

## Scabies in humans and dogs

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Scabies is a very common disease in dogs in rural and remote Aboriginal Communities. Vets have a good understanding of the disease in dogs. However, the confusing aspect is what is the relationship between scabies in dogs in these communities and scabies in the humans in the same communities. I would like to explore this and take you through what is known about human scabies. Then we can look at the relationship between canine and human scabies.

### Scabies in humans

Scabies is a chronic skin disease caused by the mite *Sarcoptes scabiei*. In humans scabies manifests as three clinical syndromes: typical scabies, crusted scabies and transient scabies. A matrix makes this easier to understand (Table 1).

Table 1: Clinical types of scabies in humans and relationship to allergic response and number of mites.

Clinical type	Host response	Number of mites	Stability of mite population	Infectivity
Typical scabies	Allergic	<10	Stable	Low
Crusted scabies (Norwegian scabies)	Local hyperkeratosis	1000x	Stable or growing	Very high
Transient scabies	Allergic	<10	Decreasing	Very low

The typical scabies case has a well developed hypersensitivity reaction. They have allergic papules distributed symmetrically over their body and they complain of the itch even though the allergic response is probably keeping their mite population very low. Most scabies cases in humans are typical scabies. Secondary infection will occur if the skin is heavily colonised by Gram positive cocci (streptococci or staphylococci). Secondary bacterial infection is common in Indigenous communities.

The crusted scabies case is at the other end of the spectrum. The mite numbers are immense (sometimes >1000 mites/g skin flakes). The mites cause a hyperkeratosis and massive build up in keratin layers of the skin. Crusted scabies is common in people with depressed cell mediated immunity. However, it is also common in Aboriginal communities in apparently immunological normal individuals. Crusted scabies is a very dangerous disease and is associated with a significant mortality rate usually from bacteraemia.

An important point to note is that these different clinical manifestations are not due to different strains of scabies mites. It is the hosts' responses that are different.

Transient scabies is seen most often in healthcare workers dealing with scabies cases. It appears as a mild case of typical scabies that disappears when the worker has a weekend off or is absent from contact with scabies cases for a few days. The hypothesis is that if a mite transfers, the nurse or other healthcare worker who is already allergic to scabies mites, will develop an allergic response quite rapidly. This probably gets rid of the mite or at least makes it's life difficult. Transient scabies is the disease typically seen when scabies mites transfer from animals to humans.

There is a large body of literature describing this phenomenon. For example, a dog with scabies will cause transient scabies in 25% of the humans in contact with it. When the dog is treated, most of the human cases will spontaneously resolve. Rarely does an in-contact person need to receive treatment for scabies although there have been some cases reported.

For example, Estes et al (1983) made this comment "Canine scabies in humans is pruritic dermatosis that affects primarily exposed body parts, appears within one to ten days of direct exposure to infested animals, and resolves spontaneously with avoidance and/or treatment of the pet."

So that had already been established and when you actually look at the literature the same picture appears for many animal species. In horses, it was called calvaryman's itch in the First World War. It was a major scourge of people who had to look after horses where scabies got into horses and then transmitted to the people that were riding them. Also in other species – pigs, cattle, sheep, water buffalo, goats, cats, wombats.

So the same sort of story as for dogs: if these animals have scabies, people will develop transient scabies, but typically it disappears once the animal is treated or the animal is removed from contact.

An excellent study was done by Shelley Walton (1999) on strains of scabies in the Northern Territory. She showed by using microsatellites that genetically distinct strains of *S. scabiei* occurred; strains tended to cluster according to species of host (dog, human, wombat); strains also clustered according to country of origin. This was an excellent study of genetic relationships. It had the limitation that from humans in the NT only 21 mites from 7 non-crusted cases were used. The study confirmed the conclusions of previous workers who had used less rigorous techniques such as morphology of mites and experimental cross species infections. However, then Walton et al (1999) made the statement "Because of the apparent genetic separation between human scabies and dog scabies, control programs for human scabies in endemic areas do not require resources directed against zoonotic infection from dogs". Unfortunately, this was a recommendation without evidence. To be justified in making this statement Walton et al (1999) should have tested their hypothesis by doing clinical trials, not just by looking at DNA patterns of mites. Kemp et al (2002) compounded the problem further by misrepresenting veterinary knowledge in their statement: "It has long been thought that dogs may act as a reservoir for human infections. However, genetic studies cast doubt over this supposition." As you can see this statement was inaccurate.

So prior to the Northern Territory study it was known that it was hard to find animal mites on humans. There was some successful experimental cross species transmissions, humans to dog had been done on a number of occasions, dog to human had also been done and dog to rabbits had been done as well. But the general feeling was the strain from one host species is *hard to establish on another host species*. Some strains of mites could actually go across, but they were the exception rather than the rule.

So it was hard to work out why David Kemp made that comment. I suppose the only thing that I can find is in a comment in 1978 by a French parasitologist (Fain 1978), who did a lot of work on scabies and raised the possibility that the animal reservoir of mites may intermittently produce a strain that eventually establishes in humans and then transmits human to human.

Perhaps Kemp et al (2002) misinterpreted what he said, but he was looking at it more from an evolutionary perspective, rather than just from a one animal in contact with another animal.

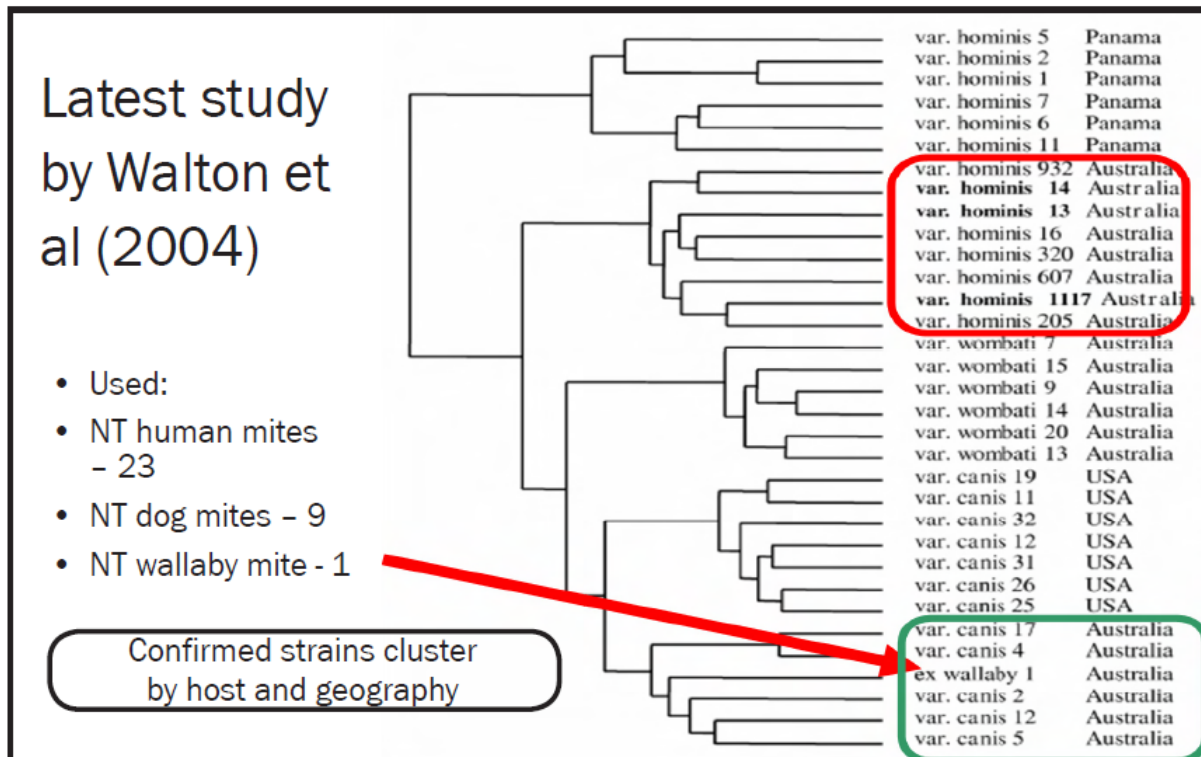
Really at that stage in 2002 veterinary clinicians did not actually think that human scabies originated from animals, except for the well recognised occasionally localised transmission.

Walton et al (2004) did some more work and again quite elegant lab based work, using more micro-satellites, using pure mites, and she actually showed that clustering affect again. So the human strains clustered together, the dog strains clustered together and then the geographic effect. So she confirmed, using a more sophisticated study, what she had shown in 1999.

population of mites reproduces and passes on. Occasionally you get cases of crusted scabies, which depends on the features within the human host, not on the features within the mite, so it's the same mite but just different responses from the human, and highly infectious. This again transmits back to humans.

When dog scabies go across to humans, you then get transient scabies. That is the scabies that vets talk about; this transient scabies. If you treat the dog, typically that strain of scabies will die out, because it is not well adapted to humans.

So I suppose my comments on this is just to make people aware that the DNA data does not provide evidence that treating scabies in dogs has no effect on human health.



One of the interesting things out of this was that she also used a strain from wallabies. Now I was amazed when Steve told me last year, that wallaby scabies is very severe up here. We don't see scabies in agile wallabies in Queensland, but it is quite common in the wallabies in the Territory. The interesting thing was that they found that the wallaby scabies sits right in the middle of the dog scabies. So it is probable that the dog scabies has got across to wallabies and now is established as an endemic, or an epidemic, spreading through the wallabies up here. So very interesting work.

But unfortunately Shelly Walton pursued this same sort of line, but less rigorously than before. So she was less dogmatic before than in the 1999 paper. However, that study since it was just genetic, does not really provide clear evidence to justify the statement that they made there about dog scabies not being of concern to human health.

So what's going on? This is the way that I look at the interaction between human and dog scabies. So we have two populations. Two populations of mites - *Sarcoptes scabiei* variety *hominis*, interacting, spreading human to human and *Sarcoptes scabiei* variety *canis*, spreading dog to dog.

The human scabies mostly causes typical scabies and the

Human-to-human transmission is the major route of transmission in these communities. But potentially there is dog-to-human transmission going on. You just can't see it because there is so much human scabies going on in the community. If we had the same high prevalence of scabies in dogs in the cities, we would be seeing human cases of transient scabies (since it would not be masked by human scabies mites as it is in Indigenous communities). I am quite confident of that.

One of the things that really worries me is that when I talk to vets and vet students, they think that dog scabies has no significance to human health, whereas it actually does. It is the cause of transient scabies in humans. Unfortunately up here, in the Northern Territory, this approach seems to have spread across and there seems to be a strong, negative attitude to dog health programs in the health profession in NT, downplaying the valuable role of environmental health associated with dog programs.

So I suppose my message here is that we should really aim to eradicate dog scabies because I think it is a good environmental health intervention.

Thanks very much. Any questions?

**Question and Answer Session:**

Q Mine is more a comment. But we had a kangaroo joey that had been present in an Aboriginal community for three or four weeks and it came in with very crusty lesions on both its ears and we were able to scrape and get mites and eggs from the ears of that kangaroo joey. It was a red kangaroo. We never pursued it any further, we treated it and it was fine, but it was living in a very crowded household where there was both the presence of dogs and humans, and so I think scabies mites could go from one to the other, to the other and obviously it was a reproducing mite.

RS Yeah I think that's interesting. Scabies in wild populations has actually been devastating for some populations, because once scabies establishes in some of these wild populations that are new to scabies, it can actually spread in quite an epidemic fashion. So I am concerned that it has got in to wallabies up here and if it also can get into kangaroos in Central Australia, we may have a real problem on our hands, in terms of the wildlife.

Q Rick, could you give a comment on the origin of the scabies mite in this country? Was it here before European settlement? Or has it arrived since European settlement and evolved?

RS No, I can't really comment with much confidence. My impression is that it has probably arrived with European settlement. One of the really interesting things is when you go back through the records in Arnhem Land and the anthropological expeditions to Arnhem Land, even in the 1940s they didn't see scabies in humans.

So scabies in humans in Arnhem Land was incredibly rare. It's just a new introduction into those populations. And you know the early pictures of dogs associated with Aboriginal communities from paintings, they show dogs in quite good condition, in terms of skin, so I suspect it's just a fairly recent introduction. What's your impression, Graham?

Q [? 8:51 - inaudible comment].

RS Yeah I think it's got - scabies has got into wombats and koalas and I suspect it's probably come across from other species, but there is no good evidence for that.

Q Rick, your thoughts on treatment options, comparing the standard of Ivermectin to other things, Pour-On, injection and so on?

RS I'm not probably one to comment on treatment in the veterinary area. In the human area Ivermectin is a hell of a long way ahead of anything else, but unfortunately Ivermectin is not licensed for use in treating human scabies, but you can get special access. There will be other people in the room who could probably say much more, with a lot more confidence on treating animals. Does anyone want to take up that challenge?

Rob Well because of the worry about Ivermectin and the reactions with anything of Collie genetics I have been using Moxidectin as a Pour-On, the deer and cattle formulation, and don't appear to have had any problems using Moxidectin in dogs.

RS And you're getting quite good effect - good effect from it?

Rob Yes I do. I have got better results with my dogs than the people have obtained using Permethrin creams in people.

RS Yeah Permethrin cream for people is a fairly inadequate treatment, particularly since the instructions say don't put it on the head, you know, I have found mites on the head, the mites can't tell the difference.

Q Rick, this is a question concerning a possible variation on the theme of human scabies. I had done some work in a remote NSW community and a few days after return I came out in itchy little purulent eruptions, which actually the erupted starting in one place, but quickly all over the body, as though they were passing through the blood stream and what's more this condition sort of leapt with the enthusiasm of a flock of galahs, to my workmates, my family. We ended up having to wave to each other across the room, rather than sit close.

It responded eventually, I didn't start treatment for it for a while, because I thought they were nasty mozzie bites or something, but they did respond to Benzyl Benzoate and antibiotics. So what appeared to perhaps be a kind of allergic reaction nonetheless responded to application of an insecticidal agent. It took weeks to eventually disappear.

RS Yeah that's fairly typical - the reaction to scabies mites takes a long time to disappear. Typically in scabies once you treat a person with a papular reaction, they probably won't get rid of the papulars for two weeks, it takes quite a while. And I have seen some nurses in hospitals, when they have the mites come across, they will develop blisters within a day, quite a significant allergic reaction. The other interesting thing is that Lee Skerratt, who acquired scabies when he was working with wombat scabies, then managed to pass it on to his partner. So that was a case where the scabies actually didn't settle down. Being a good parasitologist he wanted to study it, but his partner called a halt to the experiment and he had to treat himself.

Thanks