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- [HOME](#)
- [EDITORIALS](#)
- [NEWS](#)
- [FEATURES](#)
- [OPINIONS](#)
- [REGIONAL GATEWAYS](#)
- [DOSSIERS](#)
- [LETTERS TO THE EDITOR](#)
- [BOOK REVIEWS](#)
- [ANNOUNCEMENTS](#)
- [EVENTS](#)
- [JOBS](#)
- [GRANTS](#)
- [LINKS](#)

- [E-GUIDE TO SCIENCE COMMUNICATION](#)
- [ENGLISH](#)
- [ESPAÑOL](#)
- [PORTUGUÊS](#)

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- [ENGLISH](#)
- [ESPAÑOL](#)
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- [LEGAL NOTICES](#)

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[Back to features](#)

TB or not TB: The threat of bovine tuberculosis

Natasha Bolognesi
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 Source: SciDev.Net

Bovine tuberculosis is no less dangerous to humans than common TB, but relatively little is known about it, reports *Natasha Bolognesi*.



Livestock in KwaZulu-Natal, South Africa

Bovine tuberculosis — a form of tuberculosis (TB) commonly found in cattle — is widespread throughout Africa and, despite its name, infects a variety of hosts, including wildlife, domestic livestock and humans.

European settlers are thought to have brought bovine TB into Africa in the early 1800s. Although scientists have long acknowledged its existence, the rates of infection in cattle and people are poorly understood, let alone controlled.

"Bovine TB is definitely a developing country problem," says Claire Geoghegan, from the Mammal Research Institute at the Department of Zoology and Entomology in the University of Pretoria, "but so little work has been done on this disease".

A 1998 article in the *Journal of Emerging Infectious Diseases* stated that only seven of all African nations consider bovine TB a notifiable disease. It estimated that approximately 85 per cent of the cattle and 82 per cent of the human population of Africa are in areas where bovine TB is only partly controlled or not at all.

According to Anita Michel at the Agricultural Research Council's Onderstepoort Veterinary Institute near Pretoria, South Africa, the lack of data on bovine TB relates to its perception as an animal disease. "With the health problems relating to HIV/AIDS and human TB, bovine TB is inevitably assigned an extremely low priority," she says.

But Claire Geoghegan regards South Africa's high level of HIV/AIDS as a major incentive for bovine TB research.

In sub-Saharan Africa, HIV/AIDS is endemic and communities are more vulnerable to opportunistic infections — especially TB.

Spotting the difference

Bovine TB is caused by *Mycobacterium bovis* — a close relative of *Mycobacterium tuberculosis*, the organism that causes TB in humans.



M. bovis is clinically difficult to distinguish from *M. tuberculosis* because, explains Geoghegan, TB strains share 99 per cent of their DNA sequences. This means that the standard test for TB — microscopic examination of sputum — cannot reveal the exact strain causing the disease.

M. bovis may be the cause of an unknown number of human TB cases in Africa, says Geoghegan.

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According to Ben Marais, from the Ukwanda Centre for Rural Health in South Africa, "The treatment for *M. bovis* differs from TB treatment in that *M. bovis* is inherently resistant to pyrazinamide, one of the standard TB drugs."

But Marais says the strongest anti-TB drugs, such as isoniazid, rifampicin and ethambutol, are still active against *M. bovis*.

Indeed, Bernard Fourie, former director of TB research at the South African Medical Research Council, says that bovine TB in humans is uncommon these days, and fully curable.

The challenge, says Fourie, lies in accurately diagnosing bovine TB.

Symptoms of bovine TB in humans are different from those of common TB, which severely compromises lung function. Young children infected with *M. bovis* typically have abdominal infections and older patients suffer from swollen and sometimes ulcerated lymph glands in the neck.

The threat to humans

If an infection is missed and no treatment offered, the disease can spread through vulnerable communities.

Fourie stresses the importance of research into bovine TB because it "can be transmitted through the air from person to person (causing lung infection), and could cause point epidemics in high-risk populations such as in HIV-infected people."

Bovine TB poses a further risk through transmission from livestock.

In Africa, cattle are important for food and as a cultural status symbol: the more cows you have the richer you must be. In a marriage transaction, for example, the groom's family will typically pay the bride's father a 'lobola' of as many as 11 cows. And some traditional ceremonial events involve the slaughter of a goat or cow. It is this close cultural and physical link with cattle, says Geoghegan, that puts rural communities at risk of infection.

Anita Michel explains that people can become infected with *M. bovis* by drinking unpasteurised cow or goat milk and possibly by eating infected organs from slaughtered animals. Cattle herders, many of whom are young boys, are also at high risk as bovine TB can be transmitted through the air from cow to human.

Gathering hard facts

Although quantified data on animal TB in Africa is scarce, studies between 1950 and 1970 in Egypt, Nigeria and Zaire indicated the presence of bovine TB. In Tanzania, as recently as 2006, 88 per cent of villages screened had at least one animal that tested positive for bovine TB and 10.5 per cent of people with stomach or lymph gland tuberculosis were infected by *M. bovis*.

Tanzanian researchers concluded that, "the growing concerns about TB in Africa and the knowledge that *M. bovis* does contribute to the current human epidemic emphasise the importance of integrating veterinary, medical and wildlife sectors in the investigation and control of this disease."

Projects to investigate bovine TB are now underway in Chad, Mozambique, South Africa, Tanzania, Uganda and Zambia.



Dip tank in KwaZulu-Natal, South Africa

Scientists working in the Greater Limpopo

Trans Frontier Conservation Area — which spans the Limpopo National Park in Mozambique, Kruger National Park in South Africa and Gonarezhou National Park in Zimbabwe — are acutely aware of the importance of quantifying the potential for disease transmission as patterns of animal and human movement change.

Efforts so far have focused on quantifying spread of the disease in wildlife before and after the establishment of wildlife parks.

Work by a bovine TB consortium is underway in Ethiopia, as part of the Initiative on Animal Health in the Developing World run by the UK's

Wellcome Trust. Consortium spokesperson Douglas Young explains, "There are no reliable data on the prevalence of *M. bovis* in either cattle or humans in Ethiopia. We are collecting data and trying to develop an economic model to assess the cost of the disease and the potential cost-benefit of interventions."

Estimating the spread

Claire Geoghegan is leading a South African research programme to quantify the prevalence of bovine TB in poverty-stricken areas, and find out who is at most risk and why.

The study area is KwaZulu-Natal province where, according to Geoghegan, the level of TB — including drug-resistant TB — and HIV/AIDS in farming communities is one of the highest in the country, if not the world.

Geoghegan's research initially aims to discover where bovine TB occurs in domestic livestock around South African wildlife parks. Studies undertaken by US researchers at the universities of Berkley and Oregon indicate there is a high prevalence of bovine TB in buffalo, warthog, kudu, lion and cheetah in the Kruger National Park in northern Mpumulanga province and in the Hluhluwe-iMfolozi park in eastern KwaZulu-Natal province.

According to Geoghegan, bovine TB was originally passed to cattle from wild animals, particularly buffalo, in the 1960s but was only picked up in the 1990s. "Bovine TB, like animals, crosses boundaries and [into] other species," she says.

Her team will determine risk factors for *M. bovis* transmission, including infection through diet and the air. Different strains of TB collected from wildlife, cattle and people will be analysed to determine the rate of animal to human transmission of bovine TB.

Containing bovine TB

Geoghegan's group are also testing cattle for infection at local dip tanks, where animals are injected under the skin with *M. bovis*. A thickening of the skin after 72 hours at the injection site indicates a positive reaction to the administered TB strain, which means that the body has been previously exposed to the bacteria and that the cow has bovine TB.

Infected cattle are then slaughtered and the farmers awarded compensation. Geoghegan stresses the importance here of a sensitive approach because of the cultural and economic value of African cattle. Trusted veterinary public health technicians provide community education in the local language, Zulu, to emphasise the importance of using the testing service for bovine TB to help prevent the disease from spreading through their cattle and families.

Ultimately, Geoghegan and her team hope to collate their results with other African data to develop mathematical models that can be used to predict bovine TB incidence throughout Africa. "Once we have the answers to our questions," says Geoghegan, "we can start education programmes to control any spread of the disease".

Their investigations are taking a holistic approach, involving doctors, farmers, educationists and veterinarians, to help familiarise all strata of society with the prevalence of bovine TB and to empower communities in the control of the disease.

Geoghegan hopes that her study will show that bovine TB's threat to public health is underestimated, but that it can be controlled to reduce disease and poverty.

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Photo Credit: Claire Geoghegan

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