

# Invasive Group A *Streptococcus* Outbreaks from Home Healthcare, England, 2018–2019

[Announcer] This program is presented by the Centers for Disease Control and Prevention.

[Sarah Gregory] Hello, I'm Sarah Gregory, and today I'm talking with Dr. Theresa Lamagni, an epidemiologist at Public Health England. We'll be discussing outbreaks of group A *Streptococcus* associated with home healthcare in England.

Welcome, Dr. Lamagni.

[Theresa Lamagni] Thank you, Sarah.

[Sarah Gregory] What is group A *Streptococcus*?

[Theresa Lamagni] So group A *Streptococcus* is a bacterium which can cause disease in people. It can colonize different body types, particularly the throat, without leading to any symptoms. But it can under certain circumstances also cause a range of infections.

[Sarah Gregory] And what illnesses does it cause?

[Theresa Lamagni] So the bacterium is actually very versatile, and it can cause a wide range of different infections at different body sites, including the respiratory tract, skin and soft tissue, or joints. And these can range in severity from very mild to, in fact, what we would call life-threatening invasive disease.

[Sarah Gregory] And where would a person most likely get infected?

[Theresa Lamagni] So the infections are primarily acquired by having close contact with someone who has the infection themselves or who is carrying the organism without any symptoms. And so, this could, of course, occur in a whole range of different settings, but primarily within the community.

[Sarah Gregory] So it's bacterial, so I guess antibiotics are used. Is that how these infections are treated?

[Theresa Lamagni] That's correct. So the infection itself needs to be treated with antibiotics, it's not something that can be left untreated. And thankfully, the bacterium remains fully susceptible to penicillin, so there's no documented resistance to penicillin worldwide. So this remains our first treatment of choice.

[Sarah Gregory] In England, these are notifiable to public health teams. What does that mean and what does it entail?

[Theresa Lamagni] Yes, that's correct. So since 2010, these infections have been notifiable by law. So that means that if a clinician diagnoses this infection in a patient, then they are required by law to notify the local health protection teams that they have diagnosed such an infection. So this is done fairly quickly. We ask them to do it within 24 hours of diagnosis, and typically we receive these notifications by phone call, although they can also email details of the patients to the local teams as well.

In addition to that, the local health protection teams have a direct feed of laboratory diagnostic information for patients within a patch in their part of the country. So they can also pick up cases by reviewing data from those systems as well.

[Sarah Gregory] A lot of these infections occur or are noticed in clinical settings. So if these infections occur at home, do they get notified and if so, how?

[Theresa Lamagni] Yeah, so the first thing to note is that invasive group A *Streptococcus* infections...these are very serious infections, the patients will be very unwell, so they would be typically admitted to a hospital for management of those infections. Regardless though of whether the patient is at home, let's say, I mean it would be very rare that they would be diagnosed in home, but let's say they are in a long-term care facility or something outside of a hospital setting. Wherever they are, when that clinical sample is taken from the patient and processed by the microbiology laboratory, all of those infections (regardless of where the patient actually is at the time) will all be notified to us. So in the UK, our microbiology laboratories are based mainly in hospitals, and they will take samples from across all different settings, not just hospital inpatient. So it's quite easy for them to notify those infections regardless of where the patient resides.

[Sarah Gregory] I see, okay. So apparently, England is unique in having home healthcare-acquired infections. Why is this? Does this mean that only England has them or only England is aware that they have them?

[Theresa Lamagni] Well, that's an excellent question and the question that we're asking ourselves, as well. It does seem to me that it's unclear that we are unique in being the only country where these outbreaks occur. I think it's very likely that they do occur elsewhere. I think what we conceived from our own experience is that they are difficult to detect, so we suspect (but we may be wrong, of course) that they are actually occurring in other countries, but perhaps the teams there are not yet tuned into them and are not identifying them.

In a way, within the UK, we are quite well-placed to detect these outbreaks because we do ask that all invasive group A streptococcal isolates are sent to a central reference facility in London. So we receive those isolates from around the whole country, we can look at the different strains that are within those isolates, and we can help the local teams in identifying outbreaks by seeing patterns within those strains. So for example, a geographical cluster of the same type of strain, we can feed that back and that helps them to identify a possible outbreak on their patch.

[Sarah Gregory] Are these infections actually more prevalent at home than in a clinical setting anymore?

[Theresa Lamagni] So in terms of these invasive infections, then most of them are thought to be acquired within the community (so, general community settings), with only around about 10% or perhaps less linked to hospital settings.

[Sarah Gregory] Do home infections have the same or a higher fatality rate than hospital-acquired ones?

[Theresa Lamagni] So that's a difficult question to answer. In terms of infections that are linked to home healthcare, that we have to bear in mind who are these patients who are receiving home healthcare. So these would be patients who are unable to travel to local healthcare facilities and receive care there. So they need to...they need the healthcare provider to come to them to deliver the care they need. So if we bear that in mind, then we realize that we are talking generally about an older population, a population who may have complex health needs and may not have the physiological reserves to fight infections. So in a way, you do see a high case fatality rate within

these patients. So that is, in itself, a reflection of them as individuals rather than place where the infections arise.

[Sarah Gregory] So home healthcare infections aren't any more deadly in and of themselves if they were acquired anywhere else, is what you're saying?

[Theresa Lamagni] Well, there are some elements of care that patients are receiving at home, which are important factors within this. So a number of these patients are receiving wound care. So if you can imagine that you're a patient who has an open wound, that in itself is going to lend itself to being a high-risk portal of entry for bacteria within that wound. So they are already in a position of vulnerability in terms of acquiring infections because of those wounds, which are themselves the reason they are receiving nursing care at home quite frequently.

[Sarah Gregory] How many home healthcare outbreaks did your study investigate and what time period did they cover?

[Theresa Lamagni] Yeah, so we decided to investigate outbreaks that had occurred from the beginning of 2018, right up to when we started this study (so right up to the end of August 2019). So all the outbreaks that we could identify being linked to home healthcare were included within this study. So that was a total of 10 outbreaks over that period.

[Sarah Gregory] And why did you want to do this study?

[Theresa Lamagni] So a number of reasons, the most important of which was that over time, we had seen an increase in a number of these outbreaks in England. So we were aware that teams were detecting them more and more frequently. And importantly, we could also really appreciate the challenges that they were facing in trying to investigate them and trying to control these outbreaks. And so, we wanted just to capture their experience to actually see what seemed to work well for them, what did learn from their investigations, and what could be helpful to other teams in future who are investigating and controlling these outbreaks. So that was really the motivator for us, was to just try and see what lessons could be learned from that. And also just to use it as an opportunity to raise awareness, both within health protection teams but also the wider healthcare community, including of course, importantly the teams who re delivering care to patients at home. But these outbreaks do occur and that these are the ways in which they can be investigated.

[Sarah Gregory] So help me with this. How were these infections actually transmitted in home healthcare settings? I understand about vulnerability and open wounds, but where's the bacteria coming from?

[Theresa Lamagni] So that's a very important question and one of the key questions we wanted to answer within our study, to try and work out what is the mechanism by which these infections are being transmitted from one patient to another. And what we found in this review was that it was very hard to establish definitively what the route of transmission was. Of course, we know that the nurse and/or the equipment that he or she brings with them must play a role within the outbreak. It's the only plausible way in which it can be transmitted between one patient and another, where those patients have no direct contact with each other at all. Most of these patients are in fact house bound, so they don't even leave their homes.

So we know that they play a role. But to what is that role, what is the mechanism, that's something that we still have some question marks over. Our expectation was that we would find that in a number of these outbreaks, we would identify nurses who were colonized with group

*Invasive Group A Streptococcus Outbreaks from Home Healthcare, England, 2018–2019*

A streptococci, and that the carriage of that organism by the nurse would be the most plausible route of transmission. Now, that could well be the case. However, the screening that was undertaken of those nurses, which was fairly...it was fairly extensive, it didn't...it rarely identified a nurse as a carrier. It did in one of our outbreaks, but in most of them, it didn't.

We do need to be a little bit cautious in not over interpreting that, because in many of these outbreaks there was a considerable delay between the identification of screening as a tool...as an investigative tool within these outbreaks and it actually being delivered. So in other words, the screening sometimes took many, many weeks to organize, and that delay could mean that by the time the nurses were screened, they actually weren't colonized anymore. So maybe some of them had cleared the carriage naturally. And lastly, we had some concerns about the way some of the screening was organized and undertaken. So...and of course, we...well, not of course, but for most of these outbreaks, only the throat was screened, and we know from experiences in outbreaks in other settings that there can be other body sites which are colonized, not just the throat, whereas mostly we focused on the throat.

So we can't definitively say too much about nurses carrying the organism not being the reservoir that could have been. However, when we looked at the pattern of contacts between the nurses and the patients, we often found that in these outbreaks, there wasn't, let's say, one nurse or even a small group of nurses who had seen all of those cases before they develop their infection. So when you looked at those patterns, then it made us think, well perhaps there's more than one thing going on here and it could well be that some of the patients are being seen by this team of healthcare providers, that one or more of these patients is themselves acting as a reservoir for this infection. So nurse goes into their home, there could be contamination of their equipment, of their clothing, of the bags and materials that were used to transport the equipment. That contamination then gets transferred to the next patient. And so, it may well be that that contamination of equipment was actually the means by which the transmission was happening. However, as I said, we cannot be too conclusive about that, as we were very much reliant on information that was supplied to us.

[Sarah Gregory] I see. So what you're saying, age or gender didn't really play much part in the transmitting—I'm not talking about how sick people got. So there was no way to tell, really, how age or gender could have possibly played a part in this, correct?

[Theresa Lamagni] Not in terms of the transmission itself. I mean...clearly in terms of the susceptibility to infection, then yes, of course. But by virtue of needing these services, this was a population who are tending to be much older by and large, and more women were like to be senile as well. Again, you're looking at an older demographic, therefore more likely to be female. So I don't think that necessarily plays a role in terms of transmission, though.

[Sarah Gregory] How was your study structured?

[Theresa Lamagni] So we identified all of the outbreaks we wanted to include in the review by querying a national outbreak and case management database. So we're lucky, in a way, that we have this national database that all the local teams will input their outbreaks and incidents into. So we queried that database to identify all potential outbreaks or inclusion within that database. We then combined that with a separate database that's held by the national reference microbiology lab in London. They hold their own outbreak database, so we cross-matched them to make sure we weren't missing any. We then contacted all the health protection teams where an outbreak had been recorded and all the ones when an outbreak hadn't been recorded just to check

that they hadn't...that we hadn't missed anything in terms of how we queried those databases. And once we established all the outbreaks that occurred during that time period, we then set up semi-structured interviews which...with each of the chairs of the outbreaks within the local teams. So that's really how we went about getting our data captured for the study.

Once we'd conducted those interviews, we were able to summarize the details, feed them back to each of the teams, check that our understanding was correct and they were happy with our conclusions, and then pull out altogether into some collated findings where we could draw out some of the key themes.

[Sarah Gregory] And speaking of those key things, briefly is there anything else about this study you want to tell us?

[Theresa Lamagni] Yeah. So as we already mentioned, we included and found 10 outbreaks during this time period. All of them were outbreaks where home healthcare delivery was the most plausible mechanism of transmission. So some outbreaks, it's not necessarily...or it's very clear what the mechanism of transmission is, what are the commonalities between cases. But in all 10, it was the most plausible mechanism of transmission for the organism.

So between the 10 outbreaks, there were 96 cases of invasive group A streptococcal infection identified, with 29% of those cases very sadly dying as a result of their infection, just highlighting the impact of these devastating infections on the patients.

The outbreaks weren't typically very long, with a median duration of 199 days between the first and the last case. And importantly, they...one of the key features that we found with them is that there were often very long gaps between the cases. So the median was 21 days, but in one instance it was up to seven months between sequential cases. So that was a really key finding as well, and it really helped to explain why the detection of these outbreaks is so problematic. Because, clearly, with such a long delay, it wouldn't have been very obvious to the local teams who had seen...who had been advised of each of the cases that there was a connection between them. So really, that was one of the key findings for us was just how difficult that it can be to identify them.

[Sarah Gregory] With a seven-month gap, how are they able to tell that it is part of the same outbreak?

[Theresa Lamagni] Yeah, so that's a good question. So we had new strain-type information that tells us straight away that actually these cases were the same *emm* type (so the *emm* typing is the way we characterize these bacteria). And actually through a number of these outbreaks, they were subject to whole-genome sequencing. So the bacteria were actually investigated very thoroughly to look at the genetic fingerprint, if you'd like, of each of those strains. And by making that comparison between different cases within the outbreak, you could then infer how closely related those strains were. And that's what really helps in terms of building the evidence that this is definitely an outbreak because when you're looking at exactly the same strain between cases, then you know there must have been a transmission link between those cases. In fact, in one outbreak, which was...it was only actually identified from the whole-genome sequencing. So it wouldn't have been identifiable to the local team as an outbreak until we undertook an analysis of a group of strains that were being used, in fact, as a control group for another outbreak. And when they were selected and subject to that whole-genome sequencing as a control group, then we actually uncovered an outbreak within those control strains (so one that was entirely hidden

from view). So the entirely cryptic outbreak that would not have been identifiable without the whole-genome sequencing being applied.

[Sarah Gregory] Was there anything else that you discovered you want to tell us about?

[Theresa Lamagni] Yeah. So in seeing these delays in detection of the outbreaks, it became clear to us that it's really, really important for the local teams when they are notified of a case of iGAS-invasive group A strep infection.... when they are notified of these cases as part of their routine follow-up of the cases, that they should inquire about whether there has been any...whether the patient has received any home healthcare. And in doing so, they can record that within their local databases, such that if in the coming months (weeks and months) they another patient with iGAS infection, they can also ask about this again and they might start to see commonalities between those patients much more quickly because they recorded that in the first instance and can say, "Okay. These two patients are actually receiving wound care from the same nursing...district nursing service", for example. So it's that process of logging systematically such information which really helped to bring forward the detection of an outbreak. So that for us was a key learning point and something that we've sent back to the local teams as a lesson for the future.

[Sarah Gregory] And how were these outbreaks contained?

[Theresa Lamagni] So that's a good question, and one which is slightly difficult to answer. So once the outbreaks were detected, then we worked very closely with the providers of these services, of course, to put in place a number of different control measures depending on what we found to be happening on the ground. So the local teams would work very closely with those home healthcare services to review all of the infection prevention and control practices, so looking in great detail exactly how they went about stopping infections being transmitted from one patient to another.

So looking at what kind of equipment was being used and taken from one patient's home to another, how was that equipment transported, how was it decontaminated in between use. And as a result of that, they were able to offer advice on improvements that could be made. So for example, in a number of these outbreaks they identified that the nursing teams were using bags to transport the equipment between patients, which wasn't...didn't really lend itself to very easy cleaning and decontamination. So they were able to provide advice and say, "Okay, rather than use these bags, why not actually transport your equipment in a box that can be very readily cleaned out, that can sit in the booth of your car so it's very easy to transport in and out but can really be very thoroughly decontaminated and very quickly as well". So they were able to provide advice that helped with that.

In the outbreaks as well, the nurses were typically screened and, as I mentioned earlier, this was typically a throat screen, and they were given antibiotics that would decolonize any body sites that where they were carrying group A strep infections as well. So again, that was another key control measure that may have had an impact in emitting further transmission within these outbreaks. I have to say though, we don't really know which of these measures was effective, maybe it's a combination of all of them. It's very hard to know and we certainly need to do more research in this field to try and understand that.

[Sarah Gregory] Yeah. So on that same note, I mean, it's hard enough, as we know, to control infections in hospitals. It seems like there are major challenges for home infection control. Other

than these couple of things you mentioned, are there any other measures that you think people should just be doing on a routine basis?

[Theresa Lamagni] Yeah, I completely agree. It's really, really challenging delivering healthcare in a patient's own home. It's incredibly difficult, it's just not an environment which is designed for delivery of healthcare. So it may not necessarily be very clean and there is a real risk of contamination within that space.

So I think you note key things that we've applied as things like ensuring there are high levels of education on infection prevention and control for these teams, and just trying to work with them to review their practices and to see where we can actually improve things and make things slightly easier for them. However, these teams are extremely busy. They see a lot of patients. So a nurse may see up to 20 patients on a given day, so that's incredibly challenging in terms of trying to really maintain good infection prevention and control practices and do everything that you should do in between going from one patient to another.

[Sarah Gregory] 20 people a day. That seems hardly possible with moving, commuting from one patient to another.

[Theresa Lamagni] Very, very quick, yeah.

[Sarah Gregory] My goodness. So what do you feel is the most important public health element of this study?

[Theresa Lamagni] So for us, I think one of the most important things we wanted to do was to raise awareness of these outbreaks, just to say, "Look, this is a thing. This happens". These outbreaks really do happen. And by highlighting them both within the health community in the UK and internationally as well, and of course by highlighting the occurrence of these outbreaks with local microbiologists who might be helping to investigate them as well and diagnose infections to the teams themselves, we can help to try and improve the detection of these outbreaks. Because, clearly, the sooner you can identify the outbreak, the sooner you can start to investigate and put in place some (hopefully effective) control measures. So for us, the highlighting of the fact of these outbreaks occurring is really key.

[Sarah Gregory] Were there any surprises?

[Theresa Lamagni] So I think one of the surprises I found is that the providers of these services were not necessarily always very well setup to facilitate outbreak investigations. So we did find that there were often delays in getting information that we needed, such as which member of staff had seen which patient on which day. So very basic information sometimes was quite slow in coming to us. Making arrangements for screening of the healthcare providers, issuing antibiotics to them...all of these things were quite delayed. In some instances, there wasn't necessarily an occupational health service that was in place to provide this kind of support for the teams. So for us, that was one of the key learning points as well is just to emphasize to the commissioners who buy these services effectively for their local populations that it is really important that all these things are in place, and there is an understanding that outbreaks can and will occur amongst these providers. And they need to have these...all these different services in place to facilitate the provision of information which will help us to manage these outbreaks effectively.

[Sarah Gregory] Was there a difference in how these outbreaks were managed depending on where they occurred, like say, London versus Northampton or some more rural area?

[Theresa Lamagni] I couldn't say that there were any obvious patterns like that. I can't see that there necessarily would have been. I think the experience of the local health protection teams and the experiences of those local providers in their past experiences in managing similar situations would be the...this factor that would make the biggest difference. In other words, if it wasn't entirely new to them, if they had been through something similar in the past, they would build on that experience and would probably understand and hopefully have a good relationship and an understanding of how things are going to play out, what kind of information is going to be needed, what kind of control measures are going to be needed, how we would work with the local healthcare providers with those teams to try and educate them about what was happening and what was likely to happen over the coming weeks and months in terms of the need for screening and possibly antibiotic prophylaxis.

[Sarah Gregory] So you've mentioned several challenges. Are there any other challenges to this study that you'd like—not necessarily to the process of stopping it, but just the study itself—that you'd like to mention?

[Theresa Lamagni] Well, the...there's a lot which is still uncertain for us in terms of the...understanding the mechanisms of the transmission. As we already spoke about before, we are left with quite a lot of uncertainty, really, in terms of how the transmission...what the route of transmission is for these infections within these outbreaks. So from my money, really what I'd want to see us being able to do in the future is just to continue studying these outbreaks really carefully and trying to understand exactly what is happening, keeping an open mind about the routes of transmission but working very closely with the providers, building good relationships with them, where we would be able to do that much more to try and really unpick what might be happening within these teams and really try and use that then, of course, to formulate some potential ways of preventing the transmission.

I mean, I think there are some...just some very basic questions we feel are not answered in terms of what is effective in reducing transmission. So even simple things like use of surgical masks...if somebody is carrying group A strep in their throat and they wear a mask, how effective is that really in terms of stopping the transmission from that person to someone nearby? These for us are very, very basic questions, some of which are, once again, looked at in detail within the pandemic in the context of COVID transmission. But we really need to go that much further, I think, and look at this from the perspective of group A strep transmission.

[Sarah Gregory] Well, tell us about your job and what career path lead you to it.

[Theresa Lamagni] So I work in the UK Health Security Agency. It was formerly known as Public Health England, so some people will still remember it from that. So as an epidemiologist, it's my job to establish surveillance systems for a number of different infectious diseases and to interpret the data that comes to us, analyze it, put it out there for people to see exactly what's going on at any point in time, where we're starting to see a rise in infections, where we need to do more to try and control or investigate what might be driving changes in the epidemiology of these infections. So for me, it's all about the science of using that data to affect something positive for patients and the general population.

So that's really what my day-to-day job is. I have particular expertise in group A streptococci, that was what my PhD was in. So I spent quite a lot of time working with local health protection teams in providing advice in terms of how they should go about investigating outbreaks of group A strep infection. And in terms of my career path, so my first degree was actually in psychology.

And having finished my bachelor's degree in psychology, I was super keen to get a research job. And while I was hunting around for a research job, I actually decided to just to do some voluntary work just to keep myself busy while I was waiting for the perfect job to come my way.

And so, I worked with...in two places: one in... with the homeless shelters in London and day centers, and in drug services in Central London as well—so, providing needle exchange and working very closely with the therapeutic services that were provided to drug users. And through both those routes, I could start to see what these individuals were really facing in their lives and how infections were really playing a huge role in their lives and the impact it was having on them. It was during the time of AIDS and a lot of clients had AIDS and I had...I was able to see the impact it had on them and become very interested in infections and what could be done to prevent them.

And so, during that period I saw a job advertised that was actually monitoring risk behavior in drug users and monitoring levels of HIV and hepatitis antibodies, and I applied for that and then got really very, very interested in public health, and that was it for me. I decided to specialize in epidemiology, so I did a master's degree and eventually a PhD as well and have been there ever since.

[Sarah Gregory] Well, it's certainly a very interesting path. I always sort of...when I look back, I mean I love what I do as a communication scientist, but I think being an epidemiologist would have been a very high second-ranking choice if it had occurred to me a long time ago.

Living in England, what do like to do with your free time?

[Theresa Lamagni] So... what do I do in my free time? I like walking. I have a 14-year-old Labrador that I love taking out for nice walks on Hampstead Heath in London and traveling around the country with her. And I like to try and keep fit by swimming. And yeah, I suppose spending as much time outside and traveling when I have the opportunity. So in fact, right now I'm in Scotland rather than England. I'm looking out onto the Scottish Highlands and occasionally hearing the lovely bagpipes being piped across the loch.

[Sarah Gregory] Where exactly? I was in Scotland right before the pandemic. One of my very favorite places. Where are you?

[Theresa Lamagni] I am in Argyll, so on the West Coast of Scotland.

[Sarah Gregory] Very nice. I'm very envious, I always think that were I to have any UK roots, I would highly consider moving there.

Thank you so much for taking the time to talk with me today, Dr. Lamagni.

[Theresa Lamagni] You're very welcome. It's been my pleasure, Sarah.

[Sarah Gregory] And thanks for joining me out there. You can read the May 2022 article, Invasive Group A *Streptococcus* Outbreaks Associated with Home Healthcare, England, 2018–2019, online at [cdc.gov/eid](https://www.cdc.gov/eid).

I'm Sarah Gregory for *Emerging Infectious Diseases*.

[Announcer] For the most accurate health information, visit [cdc.gov](https://www.cdc.gov) or call 1-800-CDC-INFO.