TRANSCRIPT

S2:E6 – Scabies

Dr Blake Mumford: "*I quickly found an itchy person and asking him where he felt the greatest and most acute itching of which picking out one with a very fine needle, I took out a very small white globule scarcely discernible. Observing this with a microscope, I found it to be a very minute living creature in shape resembling a tortoise of whitish colour. A little dark upon the back with some thin and long hairs of nimble motion with six feet, a sharp head with two little horns at the end of the snout.*"

Welcome to season two of the *Spot Diagnosis*. A podcast about all things dermatological brought to you by the Skin Health Institute in Melbourne, Australia. I'm Dr Blake Mumford, Education and Research Fellow at the institute.

A/Prof Alvin Chong: I'm Associate Professor, Alvin Chong. I'm Director of Education and specialist dermatologist. Blake and I are your co-hosts. The quote you've just heard comes from a letter written in 1687 by Giovanni Cosimo Bonomo, an Italian naval physician who was the first to describe an ecological relationship between scabies and the *Sarcoptes scabiei* mite. Scabies, as you have guessed is our topic today.

Our guest speaker is infectious diseases Paediatrician, Professor Andrew Steer from Royal Children's Hospital in Melbourne, Australia. Andrew is as well, group leader of the tropical diseases research group at the Murdoch Children's Research Institute. Andrew, welcome to *Spot Diagnosis.*

Professor Andrew Steer: Thank you, Alvin and thank you, Blake. It's wonderful to join you both.

Blake: Andrew, we'd like you to share with our listeners a fun obscure fact that they might not know about scabies. Does anything come to mind?

Andrew: The species, *Sarcoptes scabies* can infect multiple animals including Australian wildlife, there are seven members of the Australian wildlife that infects, particularly, the bare-nosed wombat.

Blake: There you go. Alvin, what about you?

Alvin: Well, my fun fact is whenever I give a talk about scabies to medical students, the dermatologist trainees, invariably, a few people will start to scratch themselves. Because for some

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reason when we talk about scabies, it immediately makes you itch. I'm getting a little bit itchy myself.

Blake: Well, scabies is a parasitic infection of the skin which is caused by a mite called *Sarcoptes scabiei*. Humans and the scabies might have been close companions for over 2,500 years. Descriptions of scabies can be found in the Bible. Scabies plagues all countries across the globe and people of all ages in resource-rich and resource-poor settings. Here's a fun fact. When someone is afflicted with scabies, they aren't infected, they're infested.

Blake: Andrew, what is the scabies mite and how does it infest humans?

Andrew: The scabies mite we're talking about now is the human variety. Its scientific name is *Sarcoptes scabiei var. hominis*. It's a microscopic ectoparasite, it burrows under the skin. You can't see it with a naked eye, so you do need a microscope to be able to see it. It's the female that burrows under the skin. The male really doesn't do much other than help with reproduction. Female burrows into the epidermis, it lays two to three eggs per day. They grow into larvae after around three days and then into nymphs and then into adults at around 10 to 14 days.

Through this burrowing causes the symptoms of scabies which is severe itch. Also, they can lead to secondary infection with bacteria. It can also lead to complications of those bacterial infections. It's particularly common in resource-poor settings and we think it affects around about 200 million people around the world at any one time.

Blake: Wow, that's certainly a lot of people and that male mite sure does have an enviable lifestyle. Alvin, would you see scabies much as a Dermatologist in Melbourne?

Alvin: Well, yes. I see about 10 to 15 cases per year. Usually sporadic but occasionally, in settings of outbreaks, for example, let's say from infested hospital ward or from a nursing home. Not that many, just about 10 to 15 per year.

Blake: Andrew, do we see scabies much in Australia overall, and are there particular communities that are more affected than others?

Andrew: As Alvin said, we do. Anybody can get scabies, but there are, I guess, two main groups that we see in particular. The first is in institutions which may be overcrowded. For example, prisons, also in the elderly, in residential aged care facilities. Then the other group is amongst Aboriginal and Torres Strait Islander Australians, particularly in the northern part of Australia. There have been reports of prevalence of up to 35% people in some of these communities being infested with scabies. It's a really important public health problem in Australia among indigenous people.

Blake: How do these patients with scabies present clinically?

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Alvin: Generally, when I see these sporadic cases, we see patients who are just intensely itchy. This is not the type of you can live with this type of itch is so severe that they stop the patients from sleeping at night or they wake them from sleeping. It usually would have been going on for a few weeks. They would have used everything, topical steroids, sometimes even a course of prednisolone and it helps a little but not enough.

The reason why these patients are itchy is because scabies mites actually cause a very severe hypersensitivity reaction. To understand the clinical presentation, we always need to know a little bit of a lifecycle. When the mite gets onto the skin, the first thing it does is seeks out the cooler parts of your body. The cooler parts are acral areas so your hands, your feet, and also the scrotum in men and nipples in women. When they get onto your skin, they then start to burrow. They burrow and set up shop.

As they're there for a few weeks, they just keep pumping out bits of protein. They're living there, they're defecating into your skin, they're laying eggs. What it does is it causes your body to react to all the protein. You develop a secondary hypersensitivity reaction, and that hypersensitivity gives you that intense out of control itch. You take a few weeks for the hypersensitivity to appear. Often when a patient comes in intensely itchy, they've been infested for a few weeks already.

Blake: Basically, the mites been there and eventually the immune systems like, "Hey, hang on a tick, what's this?" Starts reacting to it and that's when you start to get the itch. Is that right?

Alvin: Absolutely, yes.

Blake: Are there clinical signs that you can look for when you see someone in your clinic, Alvin, that would give away the diagnosis of scabies?

Alvin: Yes. The first thing is that we look for what we call burrows. That's where the mites are actually living. For a non-crusted-case for typical community-acquired case, they're not that many mites, only about 10 or 15 mites. We look closely at the hands, the wrists, in the digital spaces, the ankles and the feet, and in men the scrotal area. You look for little papules with a slightly scaly squiggly line behind it. It's much easier to see with an instrument like a dematoscope or magnifying glass. When you see that, then you've got the diagnosis.

Then the secondary hypersensitivity reaction, you get a more nonspecific like an eczematous type of picture. Don't be put off by a little bit of eczema. If someone is coming in and they have the history of intense itch, that's new onset, you have to make sure they haven't got scabies. You have to look for the burrows.

Blake: Those burrows, they're pathognomonic, are they?

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Alvin: They are pathognomonic, yes.

Blake: I think that brings us to our first **skin tip**. This is a bit of a two in one special. Scabies is intensely itchy and it's one of the few conditions that will keep you up at night scratching. The second part of this one is to always look for the scabies burrows particularly on the acral and genital skin where they're commonly found.

Blake: How long after exposure to the mite do symptoms typically develop?

Alvin: If someone hasn't had scabies before then it takes four to six weeks for the immune system to kick in, so four to six weeks. If someone has had scabies before, then it can actually come on quite quickly, usually about one or two days before you develop the symptoms of itch.

Blake: How does the scabies mite actually spread?

Andrew: The mite is transmitted via person-to-person contact. It's all about close contact. We think it takes about 20 minutes of close contact, for example, holding hands for the mite to spread. That's not that long really. The mite can stay alive 24 to 36 hours off the human host, but we don't think that's a huge part of transmission. It's all about that person-to-person contact.

Blake: It's time for our next **skin tip**. After infestation, it takes about four to six weeks before patients experience symptoms after close contact with an infested individual. People who've had scabies before develop symptoms much quicker.

Blake: When we treat patients with scabies, we routinely give advice to patients to wash all their linen, towels, clothes, et cetera, to try and stop reinfestation. Just how easy is it to become infested via fomites (that is, objects that carry infection)?

Alvin: That's a great question. In the course of my research into this podcast, I read a classic paper written by Kenneth Mellanby, he's a research fellow at the Royal Society. This paper was published in 1941 in the British Medical Journal. It addressed a wartime problem. At that time, there was a question of whether scabies can be transmitted through blankets in a war setting, so soldiers and blankets.

What Mellanby did was he used volunteers who were actually pacifists. These are people who didn't go to war. He recruited about 63 of them and then subjected them to a number of different experiments. I'll go through some of it. One was to use a blanket one to seven days after they've been used by a scabies patient. Six patients, no one got infested. The second one, they used under clothing two to seven days after they had been used by a scabies patient. Six patients, no infections. They then used the bed immediately after it was vacated by scabies patients, 19 patients no one got infected. This last one, under clothing, immediately after it was removed from a scabies patient, 32

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patients and 30 did not get infected and two got infected. From there he concluded that fomites weren't really the way they spread.

Then, the kind of addendum to it was four of the patients who'd shared the bed of someone who actually had scabies, and of the four three of them got infested. This is actually a classic experiment to show that fomites are probably not the main cause of spread. It is close contact. Is there anything else you want to add, Andrew?

Andrew: No, I agree with you Alvin. It's just a classic study done 80 years ago but such useful information. I think doing that study today, if not be a little bit more challenging certainly would require pretty rigorous review by an ethics committee.

Alvin: Oh, yes.

Blake: Are there any risk factors that can predispose to someone becoming infested with scabies?

Andrew: I think there are two main risk factors. The first being the most important and that is overcrowding. Overcrowding leads to increased person-to-person contact and therefore increased transmission. That's why we see the disease more commonly in children, particularly school-aged children. In the parts of the world where I work, often school classrooms are quite crowded. There's a lot of person-to-person contact, so overcrowding is absolutely critical.

Then the second is having a problem with your immune system, either because you're being treated with, for example, steroids or you have an underlying disease like HIV or HTLV-1, or as you're becoming quite old. That puts people at risk of both ordinary scabies but also crusted scabies, which we'll come to speak about.

Blake: That brings us to our next **skin tip**. The main risk factor for scabies infection is actually overcrowding and immunosuppression, no matter what the cause, old age or HIV can predispose you to scabies and also more severe forms of scabies.

Blake: How is scabies diagnosed? Are there any tests that can be helpful in confirming the diagnosis?

Alvin: Well, scabies is mainly diagnosed clinically. We look for the burrows. They can be seen with the naked eye, but we usually use instruments that help us. Here dermoscopy is very useful. When you put the dermatoscope on a burrow, you can see a little triangle, we call it delta sign. That's actually where the scabies mite is. Then follow behind the triangle is often a little squiggly line and that's where they have burrowed. That's actually very sensitive and specific.

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I also use the old-school method of taking and scraping off the burrow and putting it on a drop of potassium hydroxide and looking at it on the light microscope. When you do that, you can then see the mite, and you can see the eggs, you can see scabies feces. When you show that to a patient, you get 100% compliance, but not everyone has a light microscope. I do and I take great delight in using it all the time. Andrew, are there some newer techniques out there? Can you take us through some of them?

Andrew: Yes. Thanks, Alvin. I wanted to touch on three things. The first is at the start of this year, our group The International Alliance for the Control of Scabies or IACS released diagnostic criteria which we think is helpful. These criteria were developed through a consensus process for about 60 dermatologists around the world. They're in three levels. The first level we call confirmed scabies where you can actually, as you're saying, you can see a mite, you can see eggs or feces, so this visualisation.

The second level is what we call clinical scabies, so seeing a burrow or seeing typical lesions in a distribution that not much else can cause that, for example in around the male genitalia. Then the third is what we call suspected scabies which is most useful in the clinical sense, going to be used by field workers or primary health-care workers in more resource-poor settings. That's the first thing.

The second thing is using other perhaps more advanced visualisation techniques. The one I wanted to highlight was confocal microscopy, where you can see a huge amount of detail under the skin, and you can see that in real-time. You can see the mouthparts of the mite moving and you can actually even see the peristalsis in the gut of the scabies mite. That's the kind of detail you can get. That's pretty cool, but not available obviously to many.

Then the third thing is, many of us in the field would love to have a test that was available. There has been work on a blood test looking in the antibodies which has had some problems. Perhaps the more promising is a direct test where you can either do a scraping or a bit of cellotape under the skin where the lesion is and take off parts of the mite or its feces or eggs and do a PCR test. That's actually being developed in Australia at the moment and there's some promising results but it's still very much experimental.

Blake: Let's say we've diagnosed a young person in the community with scabies using whatever method you prefer, using your fancy confocal microscope or just a clinical diagnosis. What do we do next?

Alvin: Well, if you have someone who's just got a fairly uncomplicated community-acquired scabies, the first line treatment would be using topical permethrin. Here, a patient needs to apply the permethrin from neck down, but they need to cover every single bit of their skin including in

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between the fingers, the genital areas, if they wash their hands, they need to reapply the permethrin. The permethrin cream is left on overnight and then in the morning the patient has a shower to wash the cream off, all the bedclothes are taken and hot wash and tumble dry.

The really important thing is that the whole household needs to be treated at the same time to prevent reinfestation. After you do this, one week later it's repeated again and then any kind of eczema is treated concurrently with topical steroids and so on. Anything else to add, Andrew?

Andrew: I think that's fantastic. Alvin, I think the main thing I guess I would emphasise is and maybe this is a skin tip possibly is treating all the contacts is just absolutely critical.

Blake: All right, it's time for a **skin tip**. It's absolutely critical to treat all the close contacts to prevent reinfestation.

Blake: Thanks for doing my job there, Andrew. Now, next question is, why do we need to do two treatments one week apart?

Andrew: When we think about scabies, we've got to think about treating the mite, but also the eggs. Actually theoretically, permethrin is active against both the mite and the eggs, so it's scabicidal and ovicidal, although some people think maybe it's not as ovicidal as we would like. We give two doses because we want to treat today, make sure all the mites are dead, and then we allow 7 to 14 days for any eggs that are there to hatch. Before they start reproducing, we give a second dose.

The other reason I think with permethrin is that as Alvin described, it's actually quite a big deal to get this treatment in all the right spots. Many people actually do recommend a second dose just for that reason to make sure you are actually getting all the spots that you want to get.

Blake: And the ovicidal or being, of course, that it kills the eggs.

Andrew: Yes, that's right.

Blake: Can you tell us about oral ivermectin, that's an alternative to permethrin that we've been mentioning. What sort of situations would you use ivermectin in?

Andrew: As you say, ivermectin is an oral drug, which is a huge advantage for treating scabies, because there's not the need to apply this, what can be difficult, messy treatment, particularly for people who might have sores at the same time, so bacterial skin infection that can be stingy to put it on. We have a lot of experience with the drug ivermectin. In fact, the discoverers of ivermectin won the Nobel prize for Medicine in 2015, because this drug is being given to probably up to two billion people for large scale public health programs to treat and prevent other neglected tropical diseases,

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particularly onchocerciasis or river blindness, and lymphatic filariasis, which is another parasitic infection that causes swollen arms and legs.

We've got lots of experience about its safety, its advantage as a clearly the oral aspect. There are some caveats. We can't give it to children under five at this stage, which is in a public health sense of problem because often there's a lot of cases of scabies in those younger children and we can't give it to pregnant and breastfeeding women. In Australia, ivermectin is approved for use as second line treatment for ordinary scabies. If permethrin fails and it's approved for first line use for crusted scabies.

Blake: It sounds like the Nobel prize was very well deserved in that case. In some cases where I was reading, ivermectin can be really effective or permethrin can be really effective. You get relief of each quite rapidly, but then in many cases that's not the case and the itch persists for some time after treatment. Why does this occur?

Alvin: I think that's because the reason why you get an itch from scabies is not necessarily just because the mite is biting you because it may not be. It's your body's immune system reacting against the proteins of the mites living in your skin. Even after you kill the mite, the protein is still there. It takes about four to six weeks for the proteins then get shed off the skin. That's probably when you notice the biggest improvement in the itch. If someone remains itchy after treatment with permethrin or ivermectin, immediately after it's not necessarily treatment failure, they just have to expect that it will take some time for that itch to improve.

Blake: I think that brings us to another **skin tip** then. The itch in scabies infestation can take up weeks to settle even after successful eradication of the scabies mite.

Blake: Alvin, just on that topic. At what point should someone consider treatment having failed?

Alvin: The general setting is if I see a patient and I've diagnosed scabies, then I give them the treatment, I always get them back for review after four to six weeks. The history is really crucial. If the itch settles down and then remains good and I examined the patient there's no more burrows, then you've got clearance. If the itch initially settles and then it gets worse again, and then I examined them and I still see burrows, then that's treatment failure.

There are a few reasons why treatment failure might occur. Most common is actually a noncompliance or mistake with the therapies or they haven't put the permethrin on properly or more importantly, they haven't treated everyone in the household at the same time. If you have one or two people who didn't get the treatments and they're actually infested, then you can very quickly get reinfestation of the whole household. I think actual resistance to topical permethrin is pretty rare.

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Blake: I guess we keep coming back to this problem of reinfestation after treatment from the environment or close contact. We mentioned fomites as a way for scabies mite spread. For people who don't know that, things like sheets that have got the mite on it, then you then touch that sheet. What advice do you give your patients about decontaminating their environment, their clothing, et cetera?

Andrew: I think the most important component of the environment for patient with scabies is their human contacts. Really important just to emphasise that treatment of contacts particularly within the household. As Alvin was talking about before with Kenneth Mellanby's work. It's not entirely clear about the role of fomites in transmission. Our studies in the Pacific, which we'll come to talk about where we've treated everybody in the community, we didn't give any specific advice around decontaminating clothes and sheets, but we were still able to see a huge reduction in the prevalence of scabies. Nonetheless, it is very important in outbreak settings and I think it's reasonable to advise the simple measures that Alvin's advised around washing sheets and clothing if treating a patient with scabies in metropolitan Melbourne, for example. Is that what you do Alvin?

Alvin: Yes, that's right. I think I read a recent paper, which went into a little bit more detail on things like if you had a soft toy, you bag it up and you put it somewhere for two or three weeks- but I think that's... I don't tend to do that.

Andrew: I think more important is applying the cream correctly, making sure the rest of the family are treated. That's really the most critical element, I think.

Blake: Can you tell listeners about the dreaded crusted scabies. What is it and how do you manage it?

Andrew: Crusted scabies, formerly known as Norwegian scabies, no longer, I think possibly out of respect for Norwegians. This is a really serious disease, but not very common. Classical or ordinary scabies at 10 to 15 mites per person. That's by far what we see the most common. We do see this- occasionally see this crusted scabies variant. This represents uncontrolled mite replication. It's essentially a failure of the immune system to control the infestation. You can see millions of mites per square inch of skin. That leads to hyperkeratinisation and a crust which can be quite thick.

We see this in patients with essentially a failure of their immune system, so patients with HIV, or on long-term corticosteroid therapy, or with malignancy, or in the very old. It's very distressing to see it. It can be localised or quite generalised. It can be very hard to treat. It's often associated with secondary infection and can lead to death, it carries its own mortality.

Looking after these patients is challenging and the advice is to admit these patients to hospital, start topical treatment to break down the crust, so keratylics and then start ivermectin, depending on severity will determine how long and how many doses of ivermectin are needed. Obviously, Blake

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coming back to our previous question. These patients often in their surroundings their environment have a lot of mites on fomites. In that situation, it's very important to decontaminate the environment.

Alvin: I'll say something else too. My experience looking after a couple of patients with crusted scabies is it's wildly, wildly infective. Sometimes you admit a patient thinking that it's psoriasis and it turns out to be crusted scabies, you basically can have a huge outbreak of scabies in that unit, in the hospital where they've been managed. We always have to be on alert. They have, I guess, the whole thing about isolating these patients with very, very strict barrier nursing and control of the environment really comes into being.

Andrew: Yes, I totally agree with that, Alvin and I think within communities where there may be a case of crusted scabies, for example, in a village, for example, in some of the parts of the world we work in, these patients can cause sustained transmission and they're often core transmitters. They are sort of driving transmission within that community. It's very important to identify them and to manage them appropriately.

Blake: Like the coronavirus super spreaders.

Andrew: Something like that, yes.

Blake: Can you tell us a bit about how you manage those outbreaks that you were just talking about? Particularly in a nursing home environment or something like that.

Andrew: Management of an outbreak in a residential aged care facility can be very challenging and quite difficult, and that's for a couple of reasons. One is that patients often present quite atypically. They may present without itch or they may in patients with dementia, for example, they may not complain of itch. Lesions may be present and sometimes those lesions can be relatively hidden and hard to see.

The second thing is that once you've had an outbreak, once you've identified an outbreak, that's indicative of transmission occurring now for several weeks. It's often much more extensive than first thought. That the approach to this difficult problem should be a comprehensive one. It should be seen as an important public health issue. Often local public health units are involved, physicians and nurses and infection control need to be involved.

There are four key elements to management of an outbreak particularly in residential aged care facility. I'll just take you through them fairly quickly. Number one is, identify early and treat and there's growing experience using ivermectin rather than permethrin because permethrin can be quite messy in elderly people. Number two isolate until 24 hours after the first treatment and longer obviously if the case has crusted scabies. Number three is extensive contact tracing and extensive

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contact treatment. Number four is looking into environmental disinfection because it is so difficult to control it. It can be more important in these scenarios.

Blake: What about endemic scabies, particularly in Aboriginal and Torres Strait Islander communities in Australia? What's your experience in that regard, Andrew?

Andrew: Particularly in tropical countries and in populations with coexisting poverty and overcrowding, scabies can be a huge problem. In some of the communities where we work, overall prevalence can be 35%. One in three people up to 50% among children. Many of these, adults and children can have a secondary bacterial infection, with two main bacteria, *Staphylococcus* (golden staph) *aureus* and group A strep or strep A. That can lead to a series of complications beyond just scabies itself. It can just be really hard to break the cycle because there's so much transmission that's occurring within these communities. Our group and others have identified scabies in these settings as being a really important public health problem.

Blake: You alluded to scabies causing more serious problems than intense itching just then. Can you tell us, our listeners a little bit about what those problems are?

Andrew: Scabies has a series of complications beyond the itch and scratch. I don't want to underestimate the impact of itch and scratch. It can lead to poor sleep, reduced economic output because of lost time at work. It can also lead to kids not going to school or performing at school.

Blake: So the quality-of-life impact as well.

Andrew: It can be a quite substantial quality of life issue. One thing I think we're learning more about is stigma as well. Unlike some of the other neglected tropical diseases that I work with, you can see scabies particularly as Alvin described it being an acral areas, particularly in your hands. There is a stigma of poverty with scabies lesions on your hand, and that can impact a person's confidence and quality of life very much.

Then there's the secondary bacterial infection with the two bacteria *staph* and *strep* A and that can really drive a series of complications. More severe and complicated skin and soft tissue infections like abscess, cellulitis, even as severe as necrotising fasciitis. It can act as a portal of entry for those bacteria. Then you get invasive infections, severe sepsis, and toxic shock, for example.

Then after the bacteria have gone, but the immune system has responded to the bacteria. There are two post-infectious sequelae which is post-streptococcal glomerulonephritis, which is a kidney disease, which can lead to chronic kidney disease and has been postulated as contributing to the high rates of end-stage renal failure in Northern Australia and indigenous populations, and the other is rheumatic fever and rheumatic heart disease.

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We're just unraveling and understanding, I think, the contribution of scabies and *strep A* infection of scabies contributing to rheumatic fever, rheumatic heart disease. Remember that rheumatic heart disease affects 34 million people worldwide. It's a chronic disease that causes 340,000 premature deaths per year.

Blake: For any medical students out there listening, that's a very common topic for exam questions. Andrew, can you tell us a bit about your mass drug administration for scabies and impetigo projects?

Andrew: I've had the great privilege of working in the Pacific for close to 20 years now. Part of my work has mostly been rheumatic heart disease initially, but then we identified this high prevalence of scabies in many communities, particularly during my time in Fiji. That then led us to thinking about what can we do about it, what can we do from a public health sense? We looked around to other neglected tropical diseases.

There's a department in the World Health Organisation called the Department of Neglected Tropical Diseases. It's a big department that deals with many diseases. A bunch of these diseases, so onchocerciasis, lymphatic filariasis, schistosomiasis, trachoma, and soil-transmitted helminths They all have an approach called mass drug administration, which is the idea here is that you offer a whole community treatment at the one-time to eliminate or eradicate the pathogen from that community.

We had the idea, maybe we could do the same thing with scabies, and that led to a trial published in 2015 where we used ivermectin based mass drug administration in a study of three islands in Fiji. To cut to the chase, what we saw was at baseline in this study, 35% of the community had scabies. We just gave our ivermectin and permethrin, came back to see the community 12 months later, and the prevalence was less than 2%. It was this sort of fantastic response and that's led to--

We also saw actually without even treating the impetigo or the bacterial skin infection, we saw a reduction by two thirds in the prevalence of the impetigo as well. That's led to exploring this idea of mass drug administration as a way of controlling scabies where it's really common. We did some subsequent studies in the Solomon Islands and other groups have been doing the same thing in Ethiopia, Tanzania, East Timor, and Samoa. It's been the beginnings of an exciting journey and the possibilities of controlling this disease.

Blake: Have you been back to that community, Andrew, and observed a sustained response?

Andrew: We have been back. We went back at 24 months and we saw further reductions in impetigo, which was really interesting and set scabies at essentially the same level, but it's obviously a critical question Blake, as I think as you're alluding to, of how long does the reduction last for, how many rounds do you need to have. Is it possible actually to eliminate? They're all things into the future.

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Blake: Any future plans or ideas to tackle this difficult problem? Is there anything happening internationally in this space?

Andrew: There's a couple of things. I mentioned before the international alliance with the control of scabies. That was founded in 2012. That group supported an application from the Solomon Islands and Ethiopia to have scabies recognised as an official World Health Organisation, neglected tropical disease or NTD, which was successful in 2017, which essentially means that WHO needs to take action which they've started to do.

In February of this year, I think we can provide a link to this informal guidance from WHO where public health control activities was published. Then excitingly for us at the end of last year, our group formed the World Scabies program, and we have funding from the Macquarie Group foundation of A$10 million to pursue elimination in Fiji and the Solomon Islands. We hope that that can be used as a model for other countries.

Blake: Well, it sounds very impressive.

Alvin: Can I say something here? I think I remembered here you came and gave us a talk a couple of years ago when your mass drug administration project and you were the lead author got published in the New England Journal of Medicine. It's such a huge achievement academically, and also the work that your group has done not just academically but in terms of the impact to the quality of life of so many people. It's a real honor to have you on this show.

Blake: Well done, Andrew.

Andrew: That's very kind of you. Obviously, it's not just me, it's a big team of people and fantastic colleagues and collaborators particularly in Fiji and the Solomon Islands and a big international network. It feels like it's the beginning of something, but we've still got quite some way to go.

Blake: Any new innovative treatments in the pipeline for treating scabies?

Andrew: Maybe I'll talk about two things. One is something relatively simple which is tea tree oil, an Australian thing. Tea tree oil does have activity against scabies. There is a trial led by a group in Canberra who are looking to trial tea tree oil as a therapy for scabies. I always thought that maybe it would be painful or stingy but actually I've applied it myself and it's quite pleasant actually.

Then the other one which is I think really exciting is a drug called moxidectin and that is actually being developed out of Melbourne by a group called Medicines Development for Global Health led by a guy called Mark Sullivan who was actually Australia's Victorian of the year last year. Moxidectin is a drug that's related to ivermectin but a little bit different. What's really cool about moxidectin is that it has a long half-life. We mentioned before one of the issues with ivermectin is you've got to

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give two doses, but this drug we think would hang around and it seems to concentrate in the skin that you would only need to give one dose which is a treatment and also as a public health measure would be really exciting.

It's been approved by the FDA for treatment of river blindness. The group are now working towards, and we hope to work with them working towards moxidectin as a treatment for scabies. It looks actually better than ivermectin, two doses of ivermectin in the in-vitro model which is a bit of a funny one. It's pigs and you put the pig version of scabies onto the ear of pigs and that's so it's a pig ear scabies model. In that model, moxidectin looks as good if not superior to ivermectin so very interesting area.

Blake: It's very interesting and sounds quite promising. All right. I think that leads us to our final questions. Alvin, they say you aren't a true dermatologist until you've contracted scabies from one of your patients. Comments, thoughts, do you have a scabies story you might want to share with our listeners?

Alvin: Well, I have been infested so I am a true dermatologist. When I got it, it was after seeing three or four scabies patients in a week. Then I was in bed and then my ankles started to itch, and I went, "No, I can't be," the denial kicks in. "It can't be scabies. What I'm thinking off?" Sure, enough the itch got worse and worse and the next thing you know I felt that my hands getting a bit itchy, and I thought, "Look, Alvin, don't be an idiot. This is scabies." The whole family got treated, the bed-clothes thing it took hours. I'm a true Dermatologist. I've got a couple of other stories.

The first thing it's actually very easy to miss scabies. I remembered an elderly gentleman coming with what looks like a drug rash and background of eczema. We stopped the drug, but eczema is just getting worse, so I thought, "We're going to start him on Narrowband UV phototherapy, except he's elderly and he needed a lot of assistance getting to the UV booths and my nurses were helping and so on. We only did it for a couple of weeks, but it got worse and worse. Then finally when I re-examined him, I saw all the burrows on his hands and I went, "Oh, no." My whole practice needed permethrin at that point.

Another story if you have a little bit of time. I had a colleague in Cambridge, my late colleague Sam Gibbs, who was a Dermatologist but did a lot of work researching scabies in Africa and he was a master at picking it. We had a patient in a medical unit. The medical team was convinced that the patient had a drug reaction, but he saw the patient he goes, "He's got scabies." He picked up a solitary live mite with a needle, put it on a drop of oil on a glass slide and put it on a microscope and let everyone have a look at a live wriggling mite. That was extremely convincing.

Blake: I love that story, Alvin. What about you, Andrew?

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Andrew: I've definitely had a few run-ins with the scabies mite during my first studies in Fiji. I think we were 21 different schools, about three and a half thousand children that we examined of whom around 40% had scabies. I definitely had a few infestations along the way.

Blake: All right. Well, sounds like I'm just going to have to grit my teeth and accept this as part of my future. Finally, what are some myths about scabies?

Andrew: For me, there are three myths, and I guess we've largely touched on them already which is number one, scabies is a disease of poor hygiene. That's wrong, it's a disease of overcrowding. Number two, fomite transmission is important, it's wrong it's overcrowding. Number three, scabies is spread from dogs. The dog scabies mite is called *Sarcoptes scabiei var. canis.* Although it can occasionally cause very mild infestations, it's actually very uncommon.

Alvin: My myth is that you can half treat scabies, you can't. If you're treating scabies, it's got to be complete, you've got to treat the whole household, you go hard or you get reinfested again.

Blake: Well, on that note I think we might bring this episode to a close. This episode has just scratched the surface of scabies but hopefully it scratched your itch on the topic. The next time you scratch yourself, just think you might have scabies. On that note, we'll wrap up this episode.

Alvin: Thank you Andrew for your time and sharing your expertise with us.

Andrew: Thank you Alvin and Blake. It's been an absolute pleasure and I've really enjoyed it. Thanks.

Blake: We also would like to thank Jo Coughlin and Peter Monaghan at the Skin Health Institute.

Alvin: We hope you have enjoyed this episode of *Spot Diagnosis.* Remember these podcasts are not meant to replace medical advice. If you have a skin condition that requires attention, we strongly encourage you to see your medical practitioner. This podcast was recorded using Zoom at the time of stage four restrictions due to the Coronavirus pandemic in Melbourne.

Alvin: For Australian GPs listening, you can receive RACGP CPD Activity points for listening to *Spot Diagnosis,* we are also running workshops for GPs. For further information is available on our website at spotdiagnosis.org.au.

Blake: For listeners who want more information on the subject, a transcript of this episode and links to other resources can be found on our website spotdiagnosis.org.au that's spotdiagnosis.org.au

Alvin: Please share *Spot Diagnosis* with your friends and colleagues, rate and review us. Let us know what you think. We would really appreciate your feedback and any suggestions.

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