What's the Matter with Tuberculosis (or was that Mexico?)

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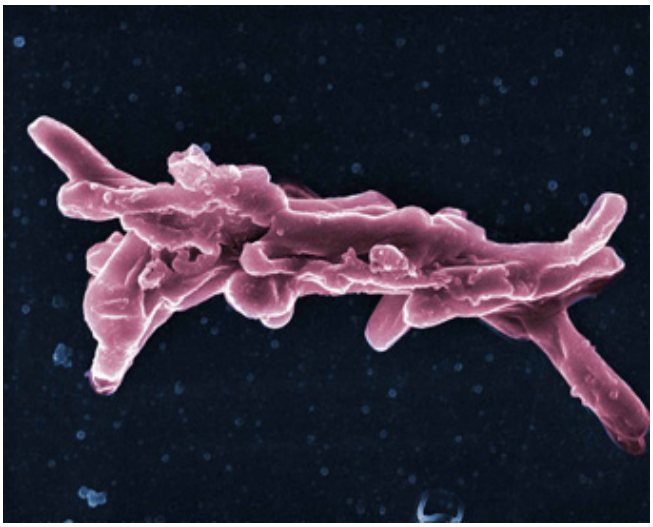
In the aftermath of the recent heated debate in the Kansas State Collegian and blog about the potential danger for public health by immigrants from below the southern border of the United States and the variety of political and especially moral questions raised in this context, it appears to be wise to summarize some important facts about tuberculosis, because any discussion, which is not based on facts, is futile – to say the least.

Tuberculosis (TB) is a bacterial infection, found in human remains from as early as 4000BC, for example in many Egyptian mummies. TB is found only in cattle and humans, and it most likely entered the human body via the consumption of unpasteurized milk. TB is a small rod-like bacillus, which can withstand many disinfectants and survive in a dry state for weeks, but can only grow in a (human or bovine) host organism. Approximately two to three billion people (roughly one in every three humans) are infected worldwide, and it is a health problem in every country.



Mycobacterium tuberculosis (MTB), was first described as the bacillus causing tuberculosis, on March 24, 1882 by Robert Koch (March 24th is now known as International TB Day.). MTB is a slow-growing aerobic bacterium that divides every 16 to 20 hours (for comparison *E. coli* can divide roughly every 20 minutes.). In healthy humans, more than 90 percent of the MTB infections are latent, showing no signs of the disease. However, the probability of staying health greatly decreases with age and the presence of secondary infections, especially the (viral infection) HIV/AIDS infection. Only patients with so-called active TB, or those showing signs of this illness usually spread MTB.

TB is most commonly spread through aerosol droplets, meaning when someone breathes, coughs or sneezes. One active TB-patient, who remains untreated, can infect 10-15 people per year in an urban environment. The infection usually begins in the lungs - infecting alveolar macrophages, where the mycobacteria replicate exponentially. It can then spread to virtually all parts of the body. Therefore, only 10-30 percent of all active TB cases show the "typical signs" of a TB-infection (fever, coughing blood,

“consumption”-like symptoms) and the typical necrotic tissue (caseus necrotis) in the lungs so that the infection can be spotted when an taking X-ray image. The other TB-infections are very hard to detect, because symptoms like headaches and other pains throughout the entire body are usually unspecific. If TB bacteria gain entry to the blood stream from an area of tissue damage, they spread through the body and set up myriad foci of infection, all appearing as tiny white tubercles in the tissues. This is called miliary tuberculosis and has a high fatality rate.

Treatment with the appropriate antibiotics kills the bacteria and allows healing to take place. Affected areas are eventually replaced by scar tissue. There were an estimated 8.8 million new TB cases in 2005: 7.4 million in Asia and sub-Saharan Africa. A total of 1.6 million people died of TB in 2005, including 195,000 patients infected with HIV.

The first genuine success in immunizing against tuberculosis, developed from an attenuated (weakened) bovine strain of tuberculosis in 1906, was BCG (Bacillus of Calmette and Guerin), It was not used outside of France until after WW2. Today, approximately 1 billion humans are vaccinated against TB, but this vaccination has become mostly ineffective due to the mutation – or rather evolution – of the mycobacterium. It is still used though in many countries which causes a “positive” diagnosis if the person is tested for TB, even if they are not infected. More testing is then required to determine if the person actually has TB.

Multidrug-resistant TB (MDR-TB) is caused by TB bacilli that are resistant to at least isoniazid and rifampicin - the two most powerful anti-TB drugs. XDR-TB is the abbreviation for extensively drug-resistant tuberculosis. TB can usually be treated with a rigorous course of four standard, or first-line, anti-TB drugs over many months. If these drugs are misused or mismanaged, multidrug-resistant TB (MDR-TB) can develop. MDR-TB takes longer to treat with second-line drugs, which are more expensive and have more side effects. According to a recent World Health Organization (WHO) report, TB patients in parts of Eastern Europe and Central Asia are now ten times more likely to have MDR-TB than those in the rest of the world. XDR-TB can develop when these second-line drugs are also misused or mismanaged and therefore also become ineffective. Because XDR-TB is resistant to first- and second-line drugs, treatment options are seriously limited. It is therefore vital that TB control is managed properly.

Finally, it has to be mentioned that it is extremely costly to treat patients with all forms of tuberculosis, because the medications have to be given in high doses and over a long period of time, often several years. In the US, the treatment of each TB-patient costs approximately $200,000! And yes, every researcher would be extremely happy to get just this amount per year for TB research!

But what does all of this have to do with Mexico?

As already pointed out, Mexico does not belong to the countries with a high risk of TB-infections and actually is in the same risk category as the USA and Canada. Illegal immigration is certainly a problem that cannot be ignored, however, the greatest risk for the health of the people of the United States comes from immigrants from Asia, Africa and the Russian Federation and anyone traveling to these places, because the incidence, prevalence and the ratio of MDR-TB and XDR-TB are much higher there than in Mexico. For instance, the incidence of TB in 2005 was 23 people per 100,000 (-6.9, compared to 2004) in Mexico and 4.5 people per 100,000 (-3,2) in the US. Both

countries belong to the lowest group (>50 per 100,000) worldwide. For comparison, the rate of infection in South Africa is over 600 per 100,000 and in China over 100 per 100,000. In the same year, the incidence of new adult TB cases of HIV-positive patients was 1.7 per 100,000 in Mexico, compared to 15 per 100,000 in the US (and the sad fact of the rate in South Africa: 58 per 100,000).

So the conclusion based on the data provided by WHO (http://www.who.int/topics/tuberculosis/en/) is that Mexico does not belong to the countries representing a special risk for TB-infection. However, TB is an enormous worldwide problem, which demands much higher efforts towards recognition and treatment and especially the development of new potent drugs and vaccines against TB.