New vaccines may not reduce TB incidence

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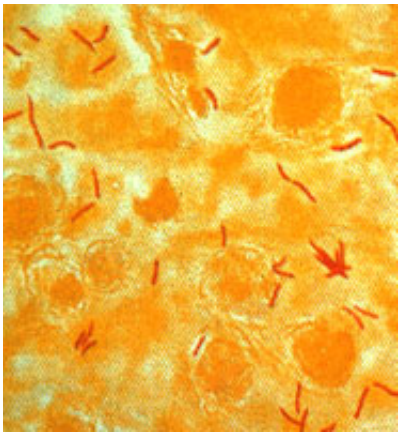

TB bacteria (red). Photo by CDC

(PhysOrg.com) -- Despite the potential of new vaccines to prevent TB, new research shows that the removal of one strain of TB can allow a previously suppressed strain to succeed. Consequently, a vaccination program could result in the proliferation of strains more likely to be, or become, drug resistant, and could even result in an increased prevalence of the disease.

The new research from the University of Bristol, in collaboration with colleagues in the USA, is published this week in the Proceedings of the National Academy of Sciences.

Tuberculosis is caused by infection with the bacterium Mycobacterium tuberculosis. There are nearly nine million new cases of TB each year

and two million deaths world wide. A major priority in medical research is the development of new, more effective anti-TB vaccines. To date, this effort has yielded more than 200 new vaccine candidates, many of which are now undergoing animal testing and early clinical trials.

Recently, large-scale genetic typing of strains of mycobacteria have revealed that there is considerably more genetic diversity than was previously believed. Current evidence suggests that distinct strains may initiate different immune responses, and that vaccines under development may be effective against only some of the circulating strains.

The ways that different strains may activate or suppress the host's immune response, and compete with each other in individual hosts, are not well understood, so Dr Caroline Colijn from Bristol University's Department of Engineering Maths, used a range of mathematical models to explore the way the different strains respond in different scenarios.

"In most scenarios increasing vaccine coverage reduces the overall TB burden", said Dr Colijn. "However, the benefits are reduced if the preferential removal of one strain allows a previously suppressed strain to succeed. We found that there is a possibility that TB prevalence may increase due to a vaccination program effective against a dominant strain, if that strain didn't provoke a good immune response.

"This creates a concern that vaccination policies could affect which strains are present in a population, potentially releasing strains with an increased potential for drug resistance, and could even result in an increase in disease levels."

This phenomenon has already been observed for other pathogens, including streptococcus pneumoniae, the bacterium that can cause pneumonia, and Haemophilus influenzae, common bacteria that cause a

wide variety of infections in children.

Even in scenarios when vaccination does not cause any such perverse effect, it affects the strain composition in the population through selective pressure, and this could be a cause for concern.

Dr Colijn added: “Our results indicate that the public health benefit of new TB vaccines and vaccination programs will depend critically on the diversity of circulating strains, the in-host competition between the strains and on the strain specificity of the vaccines.

“Larger studies of diverse clinical strains would help to determine variability of target vaccine antigens; new vaccines should be tested against as wide a variety of clinical strains as possible. They dynamics of multiple infections in individuals, and the immune responses these stimulate will also play an important role in determining the effectiveness of new interventions.”

Provided by University of Bristol