



# HOSPITAL INFECTION CONTROL & PREVENTION

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## CDC Analysis Supports Mandated Drug Stewardship in Hospitals

*Societal impact of C. diff may lead to CMS action*

By Gary Evans, Medical Writer

**A** new analysis of the immense societal costs of *Clostridioides difficile* infection (CDI) may spur the Centers for Medicare & Medicaid Services (CMS) to finalize a regulation requiring antibiotic stewardship in hospitals, *Hospital Infection Control & Prevention* has learned.

The CMS proposed regulation requiring antibiotic stewardship was issued in 2016 but has not been finalized. As proposed, the regulation “would require a hospital to develop and maintain an antibiotic stewardship program as an effective means to improve

hospital antibiotic-prescribing, [and] curb ... potentially life-threatening, antibiotic-resistant infections.”<sup>1</sup> This would promote better alignment of hospital infection control and antibiotic stewardship efforts with nationally recognized guidelines and “heighten the role and accountability of a hospital’s governing body in program implementation and oversight,” CMS states.

In addition, last year, the nation’s leading infection control groups emphasized that infection preventionists and healthcare epidemiologists are critical members of antibiotic stewardship teams.<sup>2</sup> The paper was co-authored by the Association for

THE CDC ESTIMATED IN 2015 THAT CLOSTRIDIoidES DIFFICILE INFECTION STRIKES NEARLY HALF A MILLION PATIENTS PER YEAR, LEADING TO 29,000 DEATHS.

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Professionals in Infection Control and Epidemiology (APIC), which is advocating finalization of the CMS antibiotic stewardship rule. An advocacy message on the APIC website urging members to lobby for finalization of the stewardship regulation puts the action in the context of history:

“Although infection control was elevated to a Medicare Condition of Participation (CoP) in 1986, it has essentially been unchanged for more than 30 years,” APIC states.<sup>3</sup> “Because of this lack of action, current requirements no longer fully conform to current standards for infection prevention and control, creating a burden on hospitals that are currently operating under regulations that are outdated, inefficient, and inconsistent with infection prevention and control requirements in other healthcare settings. Urge CMS to finalize the proposed revisions to Medicare hospital CoPs.”

As proposed in the 2016 CMS rule, IPs would “be responsible for communication and collaboration with the antibiotic stewardship program,” CMS states. “We believe that collaboration between the hospital’s infection prevention and control and antibiotic stewardship programs will provide the optimal approach to reducing HAIs and antibiotic resistance.”

If finalized as proposed, the CMS regulation would require documentation of the evidence-based use of the hospital formulary. CMS said the expectation would be “sustained improvements” in antibiotic use and subsequent “reductions in *C. diff* and antibiotic resistance in all departments and services of the hospital.”

## Making the Societal Case

There has been broad consensus for years that reining in the overuse and misuse of antibiotics will lessen the pressure that selects out multidrug-resistant bacteria. As bacteria mix and exchange resistant plasmids, some become resistant to virtually all available antibiotics.

Overuse of antibiotics also disrupts the commensal bacteria in the gut, clearing the way for *C. diff* to proliferate and cause diarrhea and a cascade of more serious problems in the colon. The Centers for Disease Control and Prevention (CDC) estimated in 2015 that CDI strikes nearly half a million patients a year, leading to 29,000 deaths — 15,000 of which are directly attributable to the enteric pathogen.<sup>4</sup>

The CMS proposed rule to mandate antibiotic stewardship programs did not fully incorporate this immense societal toll, but new CDC research now provides that missing piece. In a conservative estimate, the study<sup>5</sup> concludes that an antibiotic stewardship mandate in hospitals would save \$25 billion a year when the societal costs of factors like morbidity, mortality, and lost years of life are added to the economic equation, says lead author **R. Douglas Scott II**, PhD, a CDC health economist.

“In their proposed regulation, they recognized they did not have any information related to mortality and risk reduction,” he says. “They actually called for information in that proposal. This paper is a response to that. It really changes the whole dynamic of their regulatory impact assessment.”

In looking at the societal impact

of antibiotic stewardship programs, Scott and CDC co-authors focused only on CDI. The analysis looked at the costs of treatment, interventions, attributable deaths, and the “value of statistical life.”

“From a societal perspective, we are asking, ‘What will we usually pay to save a year of life?’” says co-author **Clifford McDonald**, MD, associate director for science in the CDC Division of Healthcare Quality Promotion. “When you consider what we pay to save a year of life, [antibiotic stewardship] is very cost-effective. You get a lot of effect for the costs you pay. That’s why these numbers are bigger.”

Including these values in a model projected over 2015 to 2020, the net social benefits of mandating antibiotic stewardship in hospitals range from \$21 billion to \$624 billion. Even without the societal values associated with reducing morbidity and mortality, the net benefits of a stewardship program save some \$300 million to \$7.6 billion.

“It gets kind of small, but in both scenarios there is still a benefit to a stewardship program,” Scott says. “People can argue about how good these numbers are. I looked at the available evidence, and I used a fairly conservative estimate based on the range of estimates that were available.”

Again, the range of benefits is probably conservative because the formula lacked a monetary value of severe morbidity in CDI cases.

“We didn’t have any information on severe cases, so we have undercounted that,” Scott says. “There are some other issues, but we are probably low-balling the benefit estimate.”

After adding in the societal benefits and the economics of

morbidity and mortality, “It’s a no-brainer,” he says. “That’s not necessarily coming from me, but I will let the numbers speak for themselves.”

In the never-ending fight for federal funding, in 2016 the Department of Health and Human Services (HHS) told its agencies to use an economic model that includes the societal costs.<sup>6</sup> Other government agencies, such as the Environmental Protection Agency and the Department of Transportation, have been using this model for years, showing the huge potential impact of proposed regulations, Scott says.

“HHS has to compete for Congressional attention in order to get more resources,” he says. “You’re up against EPA and DOT numbers, and [legislators] are wondering where can they get the biggest bang for the buck. We have kind of been on the short end of things, which is why HHS developed the guidelines.”

In addition to this study, the CDC has been emphasizing the amount of federal dollars invested fighting antibiotic resistance, recently posting a detailed map that shows the funds spent in each state in 2018. A total of \$240 million in state activities were supported by the CDC, ranging from \$288,861 in Vermont to \$7.2 million in Tennessee.<sup>7</sup>

## Saving Lives

Traditional economic studies of HAIs have focused on the toll on hospitals and payers, but studies projecting out to include societal costs is the logical next step, McDonald says.

“For example, we don’t prevent motor vehicle accidents just to

save money — it is to save lives,” McDonald says. “In the larger scheme of things, we pay as a society for ‘length’ of life. That’s what we do in healthcare, and we pay for it.”

This is far removed from the days when hospitals were reimbursed to some extent for medical complications, creating disincentives to prevent infections, he adds. That era is over with CMS initiatives like value-based purchasing and pay for performance. Even if you cede the high ground — looking at antibiotic stewardship strictly from a payer perspective — it still makes sense, McDonald says.

“The business case has been made for the payers,” he says. “If you prevent the *C. diff*, you prevent the readmission and shorten the length of stay.”

It’s worth reiterating that this potential societal windfall is solely focused on antibiotic stewardship programs in hospitals to prevent *C. diff* HAIs.

“We didn’t look at community-associated, which we think is now probably 40% of the pie,” McDonald says. “We were just looking at the 60% that are healthcare-associated. It really translates to acute care hospital-associated *C. diff*.”

In any case, most *C. diff* infection in the community is traced back to healthcare contacts or prior hospitalization.

“We realize a lot of them have their onset outside the hospital, but when you use an antibiotic you mess up the microbiome for two or three months,” he says.

“Inpatient antibiotic use is casting a shadow over people for several months after they leave the hospital.”

The benefits estimated also are conservative in that they focus

on CDI and not the many other adverse outcomes associated with antibiotic misuse, he says.

“Antibiotic stewardship also prevents other adverse events,” McDonald says.

“There are a lot of allergic reactions, and it is a very common cause of ER visits among children, for example. It’s a great cost benefit for society.”

The CMS proposal has not become law, but The Joint Commission began enforcing antibiotic stewardship in 2017. The Joint Commission Medication Management (MM) standard MM.09.01.01 requires antimicrobial stewardship programs.<sup>8</sup>

DNV GL Healthcare’s NIAHO (National Integrated Accreditation for Healthcare Organizations) standards also mandate antibiotic stewardship for CMS hospital accreditation.<sup>9</sup> ■

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# U.S. Caregiver Received Experimental Ebola Vaccine Post Exposure

*Cleared for release after 21-day quarantine at Nebraska facility*

An American caregiver exposed to the Ebola virus while caring for a patient in Africa was given the new experimental vaccine within 24 hours and subsequently did not develop infection. As is often the case with diseases calling for post-exposure prophylaxis, it cannot be determined whether the vaccine prevented infection or whether the patient would not have developed Ebola regardless.

“We will never know whether that was the critical factor or whether he was just lucky and if his exposure was not intense enough [to seroconvert],” says **Ted Cieslak**, MD, infectious

diseases specialist with Nebraska Medicine in Omaha.

The American missionary was exposed while providing care for an Ebola patient infected during the ongoing outbreak in the Democratic Republic of Congo. The vaccine has been deployed there, and the caregiver was immunized within 24 hours of the exposure, Cieslak says.

“We think the vaccine is good for the first few days post exposure,” he explains. “That’s different from other vaccines; for example, measles. If you were exposed to measles and you had not been vaccinated, it’s probably too late to vaccinate at that point. With

Ebola, we think there is a window of a few days there.”

After the exposure, the caregiver was flown out of Africa and quarantined in a state-of-the-art facility for the requisite three weeks at the Nebraska Medical Center, says Cieslak, who oversaw the case. The patient arrived for quarantine and monitoring at the medical center on Dec. 29, 2018. If he had developed Ebola, the plan was to transfer care to the nearby Nebraska Biocontainment Unit, where three infected healthcare workers were treated during the 2014 outbreak in West Africa.

As of Jan. 29, 2019, the Ebola

outbreak in Congo included 752 cases, with 698 confirmed and 54 probable. The outbreak, which began in August 2018, has killed 465 people for a case-fatality rate of 62%, the World Health Organization reports.<sup>1</sup>

In some areas, there have been “nosocomial transmission events in private and public health centres” including patients, visitors, and healthcare workers, the WHO reported. Overall, 65 healthcare workers have been infected while caring for Ebola patients during the outbreak. At least 18 healthcare workers have died, but that number is based on an earlier report that included only 54 healthcare workers.

“In DRC, more than 66,000 people have been vaccinated — more than 21,000 of them are health and other frontline workers,” the WHO reports. “The yet-to-be-licensed rVSV-ZEBOV vaccine has been shown to be highly protective against the Zaire strain of the Ebola virus in a major trial.”<sup>2</sup>

The WHO did not clarify in the reports whether the healthcare workers who became infected and those who died had received the vaccine. However, healthcare workers in neighboring nations are being offered the vaccine, although no Ebola cases have appeared beyond Congo, the WHO reports.

A request to clarify the number of infected healthcare workers who were immunized had yielded no WHO response as this story was filed. In one of its outbreak reports, the WHO listed immunization of providers as one of the areas being strengthened.

“Health protection and control measures such as infection prevention and control in health centers, vaccination for healthcare and other frontline workers, and safe and dignified burial practices are being

strengthened to interrupt the chains of transmission,” the WHO stated.<sup>3</sup>

## Vaccine Efficacy, Quarantine Measures

Cieslak worked many years on biological countermeasures in the U.S. Army Medical Research Institute of Infectious Diseases in Fort Detrick, MD. He commented further on Ebola and the quarantine case in the following interview with *Hospital Infection Control & Prevention*.

**HIC:** Can you tell us more about the experimental Ebola vaccine?

**Cieslak:** This vaccine underwent a trial in Guinea during the 2014-2016 outbreak. It was a ring vaccination trial of high-risk individuals. For example, if somebody in a family died of Ebola, they immunized a ring around that person — all the close contacts. These are very high-risk patients who have been in [close] contact with someone who has Ebola. They did this ring vaccination trial, and it was 100% efficacious. There has been some criticism of that trial — it wasn't big enough, etc. I'm sure more studies need to be done before the U.S. Food and Drug Administration would be willing to license that vaccine. Certainly, the preliminary data look very promising.

**HIC:** Just to clarify, this quarantined person had cared for patients in the ongoing outbreak in the Democratic Republic of Congo?

**Cieslak:** He was a healthcare provider. He cared for a patient who ultimately proved to have Ebola. At the time, they considered it a high-risk exposure. It occurred in the midst of some political unrest, and there were concerns. He was vaccinated post-exposure, as were all the of the Congolese healthcare providers who were on the team that

cared for this patient. There are these concerns about any perceptions that the American or Western providers may get [the vaccine] and it is not as available to the Congolese. I think that has led to some [care units] not giving it until there is an exposure or there is high risk in their particular province.

**HIC:** What isolation measures did you use in caring for this patient?

**Cieslak:** We don't actually call them patients. Technically, they are not admitted to the hospital. We usually refer to them as a “person under quarantine.” These are people who have been exposed to a potentially hazardous disease but have not yet come down with symptoms. The setting in our quarantine unit I would describe as more like a hotel. It is located on the medical center campus, but it is more like a hotel than a hospital.

The precautions we took in his case were fairly minimal. There are a few diseases — influenza, for example — where you actually can be contagious before you are symptomatic. With most diseases, including Ebola, you can't transmit to others until you have symptoms. Given that this person was clinically well, we didn't need to take too many precautions. He was kept on the quarantine unit so the general public did not have access to him, and he could not have visitors. The number of hospital personnel [entering the quarantine area] was limited to those who needed to interact with him.

**HIC:** You note that quarantine can be mandated, but in this case, it was voluntary.

**Cieslak:** The country issues what they call a voluntary quarantine agreement, and he signs that and agrees to abide by that. He was very cooperative, and there were no issues. Under the terms of the

agreement, providers were supposed to remain three feet away from him unless they were wearing gloves and mask. I would postulate that is an abundance of caution. It's technically not necessary, since again he was incapable of transmitting [Ebola] since he was not symptomatic.

**HIC:** What symptoms did you look for? Fever?

**Cieslak:** Fever is typically the first sign of Ebola. We took his temperature a few times a day. Other than that, it was subjective. We asked him to report any symptoms he was having and general questions about his health. The only vital sign we measured was temperature.

**HIC:** Why was the decision made to place this patient under quarantine at your facility? One would be the

ease of transferring over to your biocontainment unit if symptoms developed?

**Cieslak:** Exactly. I think that's why the state department and the CDC wanted him to come to our place. There were multiple factors in play.

In theory, a person like him, if you trust them, which we certainly did, and they have a place to go to, then they can be quarantined at home. They are just told to take their temperature a couple of times a day and call in if they develop a fever. He was a missionary in Africa and did not have a permanent home here in the states. That was part of the issue.

The assistant secretary for preparedness awarded us this grant to build a better quarantine facility, so I

think there was an element of testing the system and seeing how it worked. But again, he really had no place to go to.

His organization and our state department thought the better part of valor was to get him out of Africa and bring him here. ■

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# NIH Super Sleuths Track Down a Rare Human Pathogen

*Cutting-edge molecular epidemiology*

An outbreak of a rare human pathogen — which was traced to the stagnant water in a newly constructed building a decade earlier — was solved by investigators at the National Institutes of Health (NIH) Clinical Center using a deep bank of isolates and cutting-edge molecular epidemiology.

In 2016, NIH clinicians detected a cluster of infections in six stem-cell transplant patients caused by *Sphingomonas koreensis*.<sup>1</sup> The bacteria are a rare cause of human infections, but looking back through the center's large bank of isolates, they detected more infections, bringing the total to 12 patients since 2006. New construction in 2005 apparently allowed the bug to

establish a reservoir in the disrupted water system.

"We were amazed that the organism had been dwelling in the building for so long and had changed so little," says **Tara Palmore**, MD, hospital epidemiologist at the NIH Clinical Center.

Palmore and colleagues conducted whole-genome DNA sequencing on the clinical isolates, and cultured *S. koreensis* from the sinks and faucets in patient rooms and other areas.

"The investigation showed that two isolates of *S. koreensis* obtained from the six patients identified in the 2016 cluster were unrelated, but four isolates shared more than 99.92% genetic similarity and were resistant to multiple antibiotic agents,"

they reported. "Retrospective analysis of banked clinical isolates of [*S. koreensis*] ... revealed the intermittent recovery of a clonal strain over the past decade."

## Transmission Unknown

Following the cluster of cases in 2016, investigators looked for transmission sources. Overall, 22 of 56 cultures of water samples from faucets (39%) contained *S. koreensis*. The culture-positive rate rose to 53% if the samples were from faucets in the rooms of patients infected with the pathogen.

Investigators found one positive culture in a faucet directly linked

to a patient, but the exact mode of transmission could not be determined for the cases, Palmore says.

“Some of the patients who acquired the organism were in the ICU and not using sinks,” she says. “It could have been water on the hands of healthcare workers. It also could have been water droplets aerosolized from sinks. We don’t know, but it could have been any of the ways that other waterborne organisms can be transmitted to patients.”

Although these were high-risk patients, three of the patients died. Moreover, the patient isolates and environmental samples were resistant to multiple antibiotics. That raises the question of how bacteria that are a rare source of human infection became so drug-resistant.

“We did not find any genes that conferred resistance to antibiotics, so this wasn’t acquired drug resistance,” Palmore says. “This wasn’t drug resistance of an organism that was hanging around hospitals and being exposed to antibiotics. It was built in to the coding of the DNA of the organism — it was just naturally drug-resistant.”

This phenomenon has been described before, perhaps most profoundly by investigators who found microbes in ancient, underground caves that were naturally resistant to antibiotics to which they could not possibly have been exposed.<sup>2</sup>

## Journey to the Past

The NIH has a vast library of stored isolates, enabling investigators to look back in time

and ultimately determine the origin of the reservoir.

“It’s actually amazing that our microbiology lab has [so many] isolates banked,” she says. “The lab has been deep-freezing isolates for decades. We can go back and do this kind of research and clinical investigation.”

Investigators also were surprised to discover that *S. koreensis* was even causing infections, and wanted to look back to see if prior cases had occurred.

“This is not the type of organism that normally gets a lot of attention in hospitals,” Palmore says.

“In fact, when I have presented this investigation at other hospitals, it really takes some convincing. I have to really go into the genomic data that we presented in the paper to get people to appreciate that this is something that they need to care about it.”

Infection preventionists may understandably be focused on time-honored water bugs such as *Legionella* and *Pseudomonas*, but the findings underscore that other waterborne pathogens need to be on the radar, she says.

“Another reason we went back and looked at frozen samples was because we knew that we had not always looked at *Sphingomonas* isolates to the species level,” she says.

“By genomic sequencing, we were able to identify whether there were any matches.”

## Low Chlorine

Low chlorine levels in the hot water system were identified as the prime cause of the buildup of *S. koreensis* in the water system, Palmore and colleagues found.

“We found those low hot-water chlorine levels at the time we looked in 2016,” she says.

“We corrected the chlorine levels and monitored those closely. We’ve not had another case in going on two and a half years — since October 2016.”

Chlorine levels are now monitored at multiple sites in the hospital on an ongoing basis.

“We also culture water and follow those cultures,” she says. “Our research is ongoing into ways to reduce risk to patients.”

As IPs are well aware, in 2017 the Centers for Medicare & Medicaid Services released a memo mandating that “Medicare-certified healthcare facilities ... have water management policies to reduce the risk of growth and spread of *Legionella* and other opportunistic pathogens in building water systems.”<sup>3</sup>

While certainly complying with the directive, Palmore warns that the CMS memo does not specifically require monitoring water chlorine levels — which the NIH regards as critical after the outbreak.

“It is important to pay particular attention to free chlorine concentrations,” she says.

“That is the major measure that suppresses the growth of many types of bacteria in water.”

Although many hospitals may not have such a deep store of isolates and genome sequencing technology, Palmore thinks other epidemiologists and IPs could have detected *S. koreensis* using common laboratory identification systems.

“The question is whether they would have recognized the importance of what they found,” she says.

“Whether they would have

realized, if they found *S. koreensis* in a patient blood culture, that this is an organism they might need to be worried about.” ■

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# Study Finds Only 12.8% of Outpatient Antibiotics Appropriate

*Can drug stewardship work in ambulatory care?*

While hospitals are trying to rein in antibiotic use, outpatient settings are on the frontier of sorts in the effort to stop the rise of multidrug-resistant bacteria and their possible consequence: untreatable infections.

In an analysis using the new ICD-10-CM (international classification of diseases-clinical modification) codes, investigators showed misuse of antibiotics in ambulatory settings while unveiling a study model that could aid future research.

“Among all outpatient antibiotic prescription fills by 19,203,264 privately insured U.S. children and non-elderly adults in 2016, 23.2% were inappropriate, 35.5% were potentially appropriate, and 28.5% were not associated with a recent diagnosis code,” they concluded.

Lead author **Kao-Ping Chua**, MD, assistant professor of pediatrics at the University of Michigan, explained the important findings of the study in the following interview with *Hospital Infection Control & Prevention*.

**HIC:** Can you elaborate on the methodological framework you developed to assess outpatient

antibiotic appropriateness using ICD-10-CM diagnosis codes? You conclude it may be an approach that could be adopted by others.

**Chua:** What prompted this study<sup>1</sup> was the lack of methods to assess antibiotic appropriateness using ICD-10-CM diagnosis. Prior methods were all based on ICD-9-CM, which was replaced by ICD-10-CM in the U.S. in October 2015. To address this gap, we individually classified each and every one of the 91,000-plus ICD-10-CM diagnosis codes as being “never,” “sometimes,” or “always” indications for antibiotics. For each antibiotic prescription fill, we then looked back three days to see what types of ICD-10-CM diagnosis codes were present on claims during that period. If, for example, there were only codes that never justified antibiotics during this time period (such as acute upper respiratory infection) we classified the antibiotic as “inappropriate.”

This general framework could be used with any administrative data set that uses ICD-10-CM diagnosis codes, including Medicare and Medicaid claims, electronic medical records, and national surveys. The

vast majority of developed countries have been using some form of ICD-10 for decades, so in theory, our methods could also be adapted to other countries, assuming they have data on antibiotic prescription fills and the associated diagnosis codes.

**HIC:** Could you comment on the finding that only 12.8% of antibiotic prescriptions were appropriate?

**Chua:** It's important to look at the distribution of prescriptions across the four categories. This distribution indicates the degree to which we can be confident that an antibiotic prescription was appropriate. For 12.8% of prescriptions (“appropriate”), we can be reasonably confident. For 35.5% (“potentially appropriate”), we are not really that confident. For 23.2% (“inappropriate”), we are not confident. And for 28.5% (not associated with a recent diagnosis), we really don't have any idea.

We are not claiming that only 12.8% of antibiotics were necessary, since some of the antibiotic prescribing in the “potentially appropriate” and “not associated with a recent diagnosis” cases could, in fact, have been necessary.

However, we are claiming that we can be reasonably confident that antibiotics were appropriate just 12.8% of the time.

**HIC:** Is the level of inappropriate prescriptions in line with prior research and your general expectations?

**Chua:** The most widely cited estimate of antibiotic appropriateness came from a study<sup>2</sup> in the *Journal of the American Medical Association [JAMA]* in 2016. That study estimated that 30% of outpatient antibiotic prescriptions were inappropriate.

It's difficult to make an apples-to-apples comparison with our estimate of 23.2% for a few reasons. First, the *JAMA* study analyzed data from emergency departments and office-based visits in 2010 and 2011. In contrast, we used data from privately insured patients in 2016 that captured prescribing across a broader variety of settings.

In addition, our figure of 23.2% only refers to antibiotics written for conditions that don't justify their use. The *JAMA* authors' figure of 30% reflects both these antibiotics as well as their best estimates of the rate of inappropriate prescribing among antibiotics that are written for conditions that only sometimes justify antibiotics, like sinusitis.

To get at the latter, they used estimates of bacterial prevalence and also examined regional variation in prescribing for particular conditions, assuming that the lowest-prescribing U.S. Census region reflected the rate of appropriate prescribing.

**HIC:** Nearly two-thirds of outpatient antibiotic prescriptions are only potentially appropriate or not associated with a recent diagnosis code. Can you comment on what may be happening there?

**Chua:** Overall, 35.5% of

antibiotics were classified as potentially appropriate because they were associated with diagnoses that only sometimes justify antibiotics, like sinusitis, sore throats, and ear infections. We know that there is a lot more prescribing for these conditions than you would expect based on the percentage of times these conditions have a bacterial cause. Therefore, there is likely to be a lot of unnecessary prescribing in this category.

The 28.5% of antibiotic prescriptions that were not associated with a recent diagnosis code could have several explanations. The first is that our medical claims database captured all antibiotic prescriptions but not necessarily all visits, including dental visits (which would not be reimbursed through medical insurance) and retail clinic or urgent care center visits that are paid out of pocket. However, we know that inappropriate prescribing occurs in these settings as well, particularly retail clinic and urgent care centers.

Another possibility is that these prescriptions could be refills of antibiotics for people who take them for long periods of time, such as patients with acne. We found that about one-sixth of the 28.5% were, in fact, refills.

A final possibility is that antibiotic prescriptions occurred after a telephone or online "visit" that was not billed to insurance — that is, a prescription that occurred in the absence of examining a patient in person. While such prescriptions could be reasonable in certain circumstances, it's generally important to be able to perform a physical exam to determine whether a patient is likely to have a bacterial illness requiring antibiotics.

**HIC:** Many hospitals have

adopted antibiotic stewardship programs. Are some of the outpatient settings adopting programs to control antibiotic use? Are you aware of any approaches that are proving effective?

**Chua:** There have been decades of efforts to educate the public and physicians about antibiotic overprescribing, as well as many efforts to improve outpatient antibiotic stewardship. Some of the more effective approaches have come in research performed by the senior author of this paper, Jeff Linder, MD.

In one study,<sup>3</sup> he and his colleague doctors at primary care practices received an e-mail that indicated whether they were a "top performer" in terms of avoiding inappropriate prescribing among their peers. That simple intervention reduced inappropriate prescribing drastically, potentially because many doctors are naturally competitive and recoil at the idea of being worse clinicians than their peers. ■

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# Improving Infection Prevention by Reforming IT, Electronic Health Records

*APIC urges changes that could help IPs*

The challenge to improve the functionality and ease of appropriate use of electronic health records (EHR) and health information technology (IT) was recently outlined in a draft document by the Department of Health and Human Services (HHS).<sup>1</sup>

In submitted comments on the draft, the Association for Professionals in Infection Control and Epidemiology (APIC) outlined some of the challenges IPs face in dealing with EHRs and IT.

“Because all EHRs do not ‘talk’ to each other, relevant information may be contained in scanned records from another care setting,” APIC stated.

“A method of organizing scanned documents would facilitate the review of such information. Having a standardized format across all care settings would enable seamless communication of information despite the need for sharing information through scanned documents.”

Regarding public health reporting, APIC commented that “consideration should be given to improving the electronic transfer of reportable communicable disease and emerging infectious pathogen data from all care settings to the local and state health department.”

By way of example, APIC cited “bidirectional” web-based data exchange systems or registries<sup>3</sup>, which can pick up clusters in a timely manner, triggering use of infection control measures.

“Additionally, Ray and colleagues<sup>4</sup> found that the use of discharge data coupled with information in the registry accurately predicted which hospitals patients with an outbreak strain<sup>5</sup> of New Delhi metallo-beta-lactamase

producing *Escherichia coli* would visit,” APIC reported.

“Strategies to support public health reporting should address communicable diseases and emerging infectious pathogens,” the association commented.

The association recommended that public health departments have automated access to reports of communicable diseases and emerging infections, working with healthcare sites to control transmission.

“Our members will benefit from interoperable health information, which, in turn, will allow them to create a safer healthcare system,” APIC said.

Regarding the proposed rule’s recommendation to “leverage data already present in the EHR to reduce redocumentation in the clinical note,” APIC submitted the following comment:

“The unique ability to ‘copy and paste,’ which was not possible with a paper health record, can save time when healthcare providers recognize the importance of ensuring the information is correct and/or still applies before moving it forward.”

The caveat is that allowing unlimited copy and paste changes could lead to “the unintended consequence of incorrect information being perpetuated. One wrong piece of information becomes the ‘truth’ when there are no checks,” APIC commented.

That means it will be critical to make sure “that review and verification processes are hardwired into the ‘copy and paste’ functionality. It may be determined that certain data should not be included in copy and paste capabilities.” Moreover, “auto-populating” accurate data on, for

example, prescribed antibiotics and lab results would ensure the transfer of vital information during transitions of care.

“As with most quality improvement initiatives in healthcare, a multi-stakeholder approach is needed to reduce the unintended consequences, optimize the functionality, and ensure the needs of all are met,” APIC concluded.

The public comment period on the HHS draft closed on Jan. 28, 2019. ■

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# Are Stethoscopes a Vector for Transmission to Patients?

*Contamination found, but no definitive link to infection*

An iconic symbol of medicine, the stethoscope can serve as a fomite to transmit pathogens from patient to patient if infection control procedures are not followed, researchers report.

“Stethoscopes used in an ICU carry bacterial DNA reflecting complex microbial communities,” they found.<sup>1</sup> “Commonly used cleaning practices reduce contamination but are only partially successful at modifying or eliminating these 30 communities.”

Traditional culture studies have found pathogens on stethoscopes, raising the theoretical risk of transmission from patient to patient.

“It is well documented that practitioner stethoscopes are not routinely disinfected, and studies based on bacterial culture show that they may be contaminated with potential pathogens including methicillin-resistant and -sensitive *Staphylococcus spp.*, multidrug-resistant *P. aeruginosa*, *Acinetobacter spp.*, *Enterococcus spp.*, *Escherichia coli*, *Klebsiella spp.*, and *Streptococcus spp.*”

Using new gene sequencing techniques, the researchers quantified the bacterial populations on 17 stethoscopes in use in an ICU.

“The important message is that it introduces a new methodological approach to do the type of infection control tracing that is typically done with culture methods,” says lead author **Ronald Collman**, MD, professor of medicine in the Abramson Cancer Center at the University of Pennsylvania School of Medicine in Philadelphia. “It reminds us that maximum adherence to the most stringent infection control procedures is really required. Even these things people generally don’t think

about — stethoscopes as vectors. Maybe they could be.”

The study by Collman and colleagues included individual provider scopes, designated patient-room stethoscopes, and 18 clean, unused individual-use stethoscopes. “Bacterial contamination levels were highest on practitioner stethoscopes, followed by patient-room stethoscopes, whereas clean stethoscopes were indistinguishable from background controls,” they report.

Microbes linked to healthcare-associated infections (HAIs) included *Staphylococcus*, which “was ubiquitous and had the highest relative abundance (6.8%–14% of contaminating bacterial sequences).”

“Cleaning of practitioner stethoscopes resulted in a significant reduction in bacterial contamination levels,” but in some cases, bacteria persisted.

“At our institution, when we have a patient who has a known MRDO [multidrug-resistant organism], not only do we use gloves and gowns and personal isolation, but we put a single-use stethoscope in that room,” Collman says. “That is only used with that patient, and when the patient is discharged, we throw away the stethoscope.”

Although there is not a documented case of transmission of infection to a patient via a stethoscope, the possibility of it informs such infection control efforts, he says.

“In the last decade or so we have new methods where you can sequence the DNA,” he says. “It can tell you the relative abundance of the various types of bacteria. To our knowledge, this is

the first time stethoscopes have ever been analyzed for bacteria using these molecular methods.”

## Bang Worth Buck?

*Hospital Infection Control & Prevention* sought further comment on this issue from **Hilary Babcock**, MD, president of the Society for Healthcare Epidemiology of America. Babcock was not involved in the study.

**HIC:** The study found evidence of pathogenic genetic materials on stethoscopes, but one might expect that in a hospital.

**Babcock:** It is not surprising that bacteria will be found on devices used in a healthcare setting. That’s one of the reasons we put patients with MDROs and resistant organisms — for which we don’t have a lot of treatment options — on contact precautions, dedicated equipment, and single-use stethoscopes. We want to try to avoid spreading the highest-risk organisms from patient to patient on the stethoscope. And, of course, it is the same reason we recommend hand hygiene in between patient care. There are existing recommendations that stethoscopes and any equipment that is used between patients should be cleaned.

**HIC:** Is it possible to quantify the risk of stethoscopes to patients?

**Babcock:** It is certainly a potential risk, but it is hard to quantify that risk directly to patients. It is notable as well that the authors do point out that some of the bacteria that would be of more concern are present in low levels, and that they cannot determine from the kind of testing that they did whether



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the bacteria are viable or not — because it is molecular testing. We don't know if [the bacterial contamination] got on the next patient whether that could cause an infection or not. I think it will be interesting for them to try to match up strains with patient infections in [a subsequent study].

**HIC:** We have also seen these bacterial contamination studies involving provider white coats and neckties that may contact the patient. Is it worthwhile to fight these battles on stethoscopes and ties when it is still hard to get people to wash their hands?

**Babcock:** It's a fair question. These studies are interesting and they highlight potential risk, but as we know, there are bacteria all over the hospital. It is not a sterile environment. I think it makes sense

to focus on areas of significant risk, and it is hard to quantify the risk associated with this finding. I agree people are still trying to get higher levels of hand hygiene, and healthcare workers' hands touch the patient and touch invasive devices. Usually the stethoscope is placed on intact skin.

Again, this is not ideal, and we certainly don't want to be moving bacteria that could cause infections between patients. But it is hard to quantify the risk to focus our efforts. ■

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## CME/CE QUESTIONS

1. Due to concerns of responsibilities beyond the scope of infection prevention, the Association for Professionals in Infection Control and Epidemiology urged members to lobby against finalization of a CMS antibiotic stewardship regulation.
  - a. True
  - b. False
2. The Joint Commission began enforcing antibiotic stewardship in 2017 under which of its standards?
  - a. Environment of Care
  - b. Leadership
  - c. Infection Control
  - d. Medication Management
3. What is typically the first sign of Ebola virus infection?
  - a. Hydrophobia
  - b. Fever
  - c. Severe abdominal pain
  - d. Blurred vision
4. Tara Palmore, MD, hospital epidemiologist at the NIH Clinical Center, emphasizes the importance of which of the following measures to protect patients from waterborne pathogens?
  - a. Test for *Legionella* even in the absence of cases.
  - b. Use patient shower heads that do not aerosolize water droplets.
  - c. Check levels of chlorine in water.
  - d. Use copper pipes to connect sinks.