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INSIDE

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Highly Drug-resistant *C. auris* Continues to Emerge in U.S.

Can persist indefinitely on skin, environmental surfaces

By Gary Evans, Medical Writer

The CDC is urging infection preventionists and their clinical colleagues to have a high index of suspicion for emerging *Candida auris*, a fungus that spreads more like bacteria, can be highly drug-resistant, and survives on skin and environmental surfaces for prolonged periods.

"We want people to think about this particular [pathogen] when they see *Candida*," says **Tom Chiller**, MD, MPH, who is spearheading the CDC response as chief of the Mycotic Diseases Branch. "The key is if you are dealing with a *Candida* infection, it is important to try to figure out what that species is. As soon as you know it's something common, then you're good. But if it is not being identified get, it somewhere it can be identified. State labs can help; the CDC can help if needed. The other thing [clinicians] need to be thinking about is that this organism transmits differently [than typical fungi]. If you do identify it, you need to put contact precautions in place. Try your best to contain it — to make it the only case that shows up in your hospital."

> "THE TERM 'SUPERBUG' HAS BEEN SOMEWHAT OVERUSED IN OVERWROUGHT HEADLINES AS WE APPROACH THE WARNING SIGNS OF A POST-ANTIBIOTIC ERA."

The term "superbug" has been somewhat overused in overwrought headlines as we approach the warning signs of a post-antibiotic era. However, if there is an emerging pathogen that warrants the term, it is *C. auris*, which was first reported as the

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etiologic agent of an ear infection (hence, the *auris* name) in 2009 in Japan. *C. auris* now has been identified in other parts of Asia, Africa, South America, and the United Kingdom. In the United States as of July 31, 2017, the CDC reported 112 cases of *C. auris*, with the bulk of them in New York (77) and New Jersey (23). Illinois reported four cases, and Massachusetts three. Other states reporting at least one case include Connecticut, Florida, Indiana, Maryland, and Oklahoma.

"These are all cases in hospitals or long-term acute care facilities," Chiller says. "Right now, this is [infecting] a very medically exposed patient population. We haven't gone into the community to actually look for it yet, because we are concerned about [inpatients]. We are focusing our efforts on hospitals and long-term care facilities. I think that of the cases we have now, close to 70% or so are from the blood. Many of the cases we are seeing in the U.S. are bloodstream infections. When you look globally, a lot of the cases are bloodstream, as well."

The U.S., case counts reflect clinical infections with *C. auris*, but there also is a broader group of colonized patients. In four states that had clinical cases and then screened for colonization, a total of 120 patients were found to be asymptomatic carriers. The CDC emphasizes that recommended infection control measures are the same for both infection and colonization with *C. auris*, meaning asymptomatic carriers also would be placed in contact precautions. As with other multidrug-resistant pathogens, patients may be colonized for months and there is limited guidance on decolonization or removing isolation protocols. Healthcare workers certainly could have their hands transiently colonized long enough to risk cross-transmission, but they do not need to be tested for *C. auris* unless they are identified as a possible source of transmission to patients.

The continuing global emergence of this fungus has epidemiologists not known for exaggeration describing its unusual characteristics, which typically are not seen in fungi. These include spreading in hospitals more like bacteria; persisting in the environment unless powerful sporicidals are used, and acquiring resistance easily without any tradeoff in organism fitness.

To the latter point, some organisms that acquire drug resistance sacrifice some measure of vitality, losing the ability to sustain spread but occasionally occurring as an outlier. Much feared vancomycin-resistant *Staphylococcus aureus* is an example. Unfortunately, acquiring antibiotic resistance appears to exact no price from *C. auris*, with no sacrifice in virulence or transmissibility. Some global isolates have shown pan-resistance to all three classes of antifungal drugs, but none of those strains had yet been detected in the U.S. as of this report. The CDC recently updated its interim infection guidelines for *C. auris*, but generally continues to recommend rapid detection and isolation.[1]

"We are trying to get information out to the healthcare environment and workers as quickly as we know something," Chiller says. "Right now, we are working on a clinical laboratory update because we want to start getting some information out about what physicians and hospitals must be thinking when it comes to doing colonization work or trying to screen someone who they think might be at risk of having this

organism. We are constantly trying to update this, and I am hopeful we will have that coming out very soon."

While this drug-resistant strain is still emerging, it is well to remember that currently some 46,000 healthcare-associated infections caused by other species of *Candida* occur annually in in the U.S. The broad emergence of *C. auris*, with its unusual propensity to thrive in the environment and develop drug resistance, would complicate this picture considerably, making fungal infections a public health threat on the level of the panoply of gram-negative organisms that have caused so much consternation in recent years.

Q&A with CDC Expert

Hospital Infection Control & Prevention (HIC) asked Chiller to describe the challenge of stopping *C. auris* in a recent interview, which is edited and summarized as follows:

HIC: How did this pathogen emerge so quickly — is it a distinct strain?

Chiller: Let me give what this is looking like from the epidemiological and case standpoint. We have been working with global partners for a number of years and that has really helped with whole genome sequencing. We have identified four distinct clades that seem to have developed in different parts of the world. How, when, and why those clades developed we don't really know, but they are clearly distinct so it doesn't appear they are related in any recent time period. In the U.S., all of the cases that have been seen so far relate to one of those four clades.

HIC: Is there concern that this could gain a foothold and become endemic in hospitals?

Chiller: In New York and New Jersey [hospitals] there does seem to be some local spread. We can monitor that, and some of those strains are slightly different, suggesting that they have been there a little while and have had a chance to evolve. We're seeing in some places — like Oklahoma, for example — they rapidly identified one case and they got on it right way. That particular hospital did all kinds of containment and infection control measures, increased their disinfection practices, did some surveying around the hospital and didn't find it. We feel pretty good about the fact that they probably had a "one-off" case. They reacted to contain, control, and eliminate any further spread within the hospital.

> "GENERALLY WHAT WE HAVE FOUND IS THAT IT IS TRAVELERS WHO ARE COMING IN FOR MEDICAL CARE."

That is not the case in some of these clusters in New York and New Jersey, where they didn't know it was there. It had an opportunity to spread and sort of set up shop like some of these other bad actors, *Acinetobacter*, CRE (carbapenem-resistant *Enterobacteriaceae*), and some of the other bacteria that we are trying to control. It's acting very similar. It's acting like a bacteria. That is what we are seeing right now in the U.S. There are a couple of places that continue to combat this and they are trying to take some extra measures to see if they can control and contain it. There are other places where it is a one-off introduction, probably from a traveler. Generally, what we have found is that it is travelers who are coming in for medical care. This is not just a random person who has traveled on a plane. This is someone who is medically ill in another country and is often coming here for continued medical care.

HIC: Can you speak to patient outcomes and mortality caused by these infections?

Chiller: This is a very medically experienced population. They are a very sick, lots of medical problems and lots of interventions. We know there has been around 30% mortality. Unfortunately, we don't know how much of that is related to *C. auris* because these patients are sick with multiple medical problems. I can tell you the majority is not related. At least, I don't think it is — it's hard to say. We don't know how much is truly associated with *C. auris*. We know they died *with* it, but we certainly don't know if they died *of* it.

On a more global level, we are very interested and concerned about its ability to cause death and we know that in our country, candidemia in general — bloodstream infections — are major issues at our hospitals. In many hospitals, they are the number one cause of bloodstream infections. We know *Candida* species are deadly and we know there is an associated mortality of 20% to 30% in many cases. We just don't know yet with *C. auris* in the U.S., but in talking to some global partners where there is a lot more *C. auris* in their countries — they are convinced that some of the mortality from those patients is directly due to *C. auris*. We haven't been able to really document the direct evidence of that yet.

HIC: What level of drug resistance are you seeing?

Chiller: It's interesting — there doesn't seem to be a clade-specific resistance pattern. That suggests to us that resistance, unlike with a lot

of other *Candida*, is acquired readily. They seemed to be able to acquire resistance easily, and when they have [become resistant] they are very fit. In other words, they are very content with that resistance. As you know, in the bacterial and pathogen world, we often think that acquiring resistance has sort of a fitness cost. They get this resistance and they are not as happy as they were when they didn't have it. But that doesn't seem to be the case with *C. auris*. These organisms are just as content being resistant.

So, the resistance that we've seen, unfortunately, is widespread. We see almost all of the isolates that we have been able to test, and we've talked to colleagues around the world — are resistant to fluconazole. That is one of the mainstay treatments of *Candida* through the years. About 30% to 50%, depending on where you are, are resistant to amphotericin B, an old class of drugs that is really important to have when you are treating *Candida*. And the first line therapy, which is a new class of drugs called echinocandins — depending on where you are — we are seeing 1% [resistant isolates] all the way up to 20% and 30% in some populations in Venezuela and Pakistan.

In our country, thankfully, we have had just a handful of isolates that are resistant to the amphotericin B. We have seen a case that we are fairly sure developed resistance while on echinocandin therapy, which is concerning. You hate to see bugs being able to acquire resistance while they are getting the appropriate treatment. Again, we are still trying to understand more about *C. auris*, how it acquires resistance so readily, and why it seems so fit when it has resistance. There are quite a few organisms that are resistant to two drugs, so at least we have one drug left. But there are a handful that we are finding that are resistant to all three drug classes. The problem with that is we really don't have other drug classes to treat them with. Nothing in the U.S. has been pan-resistant yet, but we do know of some in South Asia. Certainly that is a concern when you are dealing with any organism. When it develops resistance to all known treatment modalities, you start struggling with how you are going to treat people. We are hoping to keep those highly resistant strains in check and figure out ways to combat them now before they become widespread.

HIC: The other unusual characteristic of this pathogen that has been cited by investigators is that it spreads more like bacteria than fungi. Can you elaborate on this?

> "WE ARE USED TO SEEING *CANDIDEMIA*, BUT GENERALLY THE DOGMA IS THAT THOSE *CANDIDA* ARE IN OUR INTESTINAL TRACT AND ARE PART OF OUR NORMAL MICROBIOME."

Chiller: I keep telling healthcare workers, physicians, even my fellow infectious disease docs, don't think of this particular *Candida* species like other *Candida*. Think of it like a bacteria because it is spreading readily within healthcare environments, unlike the typical *Candida* that we are very used to. Remember this is one of the most common bloodstream infections we have now in our hospitals. We are used to seeing *candidemia*, but generally the dogma is that those *Candida* are in our intestinal tract and are part of our normal microbiome. They are part of our normal flora, and in a hospital when you get exposed to surgery or get put on some broad-spectrum antibiotic that are mainly antibacterial, they kill the bacteria and *Candida* has a chance to overgrow. They translocate out into the bloodstream and cause problems. We often think of *candidemia* as a sort of of autoinfection. You are infected with your own strain and you don't generally pass it from person to person or to the hospital environment.

In this case, *C. auris* is not acting like that, as far as we can tell. We still need to do more work, but it is acting like a nasty CRE or an *Acinetobacter*. It gets in a hospital environment, sets up shop, and can live on surfaces and equipment. It can be passed by hands as well as person to person and environmental surface to person. That's how *C. auris* is acting. The paradigm has shifted for this particular yeast. One of our messages is to really get docs, nurses, pharmacists, everyone aware of this. When you see this *Candida,* don't think [yeast] think bacteria because that is what it is acting like. That's a challenging message to get out there, but that has really been our focus.

HIC: What about colonization and the whole issue of asymptomatic carriers that might be a reservoir for subsequent infections?

Chiller: That's one of the things we are trying to elucidate and understand. In our web reports, we are reporting cases that are [infected] patients versus cases that are colonized. If you have a case of a patient that actually has an illness, we will often sample around that patient to understand whether this organism is being transmitted locally within the hospital and within the environment. We can then target cleaning and contain or get rid of it if we can. It definitely likes to colonize skin. We have people who had it on

their skin for nine months, so it seems to be very [capable of] surviving on skin. Again, this is slightly different than the typical, usual *Candida* that is in our gastrointestinal tract. We also know that it survives really well on surfaces, plastic, floors, window sills, beds, desks. It can clearly survive in the environment and it is also more challenging to kill.

HIC: Thus, the change to a disinfectant with a sporicidal claim?

Chiller: The typical disinfectant we use in our hospitals — quaternary ammonium — does not work well at all against *C. auris*. Quaternary ammonium is sort of like the holy water of disinfectants — we use it everywhere. But it doesn't kill *C. auris*. We really have to up our game to get this organism and use *Clostridium difficile (C. diff)*-type disinfectants. That is what we are recommending now in hospitals. That's why it is important to identify colonized or [infected] cases so we know where it is so we can stomp it out. Just because you're carrying it doesn't necessarily mean you are going to become infected with it; in fact, that's probably not the case. But it definitely means that the environment might be contaminated and we really want to eliminate it from healthcare settings as quickly as we can. Right now, we are recommending the highest level disinfectant, a *C. diff*-type sporicidal disinfectant. We are trying to look into the other possibilities for disinfectants that work. ■

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SSIs: A Common and Costly Infection

Some clear actions to take, but unresolved issues dog CDC guidelines

After an exhaustive review of the literature for evidence of best practices, the CDC has issued new guidelines[1] for the prevention of the most common and costly healthcare-associated infection: surgical site infections (SSIs).

The goal of the CDC's Healthcare Infection Control Practices Advisory Committee (HICPAC) was to thrash through the thicket of data, controlled trials, and observational studies in an attempt to bring the best evidence to bear on a guideline that had not been updated since 1999. They certainly had some success, but the bar they were bound to was a high one, and many issues fell into the dreaded "no recommendation/unresolved issue" category.

"Sadly, in surgical infections, there are tons of unresolved issues. There just aren't any studies," **Dale Bratzler**, DO, MPH, MACOI, FIDSA, said recently in Portland at the conference of the Association for Professionals in Infection Control and Epidemiology. An internist and chief executive officer of the Oklahoma Foundation for Medical Quality, Bratzler was a member of HICPAC when the SSI guidelines were being revised and was heavily involved in the effort.

> "AN ESTIMATED 77% OF DEATHS AMONG SSI PATIENTS ARE DIRECTLY ATTRIBUTABLE TO THE INFECTION."

"SSIs are the most common and most expensive HAIs reported in hospitals," he said. "They are extremely costly and have substantial patient morbidity and mortality. The risk factors include operation type, patient host factors, the [individual] surgeon, and other things. No single intervention is going to take care of the problem of surgical site infections."

Currently, SSIs infect some 160,000 to 300,000 patients annually. In estimates cited in the new CDC SSI guideline, approximately 80 million surgical procedures were performed in the United States at inpatient hospitals and ambulatory hospital-affiliated or freestanding surgical centers in 2006.[1]

"Two percent to 5% of all operations end up with an SSI, and when that happens the patient is more likely to die, or to get more inpatient and outpatient treatment," Bratzler said. "There is substantial increase in the length of stay when they are diagnosed, but as you know, more than half of SSIs are not diagnosed until the patient has already gone home, which then results in their readmission."

With regard to CMS Value-Based Purchasing and other incentivized reimbursement programs, "a single patient with an SSI can impact the payment programs for doctors, hospitals and others through all these various programs," he said. "It is very substantial and something that you want to prevent."

While the contributing factor of any given infection to subsequent mortality can be somewhat undefined for some infections, the link to developing an SSI and subsequent death is more firmly established. An estimated 77% of deaths among SSI patients are directly attributable to the infection, Bratzler said. Surgical site infections add 7 to 11 additional postoperative hospital days and cost up to $10 billion annually, he said.

Risk Factors

As mentioned, the risk factors that can contribute to the development of an SSI are legion, but Bratzler said some of them can be broken down under the following four major areas:

• **Host factors:** Includes age, morbid obesity, malnutrition, prolonged preoperative stay, cancer, and diabetes.

• **Endogenous flora/microbial factors:** Includes nasal/skin carriage, virulence, adherence, and inoculum.

• **Surgical procedures:** Includes abdominal site, wound classification, poor hemostasis, drains/foreign bodies, and urgency of the surgery.

• **Surgical team and hospital practice factors:** Includes razor shaves, intraoperative contamination, prophylactic antibiotic timing, selection and duration, preoperative screening for resistant organisms and decolonization, surgeon's skill, and surgical volume.

"There are a lot of risk factors for surgical site infections. Some of those are in your control and some are not," Bratzler said. "I love the inspirational concept of getting to 'zero.' I also think it sometimes drives underreporting and maybe some 'gaming' of reporting. I think that we just have to acknowledge that we might not be able to prevent all [SSIs], at least based on the current level of scientific knowledge that we have. That said, it is generally considered that 50% of surgical site infections are probably preventable if we did all of the evidence-based practices."

Bratzler reminded that virtually all surgical wounds become contaminated in the operating room, noting that it is a misconception that the OR is some kind of sterile environment.

"Different operations have different risks," he said. "So, colorectal surgery or vascular surgery of a lower extremity have a much higher risk of SSIs than total knee replacement. It is largely because the inoculum of the bacteria that are likely to get into the wound."

In addition, similar operations performed by the same surgeon in different patient populations will have different rates of infection, he noted.

"That's because there are different patient host factors, but I will tell you that the same operation done exactly the same way by different surgeons will have a different SSI rate," Bratzler said. "Frankly, we don't know yet how to measures surgical technique and address that as a risk factor. Clearly, there are studies that show the rate of infections varies by surgeon."

Unresolved Issues

The aforementioned areas where there is insufficient data to make any recommendation include the following unresolved issues in surgical infection prevention:

• weight-based antimicrobial dosing;

• intraoperative antimicrobial irrigation;

• antimicrobial soaking of prosthetic devices;

• antimicrobial dressings applied to surgical incision;

• optimal target for blood glucose control;

• value of HbA1C for predicting SSI;

• best strategy for maintaining normothermia;

• oxygenation in non-endotracheal intubation surgery;

• best mechanism to deliver postoperative oxygen and the optimal $Fi0_2$;

• optimal timing of preoperative bathing.

For all orthopedic surgery key questions except antimicrobial prophylaxis duration, no randomized, controlled trials were identified and only observational studies reviewed.

"I will tell you that for orthopedic surgery we made the decision, because there was not a single randomized trial, to look at observational studies," he said. "We didn't find any evidence that we could hang our hats on there, either, with one exception: Stop the antibiotics at the end of surgery duration. That was the only recommendation we made in orthopedic surgery."

The new HICPAC SSI recommendations were ranked as follows:

• **Category IA:** A strong recommendation supported by high- to moderate-quality evidence suggesting net clinical benefits or harms.

• **Category IB:** A strong recommendation supported by low-quality evidence suggesting net clinical benefits or harms or an accepted practice (e.g., aseptic technique) supported by low- to very low-quality evidence.

• **Category IC:** A strong recommendation required by state or federal regulation. "We had no category IC recommendations," Bratzler said.

• **Category II:** A weak recommendation supported by any

quality evidence suggesting a trade-off between clinical benefits and harms. "This last category is kind of flip of the coin about whether it's helpful or not," he said.

SSI Recommendations

The following are some of the major CDC/HICPAC recommendations to prevent SSIs, with comments from Bratzler.

• In clean and clean-contaminated procedures, do not administer additional prophylactic antimicrobial agent doses after the surgical incision is closed in the operating room, even in the presence of a drain. (Category IA)

"Most of you guys should be cheering because we gave a Category IA recommendation for all operations — stop antibiotics once the incision is closed," he told APIC attendees. "That is controversial with some [surgical] societies, but we didn't find a single study that showed any benefit of antibiotics post-incision closure. [The wound] is a dead vascular space with no blood flow. The way you fix those infections is reopen the wound."

Indeed, the characteristics of a wound carved out of a section of tissue makes it unlikely that antibiotics are going to penetrate to kill the bacteria in the surgical site. Of course, with the current focus on preserving antibiotic efficacy, any move to reduce unnecessary use of antimicrobials is helpful to prevent the rise of multidrug -esistant bacteria.

"Historically, we thought if we just gave a bunch of antibiotics and gave them for a long time, we could prevent surgical infections," Bratzler said. "It's important to know that you have this avascular wound — this space — and then we put tight sutures and other things to hold the skin and soft tissues together. You can give antibiotics until the cows come home and you're not going to prevent these infections once the wound is closed. Nothing is going to get in there, and giving antibiotics is going to have very little impact on infections."

• Administer preoperative antimicrobial agents only when indicated based on published clinical practice guidelines, and timed such that a bactericidal concentration of the agents is established in the serum and tissues when the incision is made. (Category IB)

• Administer the appropriate parenteral prophylactic antimicrobial agents before skin incision in all cesarean section procedures. (Category IA)

"Again, few randomized trials, except for cesarean section, where we gave Category IA based on multiple randomized trials showing reduced risk of SSIs if you give the antibiotic before the incision is made," he said.

• The literature search did not identify sufficient randomized, controlled trial evidence to evaluate the benefits and harms of intraoperative redosing of parenteral prophylactic antimicrobial agents for the prevention of SSI. *(No recommendation/unresolved issue.)*

"There are no randomized trials on these, but there are a lot of observational studies that suggest that this is a good thing to do and shows that it can reduce surgical site infection," he said. "There are also pharmacological data showing if you don't give a big enough dose, you'll never exceed the MIC [minimum inhibitory concentration]. That data is very strong, but again, there were no randomized trials of intraoperative redosing."

• Consider the use of triclosan-coated sutures for the prevention of SSI. (Category II)

"A big controversy, and we gave it a weak recommendation," Bratzler said. "However, there is really good data that if you are using braided, non-absorbable sutures that biofilm develops. There are very good reports of patients that had persistent draining that were ultimately traced to non-absorbable sutures that had biofilm on them and were contaminated. If you are using monofilament [sutures], the risk is less and if you are using absorbables the risk is less. But non-absorbable, braided sutures are clearly a risk."

• Implement perioperative glycemic control and use blood glucose target levels less than 200 mg/dL in patients with and without diabetes. (Category IA)

"We recommended this for all operations, not just cardiac surgery. There is good data in a variety of opertions that it reduces the risk of SSIs. There is substantial increased risk for SSIs in patients with diabetes and hyperglycemia."

• Maintain perioperative normothermia. (Category IA)

"We gave a [high] recommendation for keeping patients warm in the operating room," he said. "We couldn't tell you exactly what temperature to target or any best practices for keeping patients warm. There are a variety of different devices out there."

• For patients with normal pulmonary function undergoing general anesthesia with endotracheal intubation, administer increased FiO_2 during surgery and after extubation in the immediate postoperative period. To optimize tissue oxygen delivery, maintain

perioperative normothermia and adequate volume replacement. (Category IA)

"Why [normal pulmonary function]? Because that is the only group of patients that's been studied, if they didn't have 'normal pulmonary function' that got excluded from the studies," Bratzler said. "But there is evidence there that you can reduce SSIs in those patients. Also at the same time if you are keeping those patients warm and have adequate volume replacement."

A Bath's a Good Thing

• Advise patients to shower or bathe (full body) with soap (antimicrobial or nonantimicrobial) or an antiseptic agent on at least the night before the operative day. (Category IB). "We actually did not find randomized trial evidence in surgery that using chlorhexidine [CHG] or anything else was that much better than using soap and water," he said. "But taking a bath's a good thing. We don't have anything against using CHG; we just didn't find randomized trial evidence. This recommendation did not include the population colonized with MRSA, where there is good evidence that you should use CHG."

• Perform intraoperative skin preparation with an alcohol-based antiseptic agent unless contraindicated. (Category IA)

"We recommend you use an alcohol base, so there is povidone iodine-based alcohol, there is CHG-based alcohol. Alcohol kills bacteria very rapidly," Bratzler said. "In the preoperative phase, we recommended an alcohol-based antiseptic."

• Consider intraoperative irrigation of deep or subcutaneous tissues with aqueous iodophor solution for the prevention of SSI. Intraperitoneal lavage with aqueous iodophor solution in contaminated or dirty abdominal procedures is not necessary. (Category II)

"This is a weak recommendation, but perhaps in limited operations, particularly spine surgery, which was shown to be a little bit beneficial but not for abdominal operations," he said. ■

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CMS, Joint Commission Are Citing for 'Flash' Sterilization

How one hospital drove 'immediate use' sterilization to zero

A recent emphasis on sterilization issues in The Joint Commission inspections directs surveyors to ask this question: "Are there enough surgical instruments to minimize the use of immediate-use steam sterilization (aka 'flash' sterilization)?"[1]

The Centers for Medicare & Medicaid Services (CMS) also has cited for immediate use sterilization. The thinking is that it is all right in an emergency if you have no replacement for the dropped piece of equipment, but it cannot occur on a routine basis. CMS requires that any equipment subjected to immediate use sterilization is used "immediately and handled in a manner to prevent contamination during transport from the sterilizer to the patient." Thus, the abiding principle is that if you must rapidly sterilize an instrument — usually in an effort to return it to the sterile field — you must immediately use it.

It would be extremely difficult to directly link a dropped, flash-sterilized instrument to a subsequent surgical site infection, but there is enough evidence that the powers that be have banned the practice except for emergency situation.

The VA Hospital System was ahead of the trend on this, issuing a directive in 2010 to, with rare exceptions, phase out all immediate-use sterilization. **Sharon Alexander**, MPH, BSN, CIC, MT(ASCP), an infection preventionist at the VA Medical Center in Pottstown, PA, outlined her successful program recently in Portland at the annual conference of the Association for Professionals in Infection Control and

Epidemiology (APIC).

The first step was to track and analyze the common reasons staff were using immediate-use steam sterilization.

"Decreasing immediate-use steam sterilization—what those of us who have been around for a while used to call 'flash' sterilization — is an important component of [preventing SSIs]," Alexander said. "We can utilize best practice guidelines, but each facility faces challenges. In our case, the immediate challenge was actually getting a team together to [create] guidelines and best practices and to develop an attitude of zero tolerance for flash sterilization."

The baseline rate in 2010 was 18.5 immediate-use sterilizations per 1,000 operative cases.

"I assure you it was much higher prior to that," she said. "We didn't have an implementation gap; we had an implementation chasm. We had to find a way to actually identify and make sustainable interventions. We researched implementation science."

This is, essentially, plan, do, check, act — with the twist being the somewhat unpredictable nature of human behavior.

"How did we get to zero and how did we sustain it?" she says. "First of all, we needed to support the selection, development, and scale up of improvement strategies. We had the research and we knew the best practices. But you don't know where you are going until you know where you are at. So, we developed a database. We needed to drill down. The biggest thing was what was flashed, why, and how often?"

Reasons cited for flashing a surgical instrument include: a replacement was not available, batteries were not charged on equipment, or it was a one-of-a-kind instrument.

"We staged our interventions," Alexander said. "We didn't try to eat the elephant all at once. And I think that is why some programs fail — they say, 'Let's tackle it all.' No, you have to tackle it a bite at time. The biggest issue was that the batteries were not charged. If you knew you were going to have a case, don't you think you should plug it in the night before? Also, if you knew you were going to need a camera, don't you think you would find it beforehand? Those kinds of things — a lack of anticipation. This wasn't just at the frontline level; it was at the supervisory level."

With regard to one-of-a-kind items, she said, "If you keep dropping one-of-a-kind items, maybe you need to buy some more. Also, it is not all about instrumentation. We found out after we did some of this that we had had holes in [instrument] wrappers that you could drive a truck through. We ended up going to rigid containers, and that solved a lot of the problem."

The program enjoyed steady success, from 18.5 per 1,000 operative cases, to 15.8, to 10.2, and to 2.6.

"We had zero for both fiscal year 2014 and 2016," she said. "We actually dropped one instrument in fiscal year 2015. You would have thought the roof was failing. There were questions, concerns, everybody was upset — it was wonderful! I am proud to tell you that to date since that dropped instrument [in 2015], we have not flashed anything. Your team can do this, too. You have to get the folks on the frontline engaged. They have to truly believe that their efforts recording on that [flash sterilization] log are actually going to be taken seriously and we are going to utilize the data. Now, we are doing no flashing. None. It's possible. You can do this." ■

REFERENCE

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Poor Oral Care During Hospitalization May Lead to Pneumonia

NV-HAP is an infection few have on their radar

Ventilator-associated pneumonia (VAP) is a commonly tracked healthcare-associated infection, and frequently the target of interventions to protect patients. On the other hand, non-ventilator healthcare-associated pneumonia (NV-HAP) falls into a gray area, where it often remains unreported in surveillance systems.

After a patient that seemed on her way to recovery developed

NV-HAP and died, **Barbara Quinn**, RN, ACNS-BC, a clinical nurse specialist at Sutter Health in Shingle Springs, CA, began looking into the problem. Quinn recently presented her findings in Portland at the annual APIC conference, reporting that a major risk factor for NV-HAP is disrupted bacteria in the patient's mouth that are aspirated into the lungs to seed pneumonia. The lack of oral care during hospital stays emerged as a major risk factor.

"We started looking into this and trying to figure out if we had an issue," she said. "We did a retrospective chart review for one year. That included 24,000 patients in that year and over 94,000 patient days."

Not surprisingly, the majority of the NV-HAP cases happened outside of the ICU.

"They were not our ICU patients on ventilators — they were medical-surgical patients, oncology, orthopedic, and neurology," Quinn said. "In those patients, when we looked at the preventive care that we knew actually helps prevent pneumonia — especially oral care, because we felt like that was the most modifiable risk factor for all of these patients — only 27% of the patients had oral care. When we looked at the chart for the frequency of oral care, it was like once every other day. It was mortifying from a nurse's perspective."

With that as a "dismal" baseline, Quinn and colleagues reviewed the literature to analyze the cost, length of stay, and mortality.

"Those three things — because to do anything about it, we needed funding," she said. "We needed some kind of return on investment strategy. When we looked at our year's worth of data, we found $4.5 million dollars were spent, 23 patients died with pneumonia, and over 1,000 patient days [resulted] that could have been prevented."

They then performed an oral-care gap analysis by reviewing the literature and deciding what to include. "What is the best practice, and what are our gaps in those areas?" she said. "That would help direct us to areas where we needed to take action."

These(cost, length of stay, and mortality) were the three most common gaps identified in the analysis, and likely a good starting point for IPs wanting to look into the problem at their facility.

"A common gap that we find is that the only oral care protocol or policy is for patients in the ICU on a ventilator," she said. "That was something that we had to change. We had to write a policy to cover all of the patients."

Similarly, ICU patients on vents were receiving best practice oral chlorhexidine washes. Another best practice was brushing patients' teeth or having them brush. Those were added for non-vent patients.

"We've been working with the American Dental Association [ADA] at the national level to come up with a protocol that meets the particular needs of a hospitalized patient, and follows the ADA guidelines," she said, showing the recommendations on a slide. "The first thing you're going to notice where it says frequency — four times a day. An audible gasp is usually what we get. But think about how quickly the bacteria replicates — five times every 24 hours. That means every six hours, you have to start all over again. How quickly the bacterial pathogens found in the environment get into those mouths."

The task may seem daunting, but Quinn reminded that about 75-80% of patients in the hospital can brush their own teeth. They will need initial instructions and tips, along with a reminder of why it's important, but the results can be dramatic. Suction toothbrushes are available to use for dementia or stroke patients that may be prone to aspirate during the cleaning.

After 2.5 years, NV-HAP was reduced by 70% from baseline.

"In that two-and-a-half years, we avoided 164 cases of hospital-acquired pneumonia," she said. "That means we saved 31 lives. We saved $6 million and about 1,500 extra patient days." ■

Virulent, Drug-resistant Pneumonia Bug Emerges in China ICU

Strain identified after fatal outbreak in ventilation patients

In particularly unwelcome news from China, researchers report they have isolated a strain of *Klebsiella pneumoniae* that is both hypervirulent and highly drug-resistant. A worse combination is difficult to imagine. Usually, hypervirulent *K. pneumoniae* remains susceptible to drugs, but acquiring resistance apparently through genetic transfer in nature means this is a bug that could possibly infect heathy people in the community, let alone frail hospital patients.

The pathogen was discovered during an investigation of a fatal outbreak of ventilator-associated pneumonia in an ICU at the Second Affiliated Hospital of Zhejiang University in Hangzhou. The researchers collected 21 carbapenem-resistant *K. pneumoniae* strains from five patients, all of whom died. As infection preventionists are well aware, carbapenem is a last resort drug and its use typically indicates nothing else has worked.

All five patients — aged 53 to 73 — had undergone surgery for multiple trauma and placed on mechanical ventilation.

"They all had severe pneumonia, carbapenem-resistant *K. pneumoniae* infections, and poor responses to antibiotic treatment, and died due to severe lung infection, multiorgan failure, or septic shock," the researchers reported.[1] "All five representative carbapenem-resistant *K. pneumoniae* strains belonged to the ST11 type, which is the most prevalent carbapenem-resistant *K. pneumoniae* type in China, and originated from the same clone. The ST11 carbapenem-resistant hypervirulent *K. pneumoniae* strains pose a substantial threat to human health because they are simultaneously hypervirulent, multidrug-resistant, and highly transmissible."

It seems virtually inevitable that we will see this pathogen in the United States. Last year, a female patient in an acute care hospital in Reno, NV, died of carbapenem-resistant Enterobacteriaceae (CRE) that was resistant to 26 antibiotics.[2] The pathogen was *K. pneumoniae* that was isolated from a wound specimen. Of note, the patient had recently been hospitalized in India, and the specific enzyme conferring pan resistance was first discovered in that country: New Delhi metallo-beta-lactamase-1 (NDM-1).

In addition, medical researchers performing a lab experiment previously combined a *K. pneumoniae* carbapenemase (KPC) strain now common in much of the U.S. with a highly virulent isolate from Asia, conferring the multidrug resistance of the former and the killing power of the latter into a new microorganism similar to one detected in China. Researcher **Tom Chiang**, MD, an assistant professor at Rutgers New Jersey Medical School who conducted the experiment, essentially predicted the China finding would happen in a previous interview with *Hospital Infection Control & Prevention*. *(For more information, see the February 2014 issue of* HIC.*)*

"Our study was important to show that it is possible for the virulent strains to obtain KPCs and we're just beginning to see the tip of the iceberg on carbapenem resistant — possibly pan resistant — strains of *K. pneumoniae* emerge," Chiang says. "It will probably first disseminate in Asia, as the virulent strains are endemic there. If it disseminates here, the consequences will be catastrophic for the healthcare system. *K. pneumoniae* is the second-most prevalent gram-negative bacteria in our hospital and our affiliated hospitals, surpassing *Pseudomonas aeruginosa* several years ago and second only to *E. coli* now." ■

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2. CDC. Notes from the Field: Pan-Resistant New Delhi Metallo-Beta-Lactamase-Producing *Klebsiella pneumoniae* — Washoe County, Nevada, 2016. *MMWR* 2017;66(1):33.

COMING IN FUTURE MONTHS

- Using IGRA to streamline volunteer TB testing
- A timely update on CMS and infection control
- MERS still causing hospital outbreaks in ME
- A decision tree to guide *C. diff* testing

HOSPITAL INFECTION CONTROL & PREVENTION

CME/CE INSTRUCTIONS

To earn credit for this activity, please follow these instructions:

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3. Pass the online test with a score of 100%; you will be allowed to answer the questions as many times as needed to achieve a score of 100%.

4. After completing the test, a credit letter will be emailed to you instantly.

5. Twice yearly after the test, your browser will be directed to an activity evaluation form, which must be completed to receive your credit letter.

CME/CE QUESTIONS

1. According to CDC investigators, which of the following is true of the fungus *Candida auris*?

A. It spreads more like a bacteria than a fungus.
B. Some global isolates are pan-resistant.
C. It can survive on the skin for up to nine months.
D. All of the above

2. What kind of disinfectant is recommended to remove *C. auris* from the hospital environment?

A. Phenols
B. Quaternary ammonium
C. Alcohol wipes
D. Sporicidal

3. How many surgeries are estimated to result in a surgical site infection?

A. 1%
B. 2% to 5%
C. 6% to 8%
D. About 10%

4. Researchers trying to prevent non-ventilator pneumonia HAIs report a common gap that oral care protocol or policies are usually only for ICU patients on ventilators.

A. True
B. False

CME/CE OBJECTIVES

Upon completion of this educational activity, participants should be able to:

1. Identify the clinical, legal, or educational issues encountered by infection preventionists and epidemiologists;
2. Describe the effect of infection control and prevention issues on nurses, hospitals, or the healthcare industry in general;
3. Cite solutions to the problems encountered by infection preventionists based on guidelines from the relevant regulatory authorities, and/or independent recommendations from clinicians at individual institutions.