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Infection preventionists and laboratorians: Case studies on successful collaboration

Maureen Spencer RN, BSN, Med, CIC ^a, Denise Uettwiller-Geiger PhD, DLM (ASCP) ^b,
Jennifer Sanguinet MBA-HCM, BSIS, CIC ^c, Helen Boehm Johnson MD ^{d,*}, Denise Graham ^e

^a Corporate Director of Infection Prevention, Universal Health Services, King of Prussia, PA

^b Director of Laboratory Services and Clinical Trials, John T. Mather Hospital, Port Jefferson, NY

^c Director of Infection Prevention, West Hills Hospital and Medical Center, West Hills, CA

^d Freelance Medical Writer, Vero Beach, FL

^e Founder and CEO, DDG Associates, Alexandria, VA

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Efforts to reduce the incidence of hospital-acquired infection (HAI) remain a significant focus for health care facilities, particularly in this era of drug-resistant organisms. With as many as 1 in every 25 hospitalized patients acquiring an infection, the need to minimize the risk of HAIs is widely recognized as critical. Advances in the fields of biomedical technology, microbiology, pharmacology, and infection control and prevention, among others, have played a tremendous role in these efforts. However, evidence suggests that a key element in this battle against HAIs is missing: collaboration and communication between these groups in health care facilities—particularly in microbiology and infection prevention. The need for collaboration between infection preventionists (IPs) and laboratorians has been addressed in the literature; however, a survey conducted by the APIC and the American Society for Microbiology demonstrated that both IPs and laboratorians feel they lack the tools to engage in this collaboration. This article addresses strategies for a working partnership between IPs and laboratorians and reports 3 case studies on successful collaborations at major medical centers.

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Efforts to reduce the incidence of hospital-acquired infection (HAI) remain a significant focus for health care facilities, particularly in this era of drug-resistant organisms. With as many as 1 in every 25 hospitalized patients acquiring an infection,¹ the need to minimize the risk of HAIs is widely recognized as critical. In addition, HAIs are associated with an annual cost of approximately \$9.8 billion to the U.S. health care industry.² Advances in the fields of biomedical technology, microbiology, pharmacology, and infection control and prevention, among others, have played a tremendous role in these efforts. However, evidence suggests that a key element in this battle against HAIs is missing: collaboration and communication between these groups in health care facilities—particularly microbiology and infection prevention.³ A 2012 survey of infection preventionists (IPs) and laboratory professionals conducted by the Association for Professionals in Infection Control and Epidemiology (APIC) and American Society for Microbiology revealed that 70%

of those surveyed “would value assistance in relationship building between the two groups,” 83% would like to hear “about other facilities’ experience in creating partnerships,” and 78% would like “more education about best practices.”³ A recent focus group of IPs and laboratorians convened during the 2015 APIC conference and corroborated these sentiments with one IP stating that his IP colleagues “had never been to a laboratory. . .these were nurses that were on the floors for years and they were scared to death” (J. Sutton, personal communication, June 28, 2015).

IPS AND LABORATORIANS: PAST TO PRESENT

The laboratory has always been an integral part of infection prevention efforts, despite not getting formal recognition as such until the Society for Healthcare Epidemiology of America published their 1996 consensus panel report on requirements for infrastructure and essential activities of infection control and epidemiology in hospitals.⁴ The role of the laboratorian in infection prevention remains at the core of what it has always been: to provide timely analysis of specimens for infection detection. However, in this era of multidrug-resistant organisms, that role has grown far beyond simply

* Address correspondence to Helen Boehm Johnson, MD, 1321 Sea Hawk Lane, Vero Beach, FL 32963.

E-mail address: HBoehm705@aol.com (H.B. Johnson).

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identifying the presence or absence of a pathogen. Today's laboratorian, for example, is responsible for molecular typing of pathogens, recognition of patterns of antimicrobial resistance, antibiogram development, and surveillance and application of new technologies, among others.^{5,6} Although their statement predated some of the most modern laboratory technologies and multidrug-resistant organisms, Peterson and Brossette articulated the significant role laboratorians play in infection control when they wrote:

The necessary contribution from the laboratory includes surveillance, providing for a systematic observance and measurement of disease, as well as molecular typing of microbial pathogens." Present and future needs for laboratory-based surveillance will require reliable detection of new pathogens that emerge as causes of important health care-associated infections, which implies accurate identification of microbial organisms; recognition of new or emerging antimicrobial agent resistance; and participation in active surveillance for outbreaks. This contribution dictates a strong collaboration between the hospital epidemiologist and the clinical microbiologist, with a consequent positive impact on both the infection control program and the diagnostic laboratory. Such cooperation will be needed as we move to a future where pathogens of concern not only spread within the hospital but have the potential to affect both inpatients and outpatients, healthcare workers, and their households.⁷

The relationship between laboratorians and IPs has also changed significantly since the advent of electronic medical records. Traditionally, IPs would begin their days rounding in the laboratory to gather information on the most recent positive cultures and susceptibility results. This face-to-face time facilitated a natural opportunity for communication between the 2 departments. Advances in information technology and the widespread adoption of electronic medical records, although inarguably beneficial to the delivery of health care at large, have ironically made communication between the laboratory and the infection prevention department significantly less interactive. If results can be accessed by computer without any direct interface between IPs and laboratorians, the opportunity for the prompt exchange of information regarding early signs of potential cluster outbreaks is lost unless either group initiates communication with the other. Additionally, many facilities have consolidated laboratory services off-site, creating yet another obstacle for direct communication.

Laboratorians face their own internal need for collaboration as the lines of distinction between the clinical chemistry and clinical microbiology laboratories blur. The implementation of new technologies, ranging from chemiluminescent immunoassays to molecular diagnostics, has created significant overlap between the 2 fields, requiring the 2 departments to work cooperatively in maximizing testing efficiency and minimizing redundancy.⁸ Although the theoretical need for improved communication and collaboration between IPs and laboratorians has been widely recognized throughout the health care community, many hospitals find themselves struggling to achieve this goal. Some facilities, however, have been successful in these efforts, and the results have been striking.

CASE IN POINT: J.T. MATHER HOSPITAL

In 2008, J.T. Mather Hospital, a 248-bed community hospital in New York State, initiated a campaign against methicillin-resistant *Staphylococcus aureus* (MRSA) that was initially a product of the partnership between their laboratory and infection prevention team and, ultimately, all levels of the hospital infrastructure, from the c-suite to the environmental services department. Recognizing that each medically incurred MRSA infection costs a hospital between \$35,000 and \$60,000,² the hospital wanted to address the most efficient and

effective means of MRSA prevention. The goals identified by the laboratory and the infection prevention department were to rapidly identify colonized and infected patients, implement appropriate contact precautions and isolation, reduce turnaround times, streamline laboratory processes, and create a proactive rather than reactive environment.

Working together, the laboratory and infection prevention department evaluated the hospital's existing testing algorithms and isolation protocols and determined that they needed to initiate a rapid active surveillance program targeting high-risk groups using on-demand polymerase chain reaction (PCR) technology. They agreed that the sensitivity and specificity of the test along with the fact that results could be made available in <2 hours were key to providing actionable information to clinicians as rapidly as possible. Armed with statistics regarding the incidence and costs of MRSA infections along with the data supporting the use of rapid active surveillance with on-demand PCR, the departments successfully lobbied their c-suite in the acquisition of the on-demand PCR equipment. They then embarked on an education campaign with every department from nursing to pharmacy to environmental services, recognizing that these were the individuals on the front lines of collecting samples, advising treatment options, and performing the end terminal cleaning of rooms.

The campaign, entitled "The Bug Stops Here," launched in 2008 and has had significant clinical and financial results. The hospital has seen an 84% reduction in MRSA infection rates (74 infections in 2007; 12 infections in 2014) and an 84% reduction in hospital costs attributed to MRSA infection.⁹ Between 2008 and 2014, approximately 13,000 patients were tested using on-demand PCR (available 24 h/d, 7 d/wk) at a fully burdened cost of roughly \$51 per test, resulting in a total cost to the laboratory of \$650,000 over those 7 years. However, using the low end estimate of each MRSA infection's cost to a hospital (\$35,000), the savings to the hospital for the 62 fewer infections was >\$1.5 million.⁹ Additionally, the hospital saw its average length of stay in the intensive care unit or coronary care unit reduced from 4.4 days to 3.3 days over the course of the campaign, resulting in another \$500,000 in annual savings.⁹

Overall, the hospital saw an increase in operational efficiency, patient safety, and patient satisfaction, with a decrease in delays, labor, readmissions, Centers for Medicare and Medicaid Services (CMS) penalties, and MRSA HAIs. These results, according to Dr. Denise Uettwiller-Geiger, Clinical Chemist and Director of Clinical Trials at J.T. Mather Hospital, were realized because "all stakeholders saw open communication and collaboration as being paramount to achieving success."

She went on to say,

"By coming together and breaking down those silos. . . we've been able to decrease hospital acquired infections. . . to improve operational efficiency because we know how to cohort our patients more effectively and also how to move them more effectively through the organization to the appropriate level of care from the moment they hit the portal of the emergency room where 80% of our patients come from all the way down to discharge planning. We've been able to improve patient safety. . . decrease. . . or avoid those penalties from CMS (Centers for Medicare and Medicaid Services). . . [and] decrease laboratory labor because we have integrated this technology of molecular diagnostics into an existing workstation" (D. Uettwiller-Geiger, personal communication, June 2015).

CASE IN POINT: WEST HILLS HOSPITAL AND MEDICAL CENTER

As a 250-bed, semi-private room, community hospital surrounded by a number of long-term care facilities, West Hills Hospital

has grappled with the problem of identifying *Clostridium difficile* infection and carrier status in patients presenting with diarrhea. Given the high incidence of patients who do present with diarrhea and the hospital's policy of isolating all such patients, the need for rapid diagnosis of *C difficile* is urgent. The facility's laboratory department, however, is comprised of 1 microbiologist along with laboratory technicians, making the handling of complicated *C difficile* testing algorithms, including enzyme immunoassay (EIA) and glutamate dehydrogenase/toxin (GDH) onerous at best. Although positive EIA results are reliable and obtainable the same day, negative results require outsourcing to a second party expert laboratory for a confirmatory test, potentially adding days to the time to diagnosis. Similarly, negative GDH results provides relatively reliable same day answers, but positive GDH results, given their low specificity, require additional testing—again adding to the time to diagnosis.

Having identified that these algorithms and protocols were significantly impacting their facility's ability to expedite *C difficile* diagnosis and increase patient throughput, their infection prevention director and laboratory director partnered to determine a solution. Analysis of the hospital's data revealed that on average there were 12 patient isolations a day for vancomycin-resistant *Enterococcus*, MRSA, and *C difficile*, with an average daily cost of \$2,149 per medical-surgical bed,¹⁰ leading to approximately \$9.4 million spent annually on blocked beds. They postulated that eliminating just a fourth of those patients each day could save the hospital \$2.3 million. Although these numbers reflected isolation days for all patients, 40% of isolations were for suspected *C difficile*. Coupling these numbers with the constraints and delays posed by their current laboratory algorithms, the 2 departments determined that a transition to the highly sensitive and specific, user-friendly (eg, no laboratory expertise required), on-demand PCR technology offered their facility the best option for streamlining productivity. Furthermore, they calculated that clearing 1 patient for 1 day would cover the expense of testing 70 additional patients with on-demand PCR (at the estimated rate of \$30 per test) (J. Sanguinet, unpublished raw data, 2015). Armed with these numbers, they embarked on a campaign to lobby their c-suite for acquisition of the technology—an acquisition that the c-suite agreed to this year. They additionally partnered to limit what they view as unnecessary testing, by proposing a restriction on *C difficile* tests ordered such that if EIA or PCR is ordered twice within a 7-day period, the laboratory will have the authority to cancel the second test. That proposition has now become laboratory policy.

CASE IN POINT: UNIVERSAL HEALTH SERVICES

When the new director of corporate infection arrived at Universal Health Services (UHS) in 2011, she brought with her the experience of including the head of the microbiology laboratory on every infection prevention committee at her former facility. She refers to essentially having marketed the laboratory director such that everyone involved in infection control, from IPs to surgeons, would build a relationship with the director and thereby have a direct conduit to the laboratory. Hence, one of her first items of business at UHS was establishing a relationship with the laboratory directors of the 25 acute care hospitals in the system.

During her tenure at the former hospital, she saw a reduction of >60% in surgical site infections within the first year after initiating MRSA and methicillin-sensitive *S aureus* screening using on-demand PCR.¹¹ Two months into her new role at UHS, she conferred with the laboratory directors of the 6 hospitals who were using on-demand PCR to learn about their experiences with the technology. She arranged for these 6 laboratory directors to share their experiences with the remaining 19 laboratory directors. Certain

themes resonated through each of the testimonials: efficiency, rapidity, and accuracy. Within a year, 6 additional laboratorians had partnered with their IPs and persuaded their c-suite to bring the technology to their facilities. She then decided that implementing the technology at the remaining facilities would best be accomplished by taking a corporate-driven approach. This involved collaborating with a laboratorian to look at the data supporting on-demand PCR's impact on HAI rates, isolation days, and hospital economics and bringing this information to a corporate summit that included everyone from the chief medical officer to risk management.

The data they found and used in their corporate pitch was compelling. A 2011 MRSA study conducted at Massachusetts General Hospital compared passive screening with active screening using traditional culture and active screening using PCR. The article demonstrates the impact each had on the discontinuation of contact precautions.¹² Those patients in the PCR arm of the study had precaution discontinuation rates of 64% compared with 27% in the active screening with culture and 7% with the passive screening arm. Furthermore, the researchers estimated that the reduction in contact precaution days would save the facility \$1.6 million for the active screening with the PCR group compared with \$350,000 for active screening with culture and a mere \$87,000 for the passive screening group.¹² A 2011 study conducted at a small community hospital compared EIA and toxin A/B testing with PCR testing for *C difficile*.¹³ They documented a statistically significant reduction in tests ordered (118 for EIA, 38 for PCR) and patient isolation days (1,022 for EIA, 364 for PCR) when PCR technology was used.¹³

After seeing a community hospital study reporting that 18% of the facility's hospital days were devoted to isolation,¹⁴ the infection prevention director of UHS decided to look internally at their own isolation day rates within 7 of their hospitals. Although the UHS rates were lower (7%) than the study rate, they identified that within the 3-month period they monitored for contact (MRSA, vancomycin-resistant *Enterococcus*, etc), special contact (*C difficile*), droplet (influenza), and airborne negative pressure (*Mycobacterium tuberculosis* [MTB]) isolation days, there were some interesting discrepancies. For example, they identified that during those 3 months, there were only 6 real MTB cases. If each of those patients were isolated for a week, they would have accounted for 42 MTB isolation days, when in fact there were a total of 274 MTB isolation days during that period, demonstrating rule-out MTB cases on presumptive airborne precautions.

Additionally, using a template published in the *Journal of American Medical Association* in 2013,² the director had the IP from each facility in the UHS system estimate the financial impact of HAIs at their hospital. These numbers combined with the facilities' CMS penalty figures successfully demonstrated to the corporate structure that capturing some of these expenses in the preventative arm of the system's budget was in their best interest. The \$24,900 to \$174,400 investment in on-demand PCR equipment, depending on testing capacity, was deemed an expense that would easily be recouped in savings from averted HAIs, particularly given the fact that 1 on-demand system could test for multiple organisms. As a result, by June of 2015, every facility within the system had acquired on-demand PCR technology.

The next phase in the partnership, currently underway, is to standardize the screening protocols for high-risk surgeries (eg, joints, cardiac), MTB testing, and *C difficile* testing that use this new technology. As these protocols are developed, they will be mapped into algorithms designed to establish each step in the screening process such that any breakdown in the protocol could easily be identified and addressed (Fig 1).

By collaborating and tapping into one another's expertise, the infection prevention and laboratory departments were able to effect change in their facilities' technology that allowed for real-time

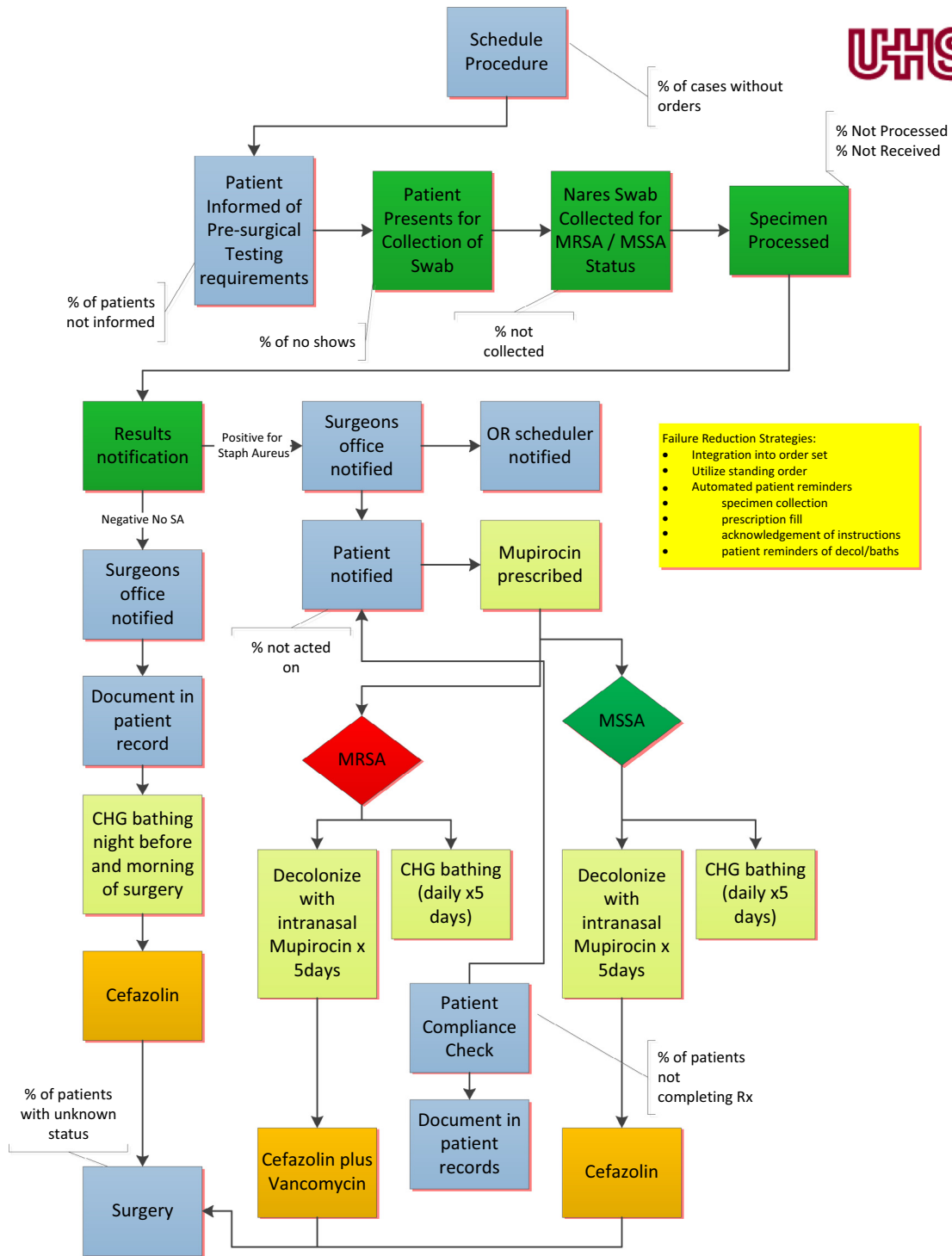


Fig 1. Universal Health Services methicillin-resistant *Staphylococcus aureus* (MRSA) and methicillin-sensitive *S aureus* (MSSA) preoperative algorithm.¹⁵ Reprinted with permission. CHG, chlorhexidine gluconate; Rx, treatment.

surveillance, reduction in isolation days, streamlined microbiology laboratory procedures, and appropriate antimicrobial treatment—all of which contribute to optimal health care delivery.

A ROADMAP FOR IPS AND LABORATORIANS

It is evident from these 3 examples that communication and collaboration between IPs and laboratorians helped effect changes

within their facilities, resulting in more efficient and cost-effective infection prevention programs and therefore high-value patient outcomes. With approximately 70% of information used by health care providers to make medical decisions originating from the laboratory, the value of building a relationship with the laboratorians is undeniable.¹⁶ However, for those IPs who have not yet entered into such a partnership with their laboratorians, it can be difficult to determine how to initiate this relationship building. A number of IPs

have shared their ideas for enhancing this collaboration in the literature,^{5,6,17} but as evidenced by the joint APIC/American Society for Microbiology survey of IPs and laboratorians,³ the gap between the 2 departments remain.

The focus group of IPs and laboratorians that convened during the 2015 APIC conference to address the need for this collaboration identified their experience-based recommendations for creating it:

- **Train together:** Having new IPs spend time at the beginning of their careers in the microbiology laboratory can not only foster better communication between the individuals in the departments, but it also help familiarize the IPs with the logistics and processes behind each test ordered. One IP in the focus group described how every new member of their IP team spends the first 2 weeks on the job in the laboratory, familiarizing themselves with the laboratory procedures and personnel.
- **Establish a schedule:** Creating a schedule of regular meetings between IPs and laboratorians will ensure a consistent exchange of information. One IP from the focus group reported that these regular meetings allowed for discussion about trends the laboratory was detecting in culture results and outlier pathogens that may not have come to the infection prevention team's attention. She would schedule these meetings just prior to every regular infection prevention committee meeting so that she could share this information with the infection prevention team at large on a regular basis.
- **Run the numbers:** IPs and laboratorians must cull isolation days, average daily bed cost, infection rate, and CMS penalty data and compare that with any expense to be incurred by a change in technology or protocol that they wish to implement. The bottom line for the c-suite is the financial bottom line; therefore, presenting a strong economic case is critical.
- **Share the burden:** Costs incurred from changes in technology can be burdensome to a laboratory department. This economic burden can be shared across departments—from microbiology to infectious disease to infection prevention—all of whom are seeking to achieve the same end result.
- **Expand the committee:** Including laboratorians in infection control committees creates shared vigilance and awareness for everything from procedural delays to cluster outbreaks. This is particularly important for facilities' with off-site laboratories where face-to-face interaction between the IP and laboratorian is limited. An IP from the focus group described how bringing the laboratorian to the unit where a cluster outbreak was occurring was pivotal in identifying the source of the outbreak, given the laboratorian's expert knowledge of the microorganism.

No one department within a health care facility truly operates alone. Each department is working toward the common goal of delivering the highest possible standard of health care delivery, but that goal is clearly more readily obtained when departments pool resources and maintain open lines of communication. IPs and laboratorians must extend their own collaboration to include other departments. Working with the pharmacology and infectious disease departments to look at pathogen infection rates and how they compare with antibiotic usage rates, developing antibiograms, and

tracking resistance patterns are all crucial elements of antimicrobial stewardship.^{5,6,17} Similarly, educating nursing staff regarding the science behind testing modalities and result interpretation can facilitate efficient patient management with those on the frontline of care.¹⁷ As epidemiologist Kathy Aureden stated, "Critical thinking is enhanced through discussion with a knowledgeable colleague."¹⁸ The challenges posed by HAIs today and the challenges that lie ahead will demand a collaborative effort on the part of all those engaged in health care delivery.

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