DR. BRIAN METZGER: All right. So one thing that will be interesting about this. You'll get to see if I have a reaction. You'll get to witness, firsthand, if I have a reaction to the flu vaccine. But I'm in good hands here, I think.

All right. Thanks to you all for coming. We're going to talk a little bit about our Antimicrobial Management Program here that's been going on, really, I think, two years, now, if I'm not mistaken. So we're going to talk a little bit about the principles of an Antimicrobial Management Program. And then go on to some of our numbers, and what we've been able to accomplish here.

So here's a little bit of the outline of what we're going to go through. Just briefly, Antimicrobial Management Program, just the background, definition, the importance, and approaches. Then we have our AMP team and the accomplishments that we've had here. Followed by some metrics and impact. And then the future, what does the future hold for the program here?

So the definition of the stewardship program, I think that's important to start with. It's a system of informatics, data collection, personnel, policy, procedures which promotes the optimal selection dosing and duration of therapy for your antimicrobial agents throughout the course of their use.

An effective antimicrobial stewardship program will limit inappropriate and excessive antimicrobial use. But really more important than that, it also will improve and optimize therapy and clinical outcomes for the individual patient. So the narrow scope of the program is really to reduce the overuse of antimicrobial agents. But again, it's broader than that.

You really want to try to improve all aspects event of antimicrobial use. And you that, really, through improved diagnostics. In other words, knowing when to use medications. And we'll touch on that briefly a little bit later. Also improve education, knowing which drugs to use. Improved dosing, safer and more effective use of the antibiotics through improve dosing. Improve timeliness-- so what's using the most appropriate empiric therapy for a particular patient and their particular disease state? We want to try to have that match up front.

And then, more appropriate therapy duration, de-escalation, stopping and antimicrobials when inappropriate. And really, that's where you get the greatest decrease in your antimicrobials is in that step. Often antibiotics sort of linger for too long.

So goals of an antimicrobial stewardship program include, prevention or slowing of antimicrobial resistance. You want to optimize the selection, dose, and duration. You want to reduce adverse drug events; reduce secondary infections, such as C difficile infections; reduce morbidity and mortality; reduce length of stay. And with, that reduces health care expenditures.

Magnitude event of microbial use, well, antibiotics are the second most commonly used class of drugs in the United States. The spend is about 8 and 1/2 billion per year. It was about 200 to 300 million prescriptions written for antimicrobials annually. And about half of that was in the outpatient setting.

30% to 50% of all hospitalized patients receive antibiotics. And I think that's fairly consistent here. We're probably more on that 30% percent end, fortunately, rather than the 50%. Then there's been studies really, over and over again. This has been a repeated finding, that up to 50% of antibiotic use is either unnecessary or inappropriate across all types of health care settings. So inpatient or outpatient, that's been fairly consistent.

And they're misused in a variety of ways. You can give them when they're not needed. They're continued when they're no longer necessary. Sometimes given at the wrong dose. Broad spectrum agents are used to treat very susceptible bacteria. And the wrong antibiotic is given to treat an infection. That would be, sort of, the worst ways of misuse of all of these.

So this demonstrates antibiotic prescriptions per 1,000 persons of all ages according to state in 2010. So in dark blue is your highest antibiotic prescription rate. And that's mainly based here, from Indiana down through Louisiana. Texas falls kind of in the middle. But you can notice it's almost like the east to west pattern, where there's less antibiotic use the further west you go. It's kind of interesting.

I like this slide, just because it shows resistance as a function of time. So if you look, with each decade that goes by you get upward moving trend lines, here. The top one is MRSA. Number two is VRE. Three is carbapenem-resistant pseudomonas. Four, also carbapenem-resistant but acinetobacter. And then five, we're starting to see a little bit of fluconazole-resistant candida species.

Just a little plug for antibiotics, just how successful they've been. So there's no questioning how successful antibiotics have been. This is looking at mortality in the US during the 20th century. And there were 220 deaths per 100,000 persons, a decline of 220 deaths over about 15 year span, after sulfa drugs and then penicillin were introduced in the '40s and '50s. And that really drove that trend all the way down to where we are, pretty much, where we are now.

The other medical technologies are thought to have reduce deaths by about 20 more persons per 100,000 over the next 45 years. But are we going to see that increase as we maybe entered a post-antibiotic era? We'll see.

I just want to give a plug to-- down here is the antibiotic-- the CDC release the antibiotic resistance threats in the United States. This just came out maybe a month ago-- an entire report dedicated to antibiotic resistance threats. The CDC named antibiotic resistance one of the world's most pressing public health threats. And they stated the case as to why we need to act now, because of the way we use antibiotics today.

And one patient directly impacts how effective they'll be tomorrow, or even in another patient. In other words, there's this shared resource that we have. There's a big public health crossover with the use of antibiotics. WHO name antimicrobial resistance as a threat to global health security. And that it's endangering the prevention and treatment of infections.

Once again, this from the CDC report that recently came out. They saw that over 2 million illnesses and about 23,000 deaths were estimated to be caused by antibiotic resistance. And that was really thought to be a conservative number. They really wanted to be conservative with their analysis. So that's really a low figure, most likely.

They labeled certain microorganisms with the threat level of urgent. And those were, of course, carbapenem-resistant Enterobacteriasceas, or CREs. So your carbapenem-resistant e. colis, Klebsiellas, those sort of organisms. C. diff also made the list. As did, maybe a surprise to some, drug-resistant Neisseria gonorrhea, which we've recently lost, or begin to lose fluoroquinolones to treat gonorrhea infection.

So having to resort to a lot of IM ceftriaxone, as well as some other antibiotics. So the number of antibiotics you can use to treat that infection are decreasing to a very small amount.

So antimicrobial resistance increases mortality and morbidity. Excessive use of antibiotics accelerates resistance. And then the converse is true. If you use antibiotics appropriately, you'll see an actual reduction of resistance in your local antibiogram. And antibiotic-resistant infections were estimated to cost the US health care system about $20 billion annually.

And I just wanted to put this on here. Then this was taken from a study where they looked at mortality. And regardless of their Apache III scores, there were separate lines for whether you had an antibiotic-resistant organism or you didn't. Where you had a higher mortality if you had an antibiotic-resistant organism.

Here's a scary look at where KPCs are nowadays. They've been reported from just about every state in the US. And the ones that haven't reported it, it's probably just more of a reporting error than anything else, because they're found just about everywhere.

This is a little bit busy, but I feel like it really describes how antibiotic resistance spreads. You can start up here with antibiotics. And they're given to the livestock who develop resistant bacteria in their guts. And that can either remain on meat, or their feces can contain these antibiotic-resistant bacteria, which, then, can be spread on crops. And then they end up to us.

And then if you go back up here, we can personally get antibiotics and develop resistant bacteria in our gut. And we can either go home and spread it in the community, and go to a health care facility. You can go home and just continue that cycle of spread.

There's a couple of different ways to approach antimicrobial stewardship. One is through a formulary restriction and pre-authorization, which we don't do a whole lot of here. There's only very select antibiotics that are ID restricted. The thing we really tried to work on here, is having an approach which involved perspective audit with intervention and feedback.

What does that mean? So it's usually a review of the antibiotics, the microbiology, and what's going on with the patient-- usually around day three-- and giving some feedback as to whether there can be de-escalation of therapy, or even stop antibiotics.

Supplemental activities, including education, guidelines, order forms, de-escalation, IV to PO interchanges, dose optimization, using health care information technology, and automatic stop orders. This is most of what I do.

So you start with your infected patient. And over time, your coverage, if you look across here, this is your spectrum of activity. So you have an initial septic patient. And you want to, usually, start fairly broad with your coverage. And you can kind of narrow it down over time, especially based on your culture results, usually at 24 to 72 hours. And then finally, when you get your sensitivities back, that's when you can really narrow down your therapy.

One other important point is that antibiotics are not benign. Even just in the past year, we've had several FDA drug safety alerts on Tygacil, with increased risk of mortality, no matter what the infection, which we don't use much of at all, here, fortunately. fluoroquinolones, which causes tendon damage and peripheral neuropathy. Azithromycin, there was that big *New England Journal* article within the past year, maybe six months ago, or so-- really well done.

I think it was in Tennessee, where they looked at a population-based look at the prescriptions for azithromycin. And then also crossed it with a database that they had, on whether patients were admitted for cardiac events, or even died. And there was a slight increase risk of mortality, especially in patients that already had cardiac disease. So those were really the patients at higher risk for having a cardiac event while on azithromycin.

Collateral damage, of course, is C.diff with up to 85% of patients having an antibiotic exposure in 28 days before the infection begins. That's not our AMP team, but it can sometimes be that tough. We're just going to go over some accomplishment, some clinical initiatives that we've had.

Urine reflects culture criteria, that's something that we've just started. That's something that we had just noticed. That are urinalysis criteria, we thought, could be optimized a little bit better, as to what was reflex to a culture. So we did some work on that. And we're going to wait and see how that results.

But other things that we've already worked on include weight-based dosing of antimicrobials for surgical prophylaxis, intraoperative re-dosing, renal dose adjustments, and and IV to PO switches. We introduced pharmacodynamic dosing of Zosyn and cefepime, both of which the pharmacodynamic dosing, especially of Zosyn, there were studies that showed that there was improved mortality rates when you give your Zosyn this way. It just gives you a higher time above MIC, which is key for beta-lactam antibiotics. And that decreased mortality.

AMP Highlights is another initiative that comes out of the Antimicrobial Management Program. And then stop order policy, just changing that default duration of antibiotics from 14 down to 10 days, since there's more and more data coming out that most infections can really be resolved by that 10 day period.

AUDIENCE: Are the reflex urine criteria designed to reject specimens for culture that are contaminated with squamous epithelial cells, as they so frequently are?

DR. BRIAN METZGER: Yeah, we didn't look at squamous epis. We didn't look at any epis. That can be something in the future.

AUDIENCE: [INAUDIBLE].

DR. BRIAN METZGER: Yeah. Yeah, we feel like the cultures, the urine cultures in the ER could probably be obtained a little bit more cleanly. But what we did work on is, specimens we're going to urine culture straight from a positive leukocyte esterase, without any regard to how many white cells there were.

And those specimens automatically go to microscopy to see how many WBCs are in the specimen. So trying to avoid those specimens that maybe have a 1 plus leukocyte esterase, but have three to five white cells, let's wait for the microscopy to be done before we automatically send that off.

AUDIENCE: Similar to what we do with C. diff, right? If it's not a diarrheal stool, we're not doing the [INAUDIBLE] studies on it?

DR. BRIAN METZGER: Correct. Yeah.

AUDIENCE: We should apply the same criteria for urine that we're getting in an appropriate specimen.

DR. BRIAN METZGER: Right. So just trying to optimize that criteria upfront. So revision of order sets, these are just some of the order sets which were reviewed. Really tried to use best evidence-based recommendations for all these different disease states, and tried to have that reflected in our order sets. So look for those order sets.

Metrics and impact-- we have clinical interventions that are performed by our pharmacists, here. And those increased pharmacist interventions will lead to increase the appropriate therapy. Define daily doses over adjusted patient days, that's a metric that we use to have a standardized way of looking at our antimicrobial use over time. And the theory there is that decreased overall antimicrobial use will lead to decreased antimicrobial side effects and resistance. And then finally, decreased resistance will lead to decreased morbidity, mortality, and length of stay.

So here's a look at some of our data. This one here is looking at the clinical interventions that are performed by pharmacy. And you can see in blue, 2011-2012, where the lines are almost laying on top of each other. We've had a gradual ramp-up in the amount of interventions that are performed by pharmacy.

And I just want to thank you all. Over 90% of time, those interventions have been accepted. And so that's real important. You all are very important to making this all work, and get the patients the most appropriate antibiotics or given in the most appropriate way.

And we move on to antimicrobial use. So this is looking at all antibiotics with defined daily doses over here on the left. And this is time, obviously, with again 2011 in blue, 2012 in red, and 2013 in green. And you can, in general, see that these months here are continuing a downward trend. We'll see how the latter half of this year shapes up, but you've got to think that it's certainly going to be better than 2011.

Some key targeted antibiotics that we look at include fluoroquinolones. Cipro, Levaquin, yes, they're part of core measures, but these are drugs that you'd ideally like to reserve for the outpatient setting, or reserve their susceptibility for outpatient settings.

So decrease use in the inpatient setting-- when you have an IV line, and you can give other beta-lactam antibiotics, this is really important. So we've seen fluoroquinolones come down again, almost year laying upon year. So that's been pretty successful there. As well as, this vancomycin use-- as a general trend, they're kind of laying one under each other, with decreased vancomycin use.

And that's likely been driven by that perspective audit and feedback. Or you all looking at the cultures, and seeing that there's no MRSA that's been isolated in this patient. And so we can get rid of the vancomycin after a few days, that we may have started empirically.

And I think this really just shows it all, right here. This is our antibiogram here at Saint David's. And then you have North Austin, South Austin, and Round Rock. And these are percents susceptible. In other words, here at St. David's we had 100% susceptibility with pneumococcus or Strep pneumoniae to ceftriaxone last year, which is just tremendous. And you can really see that difference between the different hospitals in the area. And you can kind of march that down for each one.

These are very important combinations, e. coli and Levaquin, pseudomonas and Levaquin, and your carbapenems for Klebsiella pseudomonas. And then your cephalosporins for Klebsiellas, Just all very important bug-drug combinations that you want to have available to you. And I think these 70's here, that's mainly because it is a PO medication that can be given widely in the community. Plus the fairly low genetic barrier that organisms have to developing fluoroquinolone resistance.

It only takes two-point mutations in DNA gyrase genes that will make that resistance happen. But we're still seeing almost 80% susceptibility, even with fluoroquinolones here. So what does the future hold with our program?

Well, this is a future of antibiotics. Most of the major drug companies have gotten out of the antibiotic business. Most antibiotics that are going through the FDA currently are made by really smaller start-up companies. You can see that trend line just go down of how many new antibiotics were made in each of these five year time periods.

And there was really only two antibiotics that came out in the '08 to 2012. I think we will see a slight bump-up if we look 2013 to 2017. There's a few drugs in the pipeline right now that will be coming out. Including one that's fairly exciting that can be used again these carbapenem-resistant organisms. It's a combination of Ceftazidime with a new beta-lactam inhibitor called avibactam.

And early on it's showing some susceptibility with the CREs. Fortunately won't need to use as much here, but I think it'll help in a lot of other places.

Other challenges-- so we talked about fewer new antibiotics in the pipeline. There's, of course, going to be more increasing antibiotic resistance out there, just as patients get sicker and sicker and need more antibiotics. Strategies include ongoing education and emphasis on stewardship, use of clinical biomarkers to discontinue inappropriate therapy. And then increase use of technology. And those last two, so the biomarkers we'll get into a little bit later with procalcitonin. I'll explain what that is .

Increase use of technology, I think, includes, in the next few years, we're going to see this change or, I don't know if you want to call it a revolution in the way that microbiology is done from setting things up in culture, and then waiting a couple days for them to grow, and doing your about antibiotic susceptibilities. Well, I think, pretty soon we'll have the ability to take these specimens and do more rapid diagnostics.

There's a few different test methodologies that are coming available, where you get a considerably more rapid answer than what you have currently. And that can lead to decreased antibiotic use, in itself. You know, you get more targeted antibiotic use at a sooner time point. Just a little ID humor. It says, "The patient in the next bed is highly infectious. Thank God for these curtains."

Just some words about various topics in stewardship. and we'll start with de-escalation. That's where you change from a broad spectrum antibiotic to a narrower spectrum antibiotic, if appropriate. It can eliminate overlapping or combination therapy, as well. And sometimes you can even stop antibiotic therapy when a non-infectious etiology is most likely.

You administer these antibiotics for the correct duration. Decrease antimicrobial exposure, and that will lead to reducing adverse events, like we've talked about. As always, you want to obtain your appropriate cultures before starting antibiotics. This idea of an antibiotic timeout is something fairly recent.

We do a timeout for some other things, obviously. But this is sort of that day three, just sort of stepping back, looking at the information that you have at that point and looking at your laboratory results, your micro results, how the patient is doing, and sort of reassessing whether that's the right antibiotic for that patient, or if you can de-escalate.

So we go into a little bit of that here. Day three, you can stop, narrow the spectrum, or reduce the number of antibiotics, based on what you're seeing coming out of your cultures. And then later on, well, you always want to be thinking about duration, especially when you get to that day three. Really a lot of durations-- so by day three, you should pretty much know where the infection is and how the patient's responded to it. So those are a couple of key factors that determine duration. And so that can be done at day three, as well.

So here is what we were talking about, procalcitonin. It's a biomarker that can assist in determining the presence, severity, or progression of infection. It's something that we have the means to do here, and are going to try to bring this on, especially in a critical care setting, where you trend. So you trend to assess the response to therapy.

It's not very good as a marker of whether somebody has a septic process upfront, on the first measurement. It's really something that you want to check around day three, and you want to see that trend come down. And once it reaches a certain threshold level, once that's decreased below a certain number, then it can give you, maybe, that added confidence to say, you know what? This probably wasn't an infectious process.

So we're going to try that, here. And there's well-established protocols on how to use this, both in the ICU setting, as well as the ER setting. The ER setting is mainly for upper respiratory infections, and even lower respiratory infections, and whether that patient needs antibiotics. That's where the test can be used, as an upfront, one time, where you get a number and then it can help determine whether that patient needs antibiotics or not.

So about procalcitonin, it's a precursor produced in thyroid C cells. Normally is in levels lesson than 0.1 nanograms per milliliter. And its half life is about 20 to 35 hours. It's released from neuro-endocrine cells. And it's stimulated by microbial endotoxins and other host factors, mainly in the setting of bacterial infection.

These procalcitonin-guided algorithms can shorten antibiotic therapy in the ICU. They can be ordered, usually at baseline. And then about three to five days later, in that ICU setting, that critical illness setting. And antibiotics can be discontinued, generally, when it's less than 0.5, is the magic number.

Just a word about duration of therapy. Like I said, you want to avoid those automatic 10 to 14 day courses of antibiotics. Those days have mostly gone. There's more and more data here, cited, where uncomplicated urinary tract infections should be treated for about three to five days; community acquired pneumonia, three to two seven; ventilator associated pneumonia, eight-- of course, there was a classic study on that-- catheter-related bloodstream infections with coag-negative staph.

So when you get your coag-negative staph infected Permcath or Port-A-Cath, you can try to treat through those, initially, with seven days of antibiotics. Meningococcal meningitis, seven days, uncomplicated secondary peritonitis, four to seven, and uncomplicated cellulitis, five days.

Just a word about asymptomatic bacteriuria. What is it? It's generally a positive urine culture with the absence of symptoms. When is treatment indicated? Basically, only a couple of situations, that's pregnant women where they have increased risk of adverse outcomes if not treated, and then anyone undergoing urologic interventions. When is it not indicated? Pretty much everything else, with some specific situations listed here.

But in general, asymptomatic bacteriuria, you really have to hone in on whether that patient had symptoms. And that can include, sometimes, just fever or altered mental status. You can get a pass with that one. Urine cultures should always be obtained, again, with symptomatic patients. Urine cultures will assist and appropriate antibiotics election if the decision is made to treat that patient. And a negative cultural will obviously exclude bacterial infection.

And an outpatient setting deal with a lot of viral versus bacterial. Rhinosinusitis, there's been a lot written on this over the past several years, where a viral ideology is, in general, estimated to occur 90% to 98% of those cases of rhinosinusitis. Prevalence of bacterial infection is significantly more rare, and is generally just in 2% to 10% of patients. It's the fifth leading cause or fifth leading indication for antimicrobial prescriptions from office-based physicians. So there's a lot of antibiotics prescribed for this, when really, 90% of the time, it's viral.

When is a bacterial ideology more likely? Well, persistent symptoms, more than 10 days without clinical improvement, escalating symptoms, more severe symptoms, greater than 102 fever with purulent nasal discharge, those are obvious kind of signs. And then again, worsening symptoms, increase in nasal discharge, new onset of fever, headaches, those are your signs for bacterial infection.

Just a word on penicillin allergies. We see a lot of this. There's a lot of folks that will claim that they have a penicillin allergy. It's something we see very commonly in the hospital. It's thought that about 10%-- I think that's pretty conservative-- of people will report an allergy to penicillin. But really 90% of these will be able to tolerate penicillin treatment.

There's your typical reactions. You're Type I, of course, is the one that we're most was worried about. Screening is very important to differentiate who really has a pen allergy. History is so key with this. Where you just ask the patient to describe what their reaction was, How long ago did it occur-- since anything more than 10 years ago is thought to be less significant.

So if their reaction just occurred in the past few years, you would take that a little more seriously. If they give you an answer that they just had a rash. When did it occur? Was it after the first dose, which would be more like a Type I reaction. Did it occur after the 10th dose, which would not be like a Type I, hypersensitivity reaction.

And then since then, have you taken a penicillin, cephalosporin, carbapenem, or monobactam. Obviously, you don't want to ask them like that. And really that last one, it's really for us. Patients usually can't recall all this stuff. But I'll usually look back in Medatech, and even though they've had a pen allergy, well, they got Ancef prophylaxis for their cholecystectomy that they had two years ago. Or they've got Rocephin when they came in when they had community acquired pneumonia last year.

And so that can be really helpful in determining whether someone has a pen allergy. Cephalosporin cross-reactivity is really less than 1%. So that's why it's important to sort of differentiate, well, did you have your reaction to actual penicillins, or ampicillin? Or did you have it with cephalosporins? Because they usually say they had it with Augmentin, amoxicillin, or something like that.

Then you can go ahead and try cephalosporins, since that cross-reactivity is really so low. Unless, of course, they report Type I hypersensitivity. Then that's to be taken seriously. But if they just report rash or, I don't know, GI upset, you see that one, sometimes, then that's not a true allergic reaction.

Cross-reactivity can be high with agents with identical side chains. So there's a little bit of cross-reaction there. Carbapenem and monobactam, or Aztreonam cross-reactivity is close to 1%. It's very small.

Just a few words about cellulitis. Simple abscesses need an IND. Usually that's sufficient. There's a lot of data on them not even needing antibiotics, but short courses is appropriate for that setting. Recommended in any of these settings here, severe disease, comorbid conditions, suppressive conditions, extremities of age, rapid progression.

I just wanted to show the difference in picture form. Just what I mean when I talk about a non-pyogenic versus a pyogenic infection. Strep is more of this streaky redness. Whereas a staph infection is usually going to have, sort of, a juicy center there, that needs to be INDed.

Staph is a pyogenic infection. It creates pus. Whereas strep likes to just run in tissue planes. It will just streak right up. So that can sometimes be an important differentiating factor, just on clinical appearance, of how the cellulitis looks.

More staph-like, more strep. And the reason that that's important, staph, with about a 50/50 shot of it being MRSA verses MMSA, you're, of course, going to want to have MRSA coverage on board. But if you see something like this, it's really not going to be staph. And something like Cefazolin, or even ampicillin or something like that would be appropriate.

AUDIENCE: How about stasis dermatitis-- in differentiating cellulitis from stasis dermatitis?

DR. BRIAN METZGER: Absolutely. So just a simple feel. You know, a lot of those stasis dermatitis are very cold. That, right off the bat, will tell you that it's not cellulitis, if you don't have the warmth that you would normally have.

So the take home points. Antibiotics best practices-- really a first step in antimicrobial stewardship. Ensure all orders have a dose duration and indication. You really want to try to make that part of your every day practice. You want to get cultures before starting antibiotics. And take an antibiotic timeout. Just take that minute and reassess the antibiotics after 48 to 72 hours. You just want to try to make that part of your routine, make that part of your practice.

And again, another plug for the CDC report. That's where that's taken from. If you're interested, you can find that online on CDC.gov. And with that, I'll ask for any questions. If you can't read it, "I know other hospitals worry about super bug, but ours is the only one that understands the account system." Hopefully it won't get that bad.

AUDIENCE: Are they using the [INAUDIBLE] of calcitonin here at Marshall for a biomarker?

DR. BRIAN METZGER: We're not using it yet, here. We have the machine to do it. And we're just establishing those protocols on how to use it. And especially in the critical care setting, though it can be used in the outpatient or ER setting for respiratory tract infections. And there's a lot of data on that that you can find on what the cutoff values are and how to interpret those values.

AUDIENCE: So it could be the new ER troponin?

DR. BRIAN METZGER: Yeah. You have to try to triage which patients may have bacterial infection or not. Yeah. But it's found to be pretty helpful reducing antibiotic exposure. Victor.

VICTOR: Well, I with you would emphasize, or comment on the culture taking, because it's very important. And if you don't do it properly then [INAUDIBLE].

DR. BRIAN METZGER: Yes.

VICTOR: Correct?

DR. BRIAN METZGER: Yes. So not only getting a culture, but getting it properly. And as part of the stewardship program, we do talk about rates of contaminated blood cultures or contaminated urine cultures, and how we're doing as a hospital, along those lines. But do you mean surgical cultures, as well?

VICTOR: We delegate the [INAUDIBLE] of somebody to do a culture, but they do not properly [INAUDIBLE].

DR. BRIAN METZGER: Right, or I guess an important point there could also be, instead of in the OR if you see pus, don't swab it. Submit the actual pus itself. Or submit tissue right around it. With taking it by way of swab can really decrease your rate of growing that organism. There's a little bit of culture error there, if you put it on a swab. Anything else? Yes.

AUDIENCE: So what do you do when your cultures are all negative, and yet you clearly have pus in the pelvis, and have done the appropriate cultures?

DR. BRIAN METZGER: So when you're cultures are negative in a--

AUDIENCE: Sick patient, where you've done all the appropriate cultures.

DR. BRIAN METZGER: Well, that's a situation where--

AUDIENCE: [INAUDIBLE]?

DR. BRIAN METZGER: Yeah. That's really, you're kind of stuck on empiric therapy, or treating to what's most likely to have grown, in that situation. And I'm not saying it in your case, but oftentimes, you get negative cultures when you have antibiotics prior to culture acquisition. But sometimes that does that's certainly does occur. And if you see pus and you're not getting any help from your cultures, then sometimes you are stuck empiric therapy. And we just try to minimize those occurrences. Yes.

AUDIENCE: When you say cultures, are you talking about cultures, or are you doing like [INAUDIBLE] techniques, like we do for STDs? We send out for culture, but it's not actually a culture, it's a [INAUDIBLE] DNA-type research.

DR. BRIAN METZGER: Right.

AUDIENCE: Is that what you're doing?

DR. BRIAN METZGER: Well, that's what we're going to be moving toward. I could see maybe in the next three to five years, but I think definitely in the next 10 years, that it's going to be these rapid diagnostic tests, that are actually more sensitive than the actual culture themselves.

It's just right now, the culture gives us the additional information of susceptibility reporting. But that's changing, as well. We're getting rapid susceptibility testing, as well. That there are some diagnostics that are coming out that not only give you what the bug, but also tests for a variety of genetic mutations or plasmids that will show if that organism is resistant.

So it will not only tell you it's a Staph aureus, but it will also look for the MecA gene and tell you that it's MRSA. Or it will tell you it's an enterococcus faecium, but it will also look for the VanA gene and tell you it's a VRE. So all those things are starting to come together. And I think in the next few years we'll have that.

AUDIENCE: Does that mean that could change the need for how to collect the swabs, the specimens? And also, is it possible they may be able to do [INAUDIBLE] for unit volume, so that when [INAUDIBLE] or whatever the number is, and you start the antibiotic with a drop of [INAUDIBLE] anyone? Because it has thought to be [INAUDIBLE].

DR. BRIAN METZGER: Yeah, the PCT sort of moves towards that. Talking about having something that--

AUDIENCE: And with [INAUDIBLE] some people may only need two [INAUDIBLE], because they have reduced the time to such a level that you don't need that amount.

DR. BRIAN METZGER: Right. So just talking about having some sort of marker that drifts down to let you know when to stop antibiotics. And I think the procalcitonin, that's where it is most helpful. That once it reaches that critical threshold below a certain number, that that's actually when you can stop your antibiotics.

AUDIENCE: Well, that's still a [INAUDIBLE] marker.

DR. BRIAN METZGER: Yeah, right. Right. It's not a measure of the organism itself, no. OK.

AUDIENCE: Well, thank you.

DR. BRIAN METZGER: All right, thank you.

[APPLAUSE]