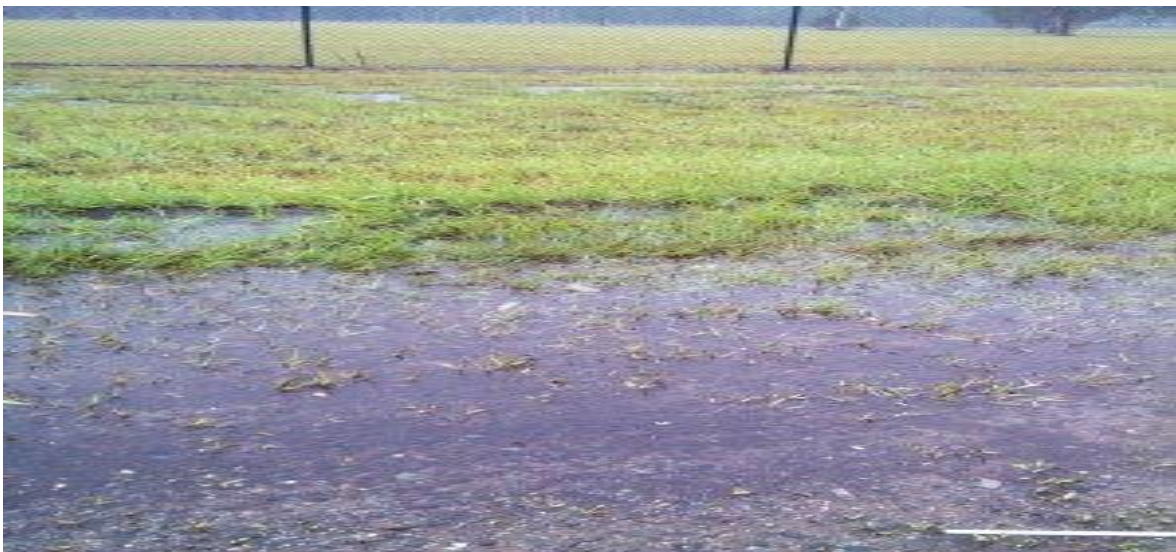


Disease Discourse – Melioidosis in Goats

If you are in the tropics or sub-tropics and your goat pastures look like this, you need to read this 8 page factsheet.



The wet season in northern Australia is the beginning of the melioidosis season. This disease is caused by a soil-borne bacteria that used to be called *Pseudomonas pseudomallei*, but has since been renamed as *Burkholderia pseudomallei*. When these soil bacteria enter the body of any animal (animal or human) then disease can occur, based on the species susceptibility and unfortunately, goats are very susceptible. It is a tropical disease, most commonly found in northern Australia and SE Asia in the belt from 20 degrees north to 20 degrees south latitude. There are suggestions that this disease is now in India, Pacific Islands, Taiwan, China ¹ and the Caribbean,² although whether this is spread or just better diagnostic capacity and awareness in these developing countries³ remains debatable. Also it is uncertain as to whether climate change is having an affect or not.

Camels and alpacas are most susceptible,⁴ followed by goats and sheep and then by pigs. It is rarer in cattle⁵ and horses. Camels that were moved into northern wet areas and an alpaca that was moved to Darwin,⁶ all

¹ Li, L. and Y. W. He (1992). "Pseudomonas pseudomallei and melioidosis in China." Chin Med J (Engl) **105**(9): 775-779.

² Dance, D. A. (2000). "Melioidosis as an emerging global problem." Acta Trop **74**(2-3): 115-119.

³ Currie, B. J., D. A. Dance and A. C. Cheng (2008). "The global distribution of Burkholderia pseudomallei and melioidosis: an update." Trans R Soc Trop Med Hyg **102** Suppl 1: S1-4.

⁴ Radunz, B., L. Melville and B. Currie (2009). "Territory One Medicine, One Health network and melioidosis in livestock and humans." Proceedings of the Australian Veterinary Association (AVA) Annual Conferences, 2009 AVA Annual Conference, Cattle/Public Health Stream.

⁵ Choy, J. L., M. Mayo, A. Janmaat and B. J. Currie (2000). "Animal melioidosis in Australia." Acta Trop **74**(2-3): 153-158.

died of melioidosis.⁷ Melioidosis can also occur in crocodiles, native birds, kangaroos and other Australian wildlife.⁸ Pigs can become infected but often show no clinical signs with diagnosis only being made when abscesses are found during abattoir inspections.⁹ Similar susceptibilities have been found in SE Asia e.g. Thailand, where goats were found to be the most susceptible, with an incidence of 1.63 per 100,000 goats each year, followed by pigs and cattle.¹⁰ One group of researchers suggested that goats milk produced in tropical areas should be pasteurized.¹¹ Zoonotic transmission of melioidosis from animals to humans is extremely unusual.¹² Cases in animals and people occur in similar geographic areas as both are exposed to the same soils and muddy waters containing these bacteria.

Melioidosis in People

Goat owners in the tropics are at risk especially if they work in muddy paddocks or areas of introduced grasses. However people are less susceptible than animals and generally only get melioidosis if immune-compromised due to diabetes, kidney disease, chronic lung or heart disease, or high alcohol/kava consumption. Up until September 2012 there were 97 cases in people in the Northern Territory for that year, mainly from indigenous communities. It is estimated that melioidosis kills 1000 people a year in Thailand and the areas where goats are most affected are also the areas where people are likely to be reported as having this disease.¹³

A HealthMap/ProMED-mail map can be accessed at this website, <<http://healthmap.org/r/1yAg>>. All that is needed is to use the advanced search capacity and add "melioidosis" as the disease and then add in a time period of a couple of years. This will then show a map of the melioidosis cases that have been reported for all human and livestock diseases. Alternatively the United States' [Centers for Disease Control and Prevention](http://www.cdc.gov) website has maps of where melioidosis in people is likely to occur, see map below. Susceptible livestock, such as goats, would have a similar distribution pattern.

⁶ Radunz, B., L. Melville and B. Currie (2009). "Territory One Medicine, One Health network and melioidosis in livestock and humans." Proceedings of the Australian Veterinary Association (AVA) Annual Conferences, 2009 AVA Annual Conference, Cattle/Public Health Stream.

⁷ Ibid.

⁸ Choy, J. L., M. Mayo, A. Janmaat and B. J. Currie (2000). "Animal melioidosis in Australia." Acta Trop **74**(2-3): 153-158.

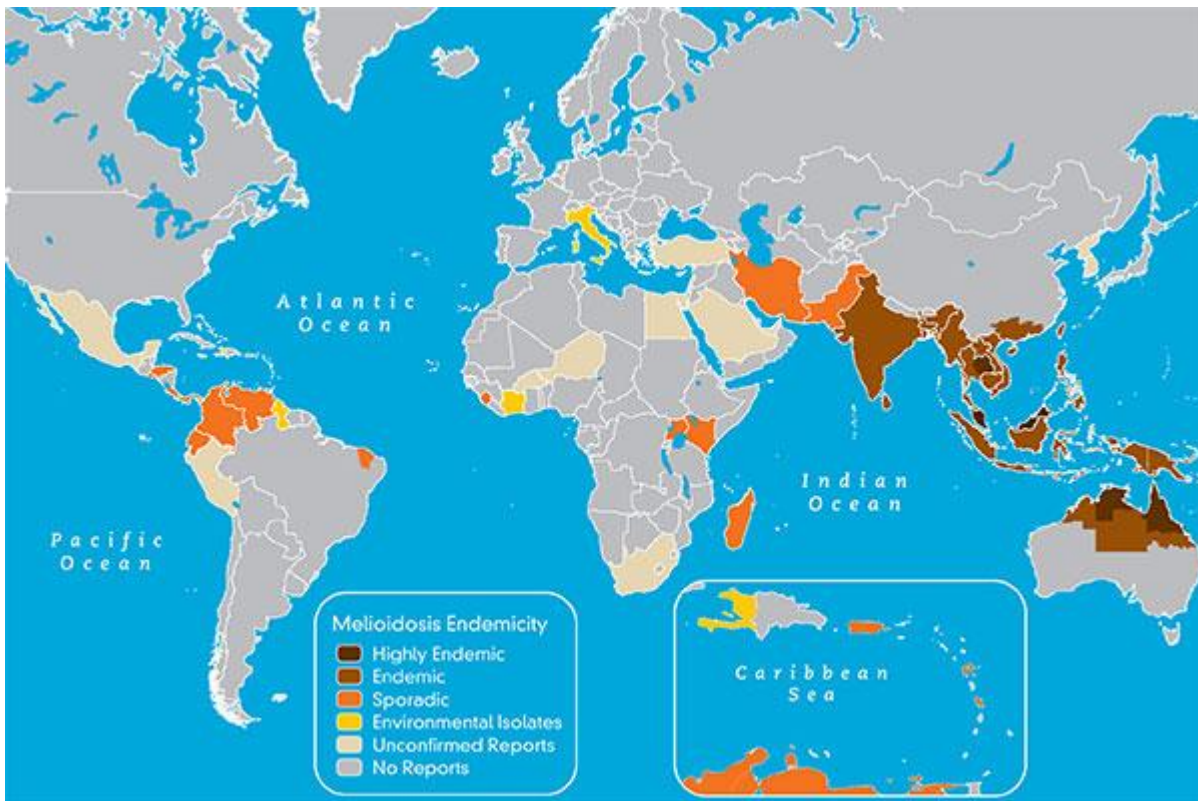
⁹ Ibid.

¹⁰ Limmathurotsakul, D., S. Thammasart, N. Warrasuth, P. Thapanagulsak, A. Jatapai, V. Pengreungrojanachai, S. Anun, W. Joraka, P. Thongkamkoon, P. Saiyen, S. Wongratanacheewin, N. P. Day and S. J. Peacock (2012). "Melioidosis in animals, Thailand, 2006-2010." Emerg Infect Dis **18**(2): 325-327.

¹¹ Choy, J. L., M. Mayo, A. Janmaat and B. J. Currie (2000). "Animal melioidosis in Australia." Acta Trop **74**(2-3): 153-158.

¹² Ibid.

¹³ Limmathurotsakul, D., S. Thammasart, N. Warrasuth, P. Thapanagulsak, A. Jatapai, V. Pengreungrojanachai, S. Anun, W. Joraka, P. Thongkamkoon, P. Saiyen, S. Wongratanacheewin, N. P. Day and S. J. Peacock (2012). "Melioidosis in animals, Thailand, 2006-2010." Emerg Infect Dis **18**(2): 325-327.



What is now also being seen is that travellers who go trekking in the jungles are returning to Europe carrying this disease. The initial infection is generally via cuts and abrasions and early signs are few so international travellers return to their home countries carrying the bacteria within their bodies. This disease is also being reported in France and one author called melioidosis “a tropical time bomb”.¹⁴

What is of major concern is that the mortality rates for melioidosis are still quite high, despite being of bacterial origin with antibiotic treatments available. Reports from France indicated a mortality rate of 40%.¹⁵ Mortality rates in the Northern Territory (NT) have been reducing over recent years and are now considered to be the lowest in the world. In a retrospective study of cases in the Darwin hospital over 20 years, the mortality rate decreased from 30% in the first 5 years to 9% in the last five years. This was attributed to earlier diagnosis and improvements in intensive care management. Of the 77 fatal cases (14%), all had known risk factors for melioidosis.¹⁶ One patient actually lived in a city apartment and it was thought exposure was during a cyclone that resulted in muddy water coming into contact with her lungs. In a 12 year study in the NT of confirmed melioidosis cases, a significant correlation was found between the median rainfall in the 14 days before admission, with 211 mm for those dying with melioidosis, compared to 110 mm for those surviving. The authors thought that heavy monsoonal rains and winds may cause a shift towards inhalation of the melioidosis bacteria.¹⁷

¹⁴ Perret, J. L. (1997). "[Melioidosis: a tropical time bomb that is spreading]." *Med Trop (Mars)* **57**(2): 195-201.

¹⁵ Ibid.

¹⁶ Currie BJ, W. L., Cheng AC (2010). "The Epidemiology and Clinical Spectrum of Melioidosis: 540 Cases from the 20 Year Darwin Prospective Study." *The Epidemiology and Clinical Spectrum of Melioidosis: 540 Cases from the 20 Year Darwin Prospective Study. PLoS Negl Trop Dis* **4**(11).

¹⁷ Currie, B. J. and S. P. Jacups (2003). "Intensity of rainfall and severity of melioidosis, Australia." *Emerg Infect Dis* **9**(12): 1538-1542.

Climate change with the associated severe weather events may increase the incidence of melioidosis¹⁸ and when cyclones travel far inland in the NT, this disease shows up in these new inland areas¹⁹. In recent years cases have been seen in people in temperate areas in Australia, specifically Toodyay outside of Perth²⁰ and Ipswich/ Brisbane areas,²¹ the later cases associated with severe rainfall events.²² Melioidosis is another good reason for people to stay out of flood waters.

The treatment aims to kill the bacteria with antibiotics, stop blood poisoning, find and drain the internal abscesses and boost the patient's immune system. Early vigorous treatment for people is the key and any rural worker or gardener with these symptoms should seek medical advice: fever, breathing problems, abscesses under the skin or general illness. Treatment and recovery periods are very long, with relapses very likely.

There is no real evidence that close contact with livestock increases the risk of people getting melioidosis, although one reference suggested that there may have been three possible zoonotic cases in Australia.²³ These same authors suggested pasteurisation for commercial goat's milk produced in the tropics. It is thought that people, like goats and other animals get it via contaminated soil or water. The bacteria are not setting out to infect people and livestock as they are just happily growing in the mud or even in amoebas in the water. Our livestock, and even people, are just collateral damage if the bacteria end up in the wrong place.

Clinical Signs

The clinical signs in goats vary from sudden death to hind-leg lameness to nervous signs. Nine out of 43 (21%) experimentally infected goats had aortic lesions at autopsy and seven died from aortic aneurysm rupture.²⁴ In goats, these bacteria cause abscesses in lymph nodes and the clinical signs depend on where the internal swollen lymph node is located. If the lungs are affected then there could be coughing and respiratory distress. The udder can become infected, producing a severe mastitis and this was the case in a Boer doe in South Africa.²⁵ Similarly the testes can be infected.²⁶ Transplacental transmission in goats has also been documented and so any kids from an infected doe should be carefully examined.²⁷

Melioidosis was first identified in 1954 in 5 out of 6 goat herds around Townsville.²⁸ Of the goats identified at post-mortem as having melioidosis, 10 out of 18 had no clinical signs and 4 had palpable lesions (swollen

¹⁸ Inglis, T. J. and A. Q. Sousa (2009). "The public health implications of melioidosis." *Braz J Infect Dis* **13**(1): 59-66.

¹⁹ Inglis, T. J., L. O'Reilly, A. J. Merritt, A. Levy and C. H. Heath (2011). "The aftermath of the Western Australian melioidosis outbreak." *Am J Trop Med Hyg* **84**(6): 851-857.

²⁰ Golledge, C. L., W. S. Chin, A. E. Tribe, R. J. Condon and L. R. Ashdown (1992). "A case of human melioidosis originating in south-west Western Australia." *Med J Aust* **157**(5): 332-334.

²¹ Munckhof, W. J., M. J. Mayo, I. Scott and B. J. Currie (2001). "Fatal human melioidosis acquired in a subtropical Australian city." *Am J Trop Med Hyg* **65**(4): 325-328.

²² Scott, I. A., A. M. Bell and D. R. Staines (1997). "Fatal human melioidosis in south-eastern Queensland." *Med J Aust* **166**(4): 197-199.

²³ Limmathurotsakul, D., S. Thammasart, N. Warrasuth, P. Thapanagulsak, A. Jatapai, V. Pengreungrojanachai, S. Anun, W. Joraka, P. Thongkamkoon, P. Saiyen, S. Wongratanacheewin, N. P. Day and S. J. Peacock (2012). "Melioidosis in animals, Thailand, 2006-2010." *Emerg Infect Dis* **18**(2): 325-327.

²⁴ Choy, J. L., M. Mayo, A. Janmaat and B. J. Currie (2000). "Animal melioidosis in Australia." *Acta Trop* **74**(2-3): 153-158.

²⁵ Van der Lugt, J. J. and M. M. Henton (1995). "Melioidosis in a goat." *J S Afr Vet Assoc* **66**(2): 71-73.

²⁶ Fatimah, I., B. O. Ikede and R. A. Mutalib (1984). "Granulomatous orchitis and periorchitis caused by *Pseudomonas pseudomallei* in a goat." *Vet Rec* **114**(3): 67-68.

²⁷ Choy, J. L., M. Mayo, A. Janmaat and B. J. Currie (2000). "Animal melioidosis in Australia." *Acta Trop* **74**(2-3): 153-158.

²⁸ Olds, R. J. and F. A. Lewis (1954). "MELIOIDOSIS IN GOATS." *Australian Veterinary Journal* **30**(9): 253-261.

stifle joint, enlarged sub-axillary lymph node) and there were udder lesions in 2 does. There were also 3 deaths. On post-mortem, the commonest sites of lesions were the mediastinal lymph node (11 out of 18 cases), spleen and lungs. Abscesses were also found in other lymph nodes (3 out of 18 cases), kidneys, liver, udder, stifle joint, nasal cavity, adrenal gland and skin.

Another case occurred in a goat herd in Cloncurry in 1955 and the melioidosis bacteria, *B.pseudomallei*, were cultured from the milk from one goat and liver and spleen abscesses from another. This author reported that the disease in goats may run an acute fatal course or more commonly develop into a chronic condition, which may be overcome, leaving only sterile abscesses or healed lesions. Two cases of acute mastitis and one chronic case have been found in which *B.pseudomallei* was excreted in the milk of this one goat over a period of two months.²⁹

Diagnosis

Most diagnosis in animals is done via a post-mortem or at post slaughter examination. The clinical signs help in diagnosis, as can the presence of abscesses in the locations mentioned above. These abscesses can be sampled aseptically and samples sent to a laboratory for culture of the bacteria, *B.pseudomallei*.

There are blood tests available and some Queensland research on 118 experimentally infected goat sera (blood samples) and 3143 sera collected from goats in the field, has shown that the best method is to use the indirect haemagglutination test as a screening test as it is the most sensitive and picks up past infections. Then confirmation is done with a complement fixation (CF) test which is more specific.³⁰ Newer tests are now available but the [Centers for Disease Control and Prevention](#) (CDC) in the USA still recommends the indirect haemagglutination test.

Vaccine

There is no vaccine for either humans or animals and none is likely in the foreseeable future.

Treatment

Treatment is not generally considered as the disease is zoonotic. Experimental studies in goats have shown that broad spectrum antibiotics did not work.³¹ Long periods of hospitalization, surgical drainage of abscesses and long antibiotic treatments are needed for infected people and even with these efforts, treatment is often unsuccessful.

Prevention - How can you protect your goats?

Melioidosis is caused by a type of bacteria that is spread by soil and water and can survive in water for up to 20 months and in soil for up to 30 months. These bacteria live in the clay layer of dirt, around 25-30cm below the surface but with the wet season, the bacteria move up to the surface, contaminating mud, pastures and surface water. The bacteria multiply by division in both the soil and in animals. So if you are doing earthworks, keep goats away from the area and disturbed soil.

It gets into goats by being ingested (via the mouth), being inhaled (via the nose) or through scratches or wounds that get contaminated. So keep your goats out of flooded pastures and ensure their water supply is

²⁹ Cottew, G. S. (1955). "MELIOIDOSIS." Ibid. **31**(6): 155-158, ibid.

³⁰ Thomas, A. D., G. A. Spinks, T. L. D'Arcy, J. H. Norton and K. F. Trueman (1988). "Evaluation of four serological tests for the diagnosis of caprine melioidosis." *Aust Vet J* **65**(9): 261-264.

³¹ Thomas, A. D., J. C. Forbes-Faulkner, J. H. Norton and K. F. Trueman ibid. "Clinical and pathological observations on goats experimentally infected with *Pseudomonas pseudomallei*." (2): 43-46.

as clean as possible. An outbreak of human melioidosis was associated with water that was too acidic and not properly chlorinated.³² If you have to use dam or river water and are in a melioidosis area, consider chlorination. The poultry industry often uses chlorination to control other diseases, so information and the technology is readily available – see

http://www.daff.gov.au/animal-plant-health/pests-diseases-weeds/biosecurity/animal_biosecurity/bird-owners/water_biosecurity



If you have to use water like that illustrated to the right, or muddy dam or river water and are in a melioidosis area, consider chlorination.

Fortunately goats hate damp conditions so if you provide raised areas with clean feed and water they will prefer it to flooded pastures. If livestock are likely to have cuts e.g. after shearing or foot-paring, keep them away from soil by keeping them on raised floors, such as are found in a shearing shed. Lameness in dairy cattle and goats is often associated with muddy wet laneways, so it may be worth ensuring that laneways are well drained and mud free to protect from melioidosis as well.



Fortunately goats hate damp conditions so if you provide raised areas with clean feed and water, they will prefer it to flooded pastures, like the one to the left.

If cutting and carrying feed for goats, place the feed onto a tarpaulin or canvas sheet so mud does not contaminate the feed. Also cut the stems as high as possible.

³² Inglis, T. J., S. C. Garrow, C. Adams, M. Henderson, M. Mayo and B. J. Currie (1999). "Acute melioidosis outbreak in Western Australia." *Epidemiol Infect* **123**(3): 437-443.

If you live in the tropics, what are the best ways to protect yourself?

People in the tropics should be sensible and not walk around in bare feet in muddy or flooded areas, use boots and gloves while working in the field or garden, clean and cover any cuts and scrapes, protect themselves by staying indoors during cyclones and dust storms. If using bore water make sure the bore is very deep and cannot be contaminated with flood or surface water and/or consider chlorination. Do not enter flooded streams or boggy, grassy areas unless essential. People should seek medical help they get a fever or an abscess or have pneumonia-like symptoms and have been in the tropical areas or exposed to floods or cyclones. The Northern Territory Department of Health has an excellent factsheet giving similar advice³³ and is much better than the US CDC bare bones advice. See http://www.health.nt.gov.au/library/scripts/objectifyMedia.aspx?file=pdf/43/46.pdf&siteID=1&str_title=Melioidosis.pdf

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Recommended Websites

Melioidosis in people

http://iceh.uws.edu.au/fact_sheets/FS_melioidosis.html

<http://www.cdc.gov/melioidosis/>

On Farm Chlorination

http://www.agric.wa.gov.au/PC_92502.html

http://www.daff.gov.au/animal-plant-health/pests-diseases-weeds/biosecurity/animal_biosecurity/bird-owners/water_biosecurity

Bibliography

- Choy, J. L., M. Mayo, A. Janmaat and B. J. Currie (2000). "Animal melioidosis in Australia." *Acta Trop* **74**(2-3): 153-158.
- Cottew, G. S. (1955). "MELIOIDOSIS." *Australian Veterinary Journal* **31**(6): 155-158.
- Currie, B. J., D. A. Dance and A. C. Cheng (2008). "The global distribution of *Burkholderia pseudomallei* and melioidosis: an update." *Trans R Soc Trop Med Hyg* **102** Suppl 1: S1-4.
- Currie, B. J. and S. P. Jacups (2003). "Intensity of rainfall and severity of melioidosis, Australia." *Emerg Infect Dis* **9**(12): 1538-1542.
- Currie BJ, W. L., Cheng AC (2010). "The Epidemiology and Clinical Spectrum of Melioidosis: 540 Cases from the 20 Year Darwin Prospective Study." *The Epidemiology and Clinical Spectrum of Melioidosis: 540 Cases from the 20 Year Darwin Prospective Study. PLoS Negl Trop Dis* **4**(11).
- Dance, D. A. (2000). "Melioidosis as an emerging global problem." *Acta Trop* **74**(2-3): 115-119.
- Fatimah, I., B. O. Ikede and R. A. Mutalib (1984). "Granulomatous orchitis and periorchitis caused by *Pseudomonas pseudomallei* in a goat." *Vet Rec* **114**(3): 67-68.
- Golledge, C. L., W. S. Chin, A. E. Tribe, R. J. Condon and L. R. Ashdown (1992). "A case of human melioidosis originating in south-west Western Australia." *Med J Aust* **157**(5): 332-334.
- Inglis, T. J., S. C. Garrow, C. Adams, M. Henderson, M. Mayo and B. J. Currie (1999). "Acute melioidosis outbreak in Western Australia." *Epidemiol Infect* **123**(3): 437-443.
- Inglis, T. J., L. O'Reilly, A. J. Merritt, A. Levy and C. H. Heath (2011). "The aftermath of the Western Australian melioidosis outbreak." *Am J Trop Med Hyg* **84**(6): 851-857.

³³ Northern Territory Government, C. f. D. C. (2012). "Melioidosis".

Inglis, T. J. and A. Q. Sousa (2009). "The public health implications of melioidosis." Braz J Infect Dis **13**(1): 59-66.

Li, L. and Y. W. He (1992). "Pseudomonas pseudomallei and melioidosis in China." Chin Med J (Engl) **105**(9): 775-779.

Limmathurotsakul, D., S. Thammasart, N. Warrasuth, P. Thapanagulsak, A. Jatapai, V. Pengreungrojanachai, S. Anun, W. Joraka, P. Thongkamkoon, P. Saiyen, S. Wongratanacheewin, N. P. Day and S. J. Peacock (2012). "Melioidosis in animals, Thailand, 2006-2010." Emerg Infect Dis **18**(2): 325-327.

Munckhof, W. J., M. J. Mayo, I. Scott and B. J. Currie (2001). "Fatal human melioidosis acquired in a subtropical Australian city." Am J Trop Med Hyg **65**(4): 325-328.

North Territory Government, C. f. D. C. (2012). "Melioidosis".

Olds, R. J. and F. A. Lewis (1954). "MELIOIDOSIS IN GOATS." Australian Veterinary Journal **30**(9): 253-261.

Perret, J. L. (1997). "[Melioidosis: a tropical time bomb that is spreading]." Med Trop (Mars) **57**(2): 195-201.

Radunz, B., L. Melville and B. Currie (2009). "Territory One Medicine, One Health network and melioidosis in livestock and humans." Proceedings of the Australian Veterinary Association (AVA) Annual Conferences, 2009 AVA Annual Conference, Cattle/Public Health Stream.

Scott, I. A., A. M. Bell and D. R. Staines (1997). "Fatal human melioidosis in south-eastern Queensland." Med J Aust **166**(4): 197-199.

Thomas, A. D., J. C. Forbes-Faulkner, J. H. Norton and K. F. Trueman (1988). "Clinical and pathological observations on goats experimentally infected with Pseudomonas pseudomallei." Aust Vet J **65**(2): 43-46.

Thomas, A. D., G. A. Spinks, T. L. D'Arcy, J. H. Norton and K. F. Trueman (1988). "Evaluation of four serological tests for the diagnosis of caprine melioidosis." Aust Vet J **65**(9): 261-264.

Van der Lugt, J. J. and M. M. Henton (1995). "Melioidosis in a goat." J S Afr Vet Assoc **66**(2): 71-73.