



# HOSPITAL INFECTION CONTROL & PREVENTION

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MAY 2019

Vol. 46, No. 5; p. 49-60

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## A Bold Strategy to End the AIDS Epidemic in the U.S.

*Having been in this fight for decades, IPs cannot be complacent*

*By Gary Evans, Medical Writer*

**M**arshalling an array of treatment and prevention advances, public health officials have established an ambitious plan to essentially end the AIDS epidemic in the U.S. in the next decade.

While taking an overall national approach, the plan — part of a collaboration between the Centers for Disease Control and Prevention (CDC) and other federal agencies — would target specific geographic areas and at-risk populations. The goals are a 75% reduction in infections in the next five years and a 90% reduction in 10 years.<sup>1</sup>

The plan calls for an aggressive testing and treatment approach that

links rapid HIV infection diagnosis with initiation of drugs that can reduce the circulating virus to undetectable levels.

“We can now say with a good degree of scientific certainty that ‘undetectable’ really does equal ‘untransmittable,’”

**Anthony Fauci, MD,**

a pioneer in AIDS treatment and research at the National Institutes of Health (NIH), said at a recent CDC meeting. “That is one of the foundations of what we are doing with this plan.”

The adjunct to rapid detection and treatment is having at-risk but uninfected

populations, such as men who have sex with men, use new prevention approaches like pre-exposure prophylaxis

**THERE ARE APPROXIMATELY 1 MILLION PEOPLE WITH HIV INFECTION IN THE U.S., WITH SOME 40,000 NEW INFECTIONS EACH YEAR.**

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**Financial Disclosure:** Peer Reviewer Patrick Joseph, MD, reports that he is a consultant for Genomic Health, Siemens, and CareDx. Senior Writer Gary Evans, Editor Jesse Saffron, Editor Jill Drachenberg, Nurse Planner Patti Grant, RN, BSN, MS, CIC, and Editorial Group Manager Terrey L. Hatcher report no consultant, stockholder, speaker's bureau, research, or other financial relationships with companies having ties to this field of study.



## HOSPITAL INFECTION CONTROL & PREVENTION

*Hospital Infection Control & Prevention*® (ISSN 0098-180X) is published monthly by Relias LLC, 1010 Sync Street, Suite 100, Morrisville, NC 27560-5468. Periodicals postage paid at Morrisville, NC, and at additional mailing offices. POSTMASTER: Send address changes to *Hospital Infection Control & Prevention*, Relias LLC, 1010 Sync Street, Suite 100, Morrisville, NC 27560-5468.

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### SUBSCRIPTION PRICES:

U.S., Print: 1 year with Nursing Contact Hours (12 issues), \$499. Add \$19.99 for shipping & handling. Online only, single user: 1 year with Nursing Contact Hours, \$449. Outside U.S., add \$30 per year, total prepaid in U.S. funds.

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This activity is effective for 36 months from the date of publication.

This activity is intended for infection preventionists and healthcare epidemiologists.

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(PrEP). The CDC estimates that one prophylaxis pill a day is 97% effective at preventing HIV transmission from an untreated sex partner. In addition, the national plan calls for rapid response to HIV clusters, such as those linked to IV drug users.

There are approximately 1 million people with HIV infection in the U.S., with some 40,000 new infections each year. Testing is a critical first step, as the CDC estimates that nearly 40% of people with HIV either don't know about their infection or know but are not in treatment to suppress the virus. This group accounted for 80% of HIV transmission in 2016, the CDC reported.

Those driving transmission in the community also pose risk when in the hospital, says **Karen Hoffmann**, RN, MS, CIC, FSHEA, FAPIC, president of the Association for Professionals in Infection Control and Epidemiology.

"I think it is great that they are focusing on people who are not recognized to have HIV infections," she says. "When you don't know it and are early in your infection, the viral load is very high, which means a high risk of transmission in the community."

A higher titer of circulating virus presents greater risk to healthcare workers if there is a blood exposure to these patients, such as needlesticks. Although a major concern early in the epidemic, hospital transmission of HIV is now exceedingly rare with standard precautions, sharps safety devices, and effective post-exposure prophylaxis treatments for exposed workers. In addition, more than half of people with HIV in the U.S. are under treatment, which means they pose virtually no risk of nosocomial transmission.

"Healthcare workers who are

exposed to a needlestick involving HIV-infected blood at work have a 0.23% risk of becoming infected," the CDC reports.<sup>2</sup> "In other words, 2.3 of every 1,000 such injuries, if untreated, will result in infection."

There have been 58 cases of confirmed occupational transmission of HIV to healthcare workers in the U.S. Of these, only one confirmed case has been reported since 1999, the CDC notes. However, there are another 150 possible cases. The numbers also likely reflect some underreporting, as case reporting of occupational HIV is voluntary.

The gains in preventing and treating HIV are remarkable, but Hoffmann warns against celebrating imminent victory in these latter years of the epidemic.

"As IPs, we are always fighting complacency with hand hygiene, appropriate PPE [personal protective equipment], and sharps safety to build compliance on a perpetual basis," she says.

"For IPs, the issue is that half of the people out there with HIV don't know it — and we don't know it. We can't be complacent."

## 'Unusual' Infections

The CDC reported in 1981 that five gay or bisexual men with an unexplained *Pneumocystis carinii* pneumonia had been identified in Los Angeles. Two of them had died and the etiologic agent was completely unknown.

"The occurrence of pneumocystosis in these five previously healthy individuals without a clinically apparent underlying immunodeficiency is unusual," the CDC stated.<sup>3</sup> "Observations suggest the possibility of a cellular-immune dysfunction related to a common exposure that

predisposes individuals to opportunistic infections.”

The AIDS epidemic had begun. Those first deaths in the U.S. have now been followed by 700,000 others.

“HIV has cost America too much for too long,” **Jerome Adams**, MD, MPH, U.S. Surgeon General, said at a recent CDC press conference. “And the sad reality is, if we accept the status quo, over the next decade another 400,000 Americans will become infected with this virus.”

After five years of decline, HIV has plateaued in the U.S. since 2013. This is primarily because the effective prevention and treatment options are not being pursued by many people at risk, said **Robert Redfield**, MD, director of the CDC. The idea in the plan is to increase access to testing, treatment, and prevention, particularly in communities at greatest need.

“The majority of new infections occur among gay and bisexual men — with black and Latino gay and bisexual men bearing the disproportionate number of those infections, especially those between the ages of 25 and 34,” he said. “HIV touches every corner of our country, mainly cities but rural areas as well, with diagnosis rates currently highest in the South.”

The CDC and its partner agencies are establishing teams to target HIV infection in high-burden areas. The approach will bring in local health officials, implementing systems to increase routine HIV testing in clinical settings and reach more people with nonclinical testing options, Redfield said. Those at-risk but HIV negative will be directed to prevention resources.

“This includes increasing PrEP availability in community health centers, providing training

of healthcare professionals, and conducting outreach for those at highest risk,” he said. “This is a missed opportunity. If we increase access to testing and treatment for HIV infection, we can prevent a lion’s share of new infections in this country.”

## Out of Africa

We need look no farther than measles to realize a national triumph over a disease does not end the continuous threat of international introductions reaching susceptible populations. The national plan faces a steep and thorny path, but the tools are at hand now to end one of the worst epidemics in human history. It is an open question whether this approach could be applied globally, but it may represent the best hope until an HIV vaccine can be developed.

The World Health Organization estimates that 37 million people are currently living with HIV/AIDS. Another 35 million have died globally of HIV/AIDS since those first cases appeared in 1981.<sup>4</sup> A few years later, researchers identified the causative agent as human immunodeficiency virus, enabling testing of patients.

Researchers subsequently found in this century that the natural reservoir for HIV is *Pan troglodytes troglodytes* chimpanzees<sup>5</sup> in Cameroon, where bushmeat hunters likely acquired the virus in butchering and consuming the animals. Some researchers note that HIV may have circulated for decades in central Africa, spreading primarily among heterosexuals before emerging and spreading rapidly among gay and bisexual men in the U.S. (See *Hospital Infection Control & Prevention*, July 2013.)

“Life expectancy of my patients

in the winter of 1981-82 was about one year,” said Fauci, director of the NIH National Institute of Allergy and Infectious Diseases. “The reason was they came to us with advanced disease because we could not diagnose the infection. We didn’t know what it was. We were taking care of individuals with a disease that did not have a name yet.”

As the epidemic advanced, it became clear that HIV could have been acquired a decade before, with patients only presenting for treatment when they had progressed to full AIDS, which was marked then by opportunistic infections after the immune system broke down. With the dramatic advances in antiretroviral therapy, young people diagnosed with HIV today can live close to a normal life span if they are compliant with treatment, he said.

“Today, if I see a patient who is about 25 years old and recently infected, I put them on a combination antiretroviral therapy,” Fauci said. “I can look that person in the eye and tell them quite honestly that if they take their medication, they likely will live another 50-plus years.”

Having researched HIV and treated AIDS patients for decades, Fauci says the key advances were made possible as scientists broke down the HIV replication cycle and found ways to interrupt it at critical points.

The first major breakthrough was in 1987 with the approval of the drug AZT, which first showed the level of virus in the blood could be reduced temporarily, he said. With the development of two-drug combination therapy in the 1990s, viral counts could be diminished further, but again, this effect could not be sustained indefinitely.

“But in 1996, with the

advent of the protease inhibitor, which introduced the three-drug combinations for the first time, we were able to drop the level of virus below the detectable level and keep it there indefinitely,” he said. “Today, we have more than 30 drugs which when given in combinations have completely transformed the lives of individuals.”

The future will see longer-lasting combination drugs in a single pill or given in injections, he said. This therapy is really the “game-changer” because studies of condomless sex show that HIV-positive men cannot transmit the virus if they are under effective treatment.

“The fundamental scientific and clinical basis for this plan is ‘treatment is prevention’ — plus PrEP,” he says. “We know it will save lives, prevent suffering, and prevent new infections. There are good examples throughout the country that show that when

you aggressively and proactively do diagnosis, treatment, and prevention, things change.”

The critical fight will be in the geographic and demographic hot spots where HIV has currently found a reservoir.

“We are not naïve — we know we are not going to get this right the first time,” Fauci said. “We are dealing with a lot of diversity. What we do with African-American men who have sex with men may be different with transgender persons, clusters of IV drug users, and heterosexuals.”

Likewise, approaches may be different in rural versus urban communities. The plan is to monitor the interventions in real time and keep striving toward best practices, he added.

“People say, ‘You have been doing this for 37-and-a-half-years — how is this new?’” he said. “This is the first time that an accelerated effort

to implement HIV treatment and prevention in the U.S. has been simultaneously undertaken by multiple HHS [U.S. Department of Health and Human Services] agencies that are focused specifically on concentrated target populations.” ■

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# IPs Held the Line When AIDS Epidemic Hit U.S.

*‘There was so much fear’*

Currently president of the Association for Professionals in Infection Control and Epidemiology, **Karen Hoffmann**, RN, MS, CIC, FSHEA, FAPIC, was a new IP at Detroit Medical Center 38 years ago.

She recalls the day in 1981 when the Centers for Disease Control and Prevention (CDC) released a report<sup>1</sup> on the first cases of what eventually would be called AIDS. *Hospital Infection Control & Prevention* talked to Hoffmann about the IP experience during the epidemic in the following interview, which has been edited for length and clarity.

**HIC:** What was your reaction when that first report came out in 1981?

**Hoffmann:** I was actually sitting in a lecture where they said the biggest threat for infectious disease was herpes. I went back to my office and the *MMWR* [*Morbidity and Mortality Weekly Report*] had just come out on those five cases. It was just a few months later we saw our first cases of Kaposi sarcoma and *Pneumocystis carinii* pneumonia patients. I just remember the panic in healthcare personnel was unlike anything I had ever seen. It was comparable to the [more recent] fear of Ebola.

**HIC:** How did the emergence of AIDS impact the role of the infection preventionist?

**Hoffmann:** It totally changed

my career and all the careers of IPs moving forward. We didn’t really know what the route of transmission was originally; we could only presume what kind of precautions we needed. There was so much fear. Every time a new patient with HIV or suspected HIV came to a floor that hadn’t had a patient before, I would get a phone call. I would go to the floor to educate and support, explaining what the precautions should be for those patients and getting the healthcare providers comfortable enough to do the care. Sometimes, they were doing over-the-top things like bagging all the patient body fluids because they just had so much concern.

**HIC:** At that time, the isolation

measures — the precursors to “universal” and then “standard” precautions — included body substance isolation and blood and body fluid precautions.

**Hoffmann:** We did pretty quickly get good information from CDC and people who were looking at the behaviors that were unique to this population. We did the epidemiology to look at the risk factors. We could kind of then put together what we needed in terms of risk of exposure. I always felt confident in the recommendations we were making. We really spent the first decade as IPs out there working at our own facilities, but I think many of us — including myself — were called on to go far beyond that. I spoke to people who did adoptions, foster parenting, the sheriff’s department — I can’t even count how many EMS and fire departments. It was the infection preventionists who really went out and did that work and did the training.

**HIC:** Training demands must have increased considerably with

the Occupational Safety and Health Administration’s (OSHA’s) Bloodborne Pathogen Standard in 1991.

**Hoffmann:** That started a whole other wave of IPs leading the way and creating the plans for their individual facilities and really figuring out for the first time how to implement an OSHA directive for bloodborne pathogens, administrative rules, work practice rules, and engineering controls. That was brand new to healthcare facilities to have to implement.

We were the ones as IPs who had to really work outside of our own departments in train-the-trainer programs and everything else we did to get that implemented. It’s really a great success story for IPs. It put us at the forefront of preventing infections within the facility and working with direct care providers.

**HIC:** There was great concern about protecting healthcare workers, particularly from needlesticks, at least until post-exposure prophylaxis became available.

**Hoffmann:** That is still an ongoing issue. We don’t want to put anybody on prophylaxis who does not need it. Because while the drugs are amazingly effective, they also have side effects.

That is still ongoing work, but we have had so few, and recently no HIV transmission to healthcare workers from exposures.

One of the first things that I heard when I started in infection prevention is that all outbreaks are opportunities for improvement. This was really a great example of that because of all the emphasis on safe injection practices, needleless symptoms, and safe transfer of sharps in the OR.

While we had hepatitis B and C transmission going on for decades, this really got people’s attention to focus on it. So preventing HIV also prevented HBV and HCV. ■

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# IPs Finally Moving the Needle on *C. diff*

*But drug use driving MRSA spike in community*

A combination of antibiotic stewardship, infection prevention, and environmental cleaning contributed to a 20% reduction in *Clostridioides difficile* from 2016 to 2017, the Centers for Disease Control and Prevention (CDC) reports.<sup>1</sup>

“This is the first time we have seen a decline of this magnitude for *C. difficile*,” says **Athena Kourtis**, MD, PhD, MPH, a medical epidemiologist at the CDC. “We are very encouraged by that, and it actually puts us

on target to meet the goal for the national action plan.”

From a baseline of 2015, the national healthcare-associated infection (HAI) action plan calls for a 30% reduction in overall *C. diff* infections by 2020.<sup>2</sup> The surveillance data reported were drawn from hospitals reporting to the CDC’s National Healthcare Safety Network (NHSN).

“We have some data suggesting these trends are continuing, and we are really encouraged by that,” Kourtis says.

*C. difficile*, which kills some 15,000 patients annually, frequently emerges after the administration of antibiotics used for other infections disrupts the commensal bacteria in the gut. As a result, antibiotic stewardship programs tempering the use of the drugs have been heavily emphasized in recent years.

“Antibiotic stewardship has played a big role,” she says. “*C. diff* can cause diarrhea [and] colitis, and can even be life-threatening. [The reduction] may also have to do with enhanced

environmental cleaning because *C. diff* sheds spores that can survive as a dormant form of the bacteria in the environment.”

One caveat on the findings is that the NHSN data reflect hospital-onset *C. diff*, not community-onset cases. The latter include patients who have no recent history of hospitalization but likely received antibiotics after visiting a doctor, dental office, or clinic. This proportion of *C. diff* patients appears to be increasing, so further reducing the pathogen will remain a challenge.

## Off Target on MRSA

In contrast to *C. diff*, the CDC is not on track to achieve the 2020 goal for reduction of methicillin-resistant *Staphylococcus aureus* (MRSA) infections, despite a 14% decline reported for 2017 in the NHSN data. The national plan calls for a 50% reduction in MRSA bacteremia from 2015 to 2020.

“There has been a stall in our progress against staph infections,” Kourtis says. “If you look at the data so far, we are really not on track to meet that [national] goal. We are on track for a 25% decline or so, not 50%.”

In terms of hospital prevention, the CDC is concerned that there is some fatigue setting in with the rigorous demands of putting patients in contact isolation.

“That may be a factor in the less-than-optimal decline we are seeing in hospital onset infections,” she says. “The CDC continues to support the use of contact precautions, and we renewed the recommendation for them last summer on our website.”

There are some data that suggest outliers, as 6% of the NHSN hospitals reporting on MRSA had

significantly worse infection rates than the national average. However, no data were reported by the CDC suggesting these hospitals had lax compliance with contact precautions.

“I think it varies by facility in how much time you put into building and maintaining compliance,” says **Karen Hoffmann**, RN, MS, CIC, FSHEA, FAPIC, president of the Association for Professionals in Infection Control and Epidemiology. “You are always fighting complacency with healthcare staff being compliant with precautions. It is an ongoing issue.”

Some hospitals have moved away from contact precautions as a willful strategy, dropping gloves and gowns on room entry and emphasizing standard precautions with all patients. Some of these hospitals have reported success, but Kourtis says the CDC is looking at the bigger picture in reiterating its recommendation for contact precautions.

“It is time-intensive with gloves and gowns, and people washing their hands before and after,” she concedes. “But it is important. The benefits are not just in preventing infections while the patient is in the hospital. Infections can happen after patients are discharged. Post discharge is a high-risk time for developing an infection that was really acquired in the hospital.”

Thus, patients colonized with MRSA due to lack of contact precautions or lax use of them may develop infection after discharge.

“You need to look not only at the short intervals while a patient is hospitalized, but look at the time after, look at readmissions to the same hospital or to other hospitals,” Kourtis says. “The CDC can see [trends] in local, state, and regional data. We are in a better position to assess interventions like contact precautions and the effect of stopping them.”

Although infection reductions are difficult, the fact that the numbers are going down at all is a testament to infection preventionists and their clinical and public health partners. IPs are a long way from the era when a few hundred hospitals in the NHSN were reporting infection rates primarily for benchmarking rather than aggressive prevention.

## IV Drugs Spike Infections

There is an enduring analogy in healthcare epidemiology that preventing infections is like squeezing a balloon; attacking one area triggers a proportional expansion in another. Similar to the situation with *C. diff*, hospital-onset MRSA is being reduced, but infection is expanding in community-onset cases.

Some of the increase in the community is being driven by drug use, as the CDC reports that “people who inject drugs are 16 times more likely to develop an invasive MRSA infection.”<sup>3</sup>

“We are seeing an increase in community-onset MRSA infections, and we think that may be linked to the opioid crisis,” Kourtis says. “We are seeing some trends both geographically and in the age groups involved that this may be linked to unsafe injection practices. Many of the opioid abuse problems have had healthcare contact before, have visited emergency departments, or have been hospitalized.”

Thus, some of the cases may have resulted in MRSA exposure in healthcare that is amplified by the many risk factors associated with injection drug use. Many of these may present as skin infections but can become systemic and pose a serious threat in these patients.

“This is a little bit under the

radar,” she says. “Most of the [injection drug] prevention efforts so far have been focusing on transmission of bloodborne pathogens like HIV and hepatitis. Not as much thought has been given to skin or fungal infections. We see these happening more and more, and these are not always localized to the spot of the infection.”

In North Carolina, from 2007 to 2017, there was a twelvefold increase in endocarditis rates associated with injection drug use, according to the CDC.<sup>4</sup>

“We have seen cases of bloodstream infections that cause endocarditis, a potentially life-threatening infection in the heart valves,” Kourtis says. “So this is something we really want the clinicians to keep in mind and for the patients to be aware.”

MRSA is not the only infection problem being exacerbated by injection drug use, as other bacterial and fungal infections like *Streptococcus* and *Candida* are increasing in this population. For example, in New Mexico in 2017, one in five Group A strep infections were in injection drug users.<sup>5</sup>

In addition, 10% of patients with Candidemia infection in 2017 nationally reported a history of injecting drugs, the CDC reported.<sup>6</sup> The cost is considerable, as infections related to injecting drugs cost \$11.4 million at a single hospital in Miami, the CDC reports.<sup>7</sup>

The CDC is distributing information<sup>8</sup> to clinicians and patients, underscoring that risk factors for infection include sharing contaminated syringes and needles, skin wounds, and poor personal hygiene linked to homelessness. In addition to bacteremia and fungemia, infections related to drug addiction and injection can present as botulism, cellulitis, and endocarditis.

The CDC recommends, among other things, that IPs and clinician colleagues “be on alert for infections among patients who inject drugs”:

- “[Consider] bacterial or fungal infection as a cause of symptoms. Infections can present with symptoms similar to withdrawal (e.g., fever, myalgias).”
- “Assess for the presence of infections, especially in the case of a drug overdose.”
- “[If symptoms include] cranial nerve weakness, descending paralysis, or [failure] to respond to naloxone, consider wound botulism.”
- “Be aware of the risk of bloodstream infections from central lines in both inpatients and outpatients.”
- “In patients presenting with fungal and bacterial infections, consider whether injection drug use could be the cause.” ■

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# Surgical Site Infections and the Patient Microbiome

*With rare exception, SSIs may be traced to patients’ skin and nares*

**E**vidence is mounting that the vast majority of surgical site infections (SSIs) are caused by

microorganisms on patients’ skin and in their nares, meaning intensifying and improving skin prep and nasal

decolonization could greatly reduce SSIs.

“Almost all SSIs arise from the

patient's microbiome," the author of a recent research review concludes.<sup>1</sup> "The occurrence of SSIs can be viewed as a perioperative failure to control the microbiome."

A leading voice in infection control for decades, **Richard Wenzel**, MD, MSc, is emeritus chairman of the Department of Internal Medicine at Virginia Commonwealth University Medical Center in Richmond.

"There is increased recognition of the importance of the microbiome in general — that it is a good thing in the right composition with the right numbers of our own organisms and normal flora," he tells *Hospital Infection Control & Prevention*. "Most of the work has been done in the GI tract, and there hasn't been as much focus on the microbiome of the skin or the nares."

The Centers for Disease Control and Prevention (CDC) estimates that SSIs infect some 160,000 to 300,000 patients annually, with 2% to 5% of all operations resulting in infections.<sup>2</sup> SSIs are estimated to add a week to hospital stays and some \$3,000 to \$29,000 in additional costs of care.<sup>3</sup>

If most of these infections can be traced to the incision-site skin and patient nares, a redoubling of current efforts to address these sources could have substantial impact. Narrowing in on the microbiome in recent years comes after some misguided attempts to address infections from non-significant sources, including the air in operating rooms, he notes. Studies in the 1980s — subsequently found to be flawed — led to widespread implementation of laminar flow hoods in ORs used for orthopedic procedures.

"The preponderance of data show that air really is unimportant," Wenzel says. "When you look at the real data, which is what I tried to do here, almost all of the infections that we know about come from the patients' own microbiome. It's possible we will find

evidence in the next 10 years — with rare exceptions — that the microbiome is the source of all SSIs."

The key studies supporting this contention include those that have found using chlorhexidine skin preparation at the incision site — compared to using povidone iodine — reduced SSIs by 40% or more.<sup>4</sup> Other studies show SSI reductions through use of nasal decolonization via mupirocin.<sup>5</sup> More recently, two studies<sup>6,7</sup> have gone beyond mupirocin to look at use of broad-spectrum topical nasal antiseptic administered once prior to the operation and then several times daily thereafter. These studies, which Wenzel warns must be confirmed by subsequent research, showed "remarkable" SSI reductions.

## Q&A

*HIC* asked Wenzel to comment on the important implications of the microbiome to SSI reduction in the following interview, which has been edited for length and clarity.

**HIC:** You found that eradicating bacteria from the skin and nasal sites prior to surgery dramatically reduces SSIs. Are the prevention practices cited currently widely implemented?

**Wenzel:** For the skin, chlorhexidine prep is standard now. I cite two studies that were instrumental, showing a 40% to 45% reduction in surgical site infections regardless of species. In addition, I would say the majority of places are currently using mupirocin for nasal decolonization. I cite two studies in orthopedics — one with back surgery and the other with joint implants — looking at a broad-spectrum [nasal] antiseptic. That is relatively new, but there are places beginning to use that instead of a drug like mupirocin, which targets gram-positive organisms. Maybe there is more to the nose than we thought, and a nasal antiseptic that

would target both gram positives and gram negatives might be the way to go. That is sort of a little bit ahead of what we know so far. But the results so far in two studies showing a 70% [SSI] reduction in difficult operations is pretty remarkable. We have to see whether that will hold up. We need to know more about the nares as a source of gram negatives as well as other gram positives, including *Staph aureus*.

**HIC:** Regarding the studies on the non-mupirocin nasal antiseptic, it sounds like if that efficacy is borne out, it would be a game-changer for SSIs.

**Wenzel:** It would be major because mupirocin studies show roughly a 60% reduction in *Staph aureus* infections. What the nasal antiseptic studies so far suggest — and I want to be cautious — is more than a 70% reduction in total surgical site infections. That is huge. If that holds up, that means not only are the nares the source of gram positives, but probably gram negative [infections], which people haven't really talked about before. There was one dose of the broad-spectrum nasal antiseptic prior to the incision and then [daily doses] for one to two weeks afterwards.

That raises the question whether postoperative carriage in the nose is an important source of SSIs. I don't think we know yet, but these two studies make you wonder. Because most of the doses occurred after the surgery.

**HIC:** Are we starting to see reductions in SSIs overall due to these practices?

**Wenzel:** Certainly, for the chlorhexidine, no question. In terms of high-risk operations like orthopedic implants, mupirocin over the last decade has become routine. I don't know the answer to that yet for the use of the nasal antiseptics in the last three to five years. The orthopedic literature shows if you use mupirocin, you clearly cut down on *Staph aureus* SSIs, both for implants and non-implants. If you look at the softer

data in the national trends of surgical site infections after joint [implants], the CDC shows roughly a 40% reduction in infection rates over the last 15 years. Those trends are there, but that is just confirmatory data. I wouldn't rely a lot on ecologic data, but it is consistent with what people are finding in individual studies.

**HIC:** In the paper, you describe a “map of the microbiome,” including research<sup>8</sup> on *Propionibacterium acnes* that reside beneath the skin. Can you elaborate on this issue?

**Wenzel:** Darouiche et al.<sup>4</sup> showed if you use chlorhexidine as a prep instead of an iodophor, you reduce all surgical site infections by 40%, but they didn't culture everybody's nose and skin ahead of time and show which organisms were reduced all the way. I looked for confirmatory microbiological data, where people have looked at a specific organism before, during, and after surgery. A number of those studies use marker organisms [like *P. acnes*]. It is primarily on the upper chest and upper back. You would think if the microbiome is important, surgeries in those areas would show [SSIs] disproportionately with that organism — and that is exactly what happened.

So it is confirmatory data for the large overall infection rate reductions.

One of the second messages was that these organisms are in the dermis, below the epidermis, and so as a result, no current antiseptics are perfect. They do not reach the dermis. I tried to show that an acne drug was actually effective because it works to get into the dermis and actually get to the organism that is contributing to the acne. The number of the organisms are then reduced. In the future, I think there will be some studies to look at using a drug that gets into the dermis, and whether that will reduce not only *Staph aureus* but *Staph epi*, which lives in the dermis as well as the epidermis. ■

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# Avoid Antibiotics by Reducing Unnecessary Urine Tests

*Inappropriate treatment raises risk of C. diff*

Changing urine culture order test indications during a switch to a computerized physician order entry (CPOE) sharply reduced unnecessary cultures and saved considerable costs in lab expenses, researchers report. Moreover, it spared patients with asymptomatic bacteriuria from treatment more appropriate for a fully diagnosed urinary tract infection (UTI).

The researchers compared urine

culture rates before the CPOE switch with the rates after the new electronic order system was in place. CPOE changes that included a clarification of test names and resetting reflex tests — which prompt orders for further testing — “resulted in a 45% reduction in the urine cultures ordered with an estimated cost savings of \$104,000,” the authors reported.<sup>1</sup>

“During the study period, 18,954

inpatients ... had 24,569 urine cultures ordered. Overall, 6,662 urine cultures (27%) were positive,” they found.

The urine culturing rate decreased from 38.1 per 1,000 patient days preintervention to 20.9 per 1,000 patient days after the intervention, explains author **David K. Warren**, MD, MPH, hospital epidemiologist at Barnes-Jewish Hospital in St. Louis.

“It was a pretty substantial

reduction — it was what we were hoping,” he says. “We were concerned about the amount of unnecessary urine culturing that was being done. It was a robust drop.”

## Unintended Consequences?

Warren and colleagues looked for any unintended consequences of the intervention to ensure those who needed culture and treatment were not being missed.

“Infection prevention tracks CAUTIs [catheter-associated urinary tract infections] housewide,” he explains.

“We looked at the infection rate for CAUTIs, and it actually didn’t change. So we were still capturing [CAUTIs], but at the same time, we were reducing the number of urine cultures that were being performed.”

The researchers looked at the proportion of positive urine cultures that were associated with an abnormal or positive urinalysis as well as cultures associated with a negative urinalysis.

“We saw that post-intervention,

there were a larger number of positive urine cultures that were associated with an abnormal urinalysis compared to the pre-intervention period,” Warren says.

“That is more evidence that we are still detecting those people that have abnormal urinalysis associated with their urine culture.”

A prior analysis in the hospital showed that serial testing of patients admitted without a diagnosis of a UTI yielded 8.5% with asymptomatic bacteriuria.

“They had positive urine culture without any evidence of infection,” he says.

“Finding patients that have bacteriuria in their urine leads to all the downstream problems in terms of antibiotic treatment, increases the risk of resistant bacteria, and could lead to *C. diff* infection. That was part of the rationale for trying to cut down on urine culturing, especially in the area where the pre-test probability was low.”

In resetting testing algorithms, the “bar was set low” for neutropenic patients so they would not be missed if they had a UTI. Any suspect indications in these patients triggers reflex testing to

urine microscopy and urine culture, he explains.

Although the effort streamlined orders to some extent and removed defaults that could lead to overtesting, physicians still make the call if they want a test.

“Urine culture was still an orderable test for clinicians who wanted to order it by themselves. They were free to do so,” he says. “We didn’t restrict that.”

One take-home message from the study is a transition to electronic ordering can be an opportunity to improve practice — in this case, in the area of diagnostic stewardship.

“Be mindful when you are designing those systems of how they can have a big impact on reducing unnecessary testing,” Warren says. ■

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# Intervention Reduces MRSA in Non-ICU Patients With Devices

**R**outine chlorhexidine bathing and targeted use of mupirocin dramatically reduced methicillin-resistant *Staphylococcus aureus* (MRSA) infections in non-ICU patients with invasive devices like central lines, researchers report.

In the ABATE Infection (Active Bathing to Eliminate infection) trial, patients at 53 hospitals were routinely bathed with chlorhexidine and given targeted nasal mupirocin in non-critical-care units. “Hospitals were randomized and their participating non-critical-care

units assigned to either routine care or daily chlorhexidine bathing for all patients plus mupirocin for known [MRSA] carriers,” the authors reported.<sup>1</sup>

“The primary outcome was MRSA or vancomycin-resistant *Enterococcus* clinical cultures attributed to participating units.”

In this continuing trial, the use of chlorhexidine bathing and nasal mupirocin has previously proven effective at preventing infections in ICU patients. Researchers extended the practice to see whether non-ICU

patients would benefit. General patients showed no benefit, but the practice demonstrated efficacy in a subset of this population: non-ICU patients with medical devices.

“That is the main takeaway from this trial,” says lead author **Susan Huang**, MD, of the infectious disease and health policy departments at the University of California, Irvine. “It was not beneficial in a uniform way in the non-ICU patients, but it was in this high-target group of people with devices.”

The finding makes sense given that

devices and invasive lines can seed infections in non-ICU patients. The HCA Healthcare System is sufficiently convinced that it is implementing the practice in all its hospitals.

“One of the most important and intriguing findings in the trial was that people with medical devices are only 10% of the non-ICU population, but they [account for] more than 50% of all the BSIs [bloodstream infections] that occur outside of the ICU,” Huang says.

In the study, non-ICU patients with central lines and lumbar drains had a 30% reduction in BSIs.

“I think the most common reason why we did not find a benefit in the overall non-ICU population is that they are at much, much less risk of infection,” Huang says.

“I think that’s why when you look at the subgroup of those with devices, the story makes much more sense. This little group is disproportionately responsible for very serious and well-

known HAIs. For that reason, I think it gives credence to do something in a targeted fashion.” ■

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# Undetected Plague Exposes Hospital Workers

*Yersinia pestis* treatable, but may be serious if antibiotics delayed

In an incident that could have implications for therapy and support dogs in healthcare, 116 employees and students in a veterinary teaching hospital were exposed to pneumonic plague by a dog with unrecognized infection, investigators report.<sup>1</sup>

The scourge of the Middle Ages, *Yersinia pestis* is now completely treatable by antibiotics, but the prognosis diminishes if drug therapy is not given promptly. In a previously reported case,<sup>2</sup> a lab worker working with an attenuated specimen of the pathogen developed flu-like symptoms and eventually died of septic shock. The lab worker may have been lax in wearing gloves and other infection control measures when handling the specimen, the CDC reported.

Thus, it is understandable that workers at the Colorado State University Veterinary Teaching Hospital in Fort Collins, CO, were highly concerned to find out they had been exposed to *Y. pestis* — in many cases days after the fact.

Moreover, the dog had pneumonic plague, the most transmissible form of the infection, which is listed by the CDC as a possible bioterror agent

because of the possibility of spread through the air via droplets.<sup>3</sup>

Clinicians missed the initial diagnosis of the infected dog, which then exposed dozens of hospital staff in transport throughout the facility, says lead author of the report **Paula Schaffer**, DVM, a pathologist and professor at the vet hospital in Fort Collins.

A scramble began when the dog’s plague infection was belatedly recognized, with many staff members contacted for post-exposure prophylaxis.

“Misdiagnosis in the canine patient exposed a lot of people to a serious disease — this was the biggest concern,” Schaffer says. “Plague is treatable with antibiotics in animals and people when the diagnosis is made early. However, once the disease progresses, it can be very hard to treat successfully. This was very concerning for our staff. Fortunately, we had no reports of illness related to exposure.”

Schaffer and colleagues reported<sup>1</sup> that “While PCR results [for the dog] were pending, paper sheets were circulated to personnel to record contact with the dog. After the positive PCR result, emails were sent to these persons, followed by emails to all personnel.”

They added that “The delay between suspicion and diagnosis of *Y. pestis* resulted in word of mouth traveling faster than official communication, which caused anxiety among personnel. Many expressed frustration that suspicion and diagnosis of plague did not occur earlier. Two hospitalwide meetings were held for questions, discussion, and feedback.”

The communication process for zoonotic exposures at the hospital was set up to handle small-scale events, and was found lacking in this case, investigators said. The facility is now frequently updating email and phone lists and using a computerized log to document contacts that may be zoonotic exposures.

Employee fears were well-founded based on this information by the World Health Organization (WHO), which still sees bubonic and pneumonic plague appearing in some human populations.

“Pneumonic plague, or lung-based plague, is the most virulent form of plague,” the WHO reports.<sup>3</sup> “Incubation can be as short as 24 hours. Any person with pneumonic plague may transmit the disease via droplets to other humans. Untreated pneumonic



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plague, if not diagnosed and treated early, can be fatal.”

Those exposed in Colorado included 64 hospital employees, 35 veterinary students, and 17 other employees and students in laboratory roles, Schaffer says.

Treatment recommendations included antimicrobial prophylaxis for those with highest concern for exposure (59% of total cases). Overall, one-third of the 116 people were also under fever and symptom watch.

Prior to admission, the dog had been seen near a dead prairie dog — an animal reservoir of the pathogen via fleas — but did not have classic signs

of the plague, such as enlarged lymph nodes. ■

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**CME/CE QUESTIONS**

1. **An ambitious national plan has set a goal of reducing HIV infections by how much in the next five years?**
  - a. 25%
  - b. 50%
  - c. 75%
  - d. 90%
2. **Approximately how many new HIV infections are there every year in the U.S?**
  - a. 40,000
  - b. 100,000
  - c. 250,000
  - d. 1 million
3. **According to a CDC study, people who inject drugs were 16 times more likely to develop:**
  - a. HIV
  - b. invasive MRSA
  - c. active TB
  - d. hepatitis C
4. **In a study of non-ICU patients, which subgroup was found to benefit from routine chlorhexidine bathing and targeted use of mupirocin in the nares of those with MRSA?**
  - a. Non-ambulatory patients
  - b. Injection drug users
  - c. Those with invasive devices
  - d. Those in long-term care

**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.