic diseases as they affects mostly poor and underserved populations, are under-diagnosed and under-reported, does not travel far and cross distant boundaries, generates significant health burden and economic losses, control at source when feasible is cost effective.

Keywords: Antibiotic resistance, bovine mastitis, *Staphylococcus aureus*

Introduction
Lingering zoonoses are re-emerging in some regions but they attract less public awareness. These diseases occur in endemic form or cause chronic disease which tends to attract less public attention, although locally they might even be of a higher socioeconomic impact. (Maudlin *et al.*, 2009) [1]. Neglected zoonotic diseases are eradicated almost in all wealthier countries, but remain major causes of ill health and mortality across developing nations (continents) like Africa, Asia, and Latin America. They are not new pathogens, nor have they recently crossed from affecting animal populations to affecting humans.

The main reasons for these lingering zoonoses are
- Under reporting which results in an underestimation of their global burden that downgrades their relevance to policy makers and funding agencies.
- Most of the neglected zoonotic diseases are confused with other diseases. For example where malaria is present fevers due to Brucellosis and human African trypanosomiasis are often misdiagnosed.
- Although diagnostic tests are available for diagnosing neglected zoonotic diseases in animal populations, many are not standardised for routine surveillance and absence of reference standards is problematic (Welburn *et al.*, 2015) [2].

The impact of the NZD's falls most heavily on the poor, impacting on the health systems in which they live. Poor people are more at risk contracting many zoonoses. They are vulnerable to diseases associated with
1. Handling of animals (mostly called as occupational hazard) example: Anthrax, Bovine T.B.
2. Consumption of livestock products ex: cysticercosis, food borne illness
3. Vectors, water and the environment can also be the sources of Neglected zoonotic diseases (King, 2011) [3].

Once infected it is the poor that are least likely to get proper medical care. So the impact of NZD's is also worse in poor households where a dual burden is borne because both people and the animals are involved. Thus, NZD's not only make the members of the families' ill, but also at the same time, limit the productivity of their livestock and poultry. Recent research revealed that dogs can be a source of methicillin-resistant Staphylococcus aureus and could play a role in zoonotic spread (Cutler *et al.*, 2010) [10] which may come under neglected zoonoses and the organism S. aureus is also responsible for clinical mastitis (Maity *et al.*, 2020) [4].

List of diseases

WHO (2006) lists the following lingering zoonoses and is concerned about the fact that they seem to attract less public awareness:

- Bovine tuberculosis.
- Anthrax.
- Brucellosis.
- Cysticercosis.
- Neurocysticercosis.
- Cystic echinococcosis or hydatid disease.
- Rabies.
- Zoonotic sleeping sickness (Human African Trypanosomiasis).

Bovine tuberculosis or zoonotic tuberculosis

Human Tuberculosis caused by the Mycobacterium tuberculosis is one of the most devastating human infections worldwide and is one of the big three killer diseases worldwide. Bovine Tuberculosis is found throughout the world even though many developed countries have reduced or eliminated Bovine Tuberculosis from their cattle population the disease still exists in the wildlife or they are infected by the reactivation of longstanding latent infections acquired before the adoption of milk pasteurisation or infections contracted abroad (Rua-domenech *et al.*, 2006) [5]. In developing countries the disease is seen mostly in poor and marginalised families as the disease is contagious and spread by contact with infected domestic and wild animals and through the consumption of unpasteurised dairy products and from the close contact of humans with their livestock by inhaling the infected droplets which are expelled from lungs of animals suffering from latent infection by coughing. No relevant data is available about the contribution of M.bovis to T.B Epidemics of humans. As it is a chronic disease, the course of the disease is very slow taking months or years to kill an infected animal. So the animal can spread the disease to many other herd mates before it begins to manifest clinical signs. Of the total Asian cattle and buffalo populations, 6 % and less than 1 %, respectively, are found in countries where bovine TB is notifiable and a test-and-slaughter policy is used; 94 % of the cattle and more than 99 % of the buffalo populations in Asia are either only partly controlled for bovine TB or not controlled at all. Thus, 94 % of the human population lives in countries where cattle and buffaloes undergo no control or only limited control for bovine TB (Cosivi *et al.*, 1998) [6]. M. bovis TB is frequently found outside the lungs and it is almost impossible in impoverished settings to distinguish between regular TB which requires more expensive drug therapy (Welburn *et al.*, 2015) [2]. So this disease is also underdiagnosed or misdiagnosed or underestimated.

Zoonotic tuberculosis caused by M. bovis is present in most developing countries where surveillance and control activities are often inadequate or unavailable so it can be placed under Neglected zoonotic diseases. In order to control zoonotic TB proper diagnostic tests are necessary. Enzyme-linked immunosorbent assay and gamma-interferon tests may prove to be more sensitive and specific than the tuberculin test. Combination of intradermal skin test with ELISA enhances sensitivity up to 90 % when compared to individual tests. Restriction fragment length polymorphism analysis (DNA fingerprinting) could be useful in epidemiologic studies that trace the spread of disease between cattle, other animals, and humans (Van Embden *et al.*, 1995) [7] or in the rapid differentiation of *M Bovis* within the *M Tuberculosis* complex (Liebana *et al.*, 1996) [8] but the use of these techniques is limited by resources in most developing countries.

Prevention and control

1. In developed countries it can be controlled by test and slaughter method if no other reservoir host exists. Alternative strategies (e.g., programs based on slaughterhouse surveillance and traceback of tuberculous animals to herds of origin) may be technically and economically more appropriate in developing countries. Measures to prevent transmission of infection should be the primary objective to be achieved with trained public health personnel, public education, and proper hygienic practices.
2. Although not usually considered relevant to elimination programs in livestock vaccination of animals against TB would be a viable strategy in two disease control situations: in domesticated animals in developing countries and in wildlife and feral reservoirs of disease in industrialized countries where test-and-slaughter programs have failed to achieve elimination of the disease.
3. The vaccine generally used for the prevention of TB is BCG (Bacillus Calmette Guerin) but, the results obtained globally have been suboptimal and efficacy has varied considerably from region to region (O'Reilly LM *et al.*, 1995) [9]. The delivery of the vaccine poses few problems in domesticated animals, but it is fraught with difficulties in wild animals and the vaccination may compromise diagnostic tests.

Conclusion

Neglected zoonoses are public health concern. Repeated sero-surveillance, monitoring and adapting adequate major may reduce the transmission.

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