Unnecessary Deaths:

The Human and Financial Costs of Hospital Infections

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MAKING IDEAS CHANGE THE WORLD
NATIONAL CENTER FOR POLICY ANALYSIS
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Essential Facts You Need to Know About Hospital Infections

Keep in mind:

- We have the knowledge to prevent hospital infection deaths.
- We don't have to wait for a scientific breakthrough.
- Yet most hospitals have failed to act.
- The situation is growing more dangerous because, increasingly, hospital infections cannot be cured with commonly used antibiotics

1. Infections contracted in hospitals are the fourth largest killer in America. Every year in this country, two million patients[1] contract infections in hospitals, and an estimated 103,000 die as a result,[2] as many deaths as from AIDS, breast cancer, and auto accidents combined.[3]

2. A few hospitals in the U.S. are proving that infections are almost entirely preventable. How are they doing it? Through rigorous hand hygiene, meticulous cleaning of equipment and rooms in between patient use, testing incoming patients to identify those carrying dangerous bacteria and strictly isolating those who test positive, and requiring caregivers to use gowns or disposable aprons when treating positive patients.

3. In 2003, the Society for Healthcare Epidemiologists of America (SHEA) announced the precautions that, research proves, can eradicate most hospital infections. Yet only a few hospitals have taken these precautions, and the CDC still has not called on all hospitals to implement them.

4. Hospital infections add an estimated $30 billion to the nation's hospital costs each year. Patients, insurers and taxpayers pay part of that cost, but hospitals have to absorb much of the cost. As a result, infections erode hospital profits. Preventing infections can turn a financially failing hospital profitable.

5. Better infection control in hospitals is essential to prepare the nation for avian flu or bioterrorism. If avian flu were to wing its way to the U.S., the death toll would depend largely on what American hospitals did when the first avian flu patients were admitted. If hospitals have effective infection controls in place, they can prevent bird flu from infecting other patients who did not come in with it. If not, bird flu could sweep through hospitals. Right now, most hospitals are woefully underprepared. Hospitals have failed to stop the spread of ordinary infections spread by touch and would not be able to contain flu viruses, which are communicated by droplets from coughing and sneezing as well as touch. Even more challenging would be smallpox, plague, and other bioterrorism weapons that can travel through the air. Shoddy infection control is poor preparation for a flu epidemic and poor homeland security as well.

6. Hospital infection is a far deadlier problem than the number of uninsured. The Institute of Medicine estimates that as many as 18,000 people a year die prematurely because they don't have health insurance. That's tragic. But five times as many people die each year from hospital infections, and most of them are insured.[4]

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Dear Reader,

This report has been written to help you and to enlist your help in correcting a deadly situation that kills an estimated 103,000 people in this country each year—as many deaths as from AIDS, breast cancer, and auto accidents combined.[5]

Where does it kill? In our hospitals. What is it? Hospital infection.

The death toll is staggering. So is the economic cost. Hospital infections add over $30 billion a year to what the nation spends on hospital care, enough to pay for a large part of the Medicare prescription drug program.[6]

These infections are almost all preventable. A few hospitals in the U.S. are proving it, reducing some of the deadliest types of infections by 90 percent. Their achievements prove that we have the knowledge to solve this problem. No major scientific breakthrough is needed. What is lacking is leadership.

That is why I founded the Committee to Reduce Infection Deaths (RID): to motivate hospitals to make infection prevention a top priority; to inform patients about the steps they can take to reduce their risk of infection; and to ensure that no matter where you live, you can find out which hospitals in your area have the worst infection problems.

- **RID holds forums** for hospital administrators, public health officials, lawmakers, medical educators, insurers, and patient advocates, showing them how infections can be eradicated and *how much money can be saved*. The humanistic reasons to stop hospital infections are obvious. RID forums also make a compelling economic case for infection control, showing that for some hospitals, preventing infection can actually make the difference between profitability and loss.

- **RID educates** the public through television, radio, popular publications, and our website. One of our most important educational tools is the "14 Steps You Can Take to Reduce the Risk of a Hospital Infection," which is included in this study.

- **RID works with state lawmakers and other policy makers** to develop hospital infection report cards, because if you need to be hospitalized, you should be able to choose a hospital with a low infection rate.

■ **RID partners with health insurers** to develop incentives for hospitals to improve infection control and to deliver life-saving information to patients.

■ **RID is encouraging medical schools and nursing schools** to educate their students about how bacteria are spread from patient to patient in hospitals and the precautions that should be taken to protect their patients—a subject that is almost entirely neglected in most schools.

The Committee has a distinguished membership, including Dr. Sherwin Nuland, author of *The Doctor's Plague,* a biography of Ignac Semmelweis; Dr. Elizabeth Whelan, founder of the American Council on Science and Health, and Nobel Laureate Dr. Joshua Lederberg, as well as corporate leaders, philanthropists, and civic leaders. Our goal is to save lives.

Everyday you hear about health care problems such as providing for the uninsured. The Institute of Medicine recently estimated that as many as 18,000 people a year may die prematurely because they don't have health insurance.[7] But consider this even more tragic fact: Five times that many people die each year from hospital infection, and most of them are insured. Having insurance is no guarantee that you will be safe in the hospital. The only way to ensure that is to clean up this deadly problem.

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About the National Center for Policy Analysis

The National Center for Policy Analysis (NCPA) is a nonprofit, nonpartisan public policy research institute established in 1983. Its mission is to seek innovative private sector solutions to public policy problems. The NCPA focuses on issues of importance nationally and internationally. It is headquartered in Dallas, Texas, in order to draw on "outside-the-beltway" thinking, and maintains an active office in Washington, D.C., in order to inform deliberations in Congress and the Executive Branch.

The NCPA is probably best known for developing the concept of Medical Savings Accounts (MSAs), now known as Health Savings Accounts (HSAs). In 2003, as part of Medicare reform, Congress and the President made HSAs available to all nonseniors, potentially revolutionizing the entire health care industry. The NCPA home page (www.ncpa.org) links visitors to the best available information, including studies produced by think tanks all over the world.

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I

Third World Hygiene in Our First Class Medical System

Every day in hospitals across the United States wondrous medical procedures rescue patients from the brink of death. But there's a catch. In these same hospitals, hygiene is so inadequate that one out of every twenty patients contracts an infection.[8]

Infections that have been nearly eradicated in some countries are raging through American hospitals. In 2003, the Society for Healthcare Epidemiologists of America warned that although hospitals have infection control programs, "there is little evidence of control in most facilities."[9]

The danger is worsening because hospital infections, increasingly, cannot be tamed with commonly used antibiotics. One of the deadliest germs is *methicillin-resistant Staphylococcus aureus* (or MRSA). Patients who do survive MRSA often spend months in the hospital and endure repeated surgeries to cut out infected tissue. In 1974, 2 percent of *Staph* infections were MRSA. By 1995, the number had climbed to 22%, in 2003 an alarming 57% and still rising.[10]

Denmark, Holland, and Finland once faced similar rates, but brought them down below 1 percent.[11] How? Through rigorous hand hygiene, meticulous cleaning of equipment and rooms in between patient use, and testing incoming hospital patients to identify those carrying MRSA and strictly isolating them to prevent transmission to other patients. Wheelchairs and other equipment used to transport patients who test positive for MRSA are not used for other patients, and hospital staff have to change their uniforms and footwear after entering the rooms of MRSA patients, before they are permitted in other areas of the hospital.

A few hospitals—very few—in the United States are proving these precautions work here too. The University of Virginia Hospital eradicated MRSA.[12] The Veterans Hospital in Pittsburgh reduced MRSA by 85 percent in a pilot program.[13] The University of Pittsburgh-Medical Center-Presbyterian Hospital slashed MRSA by 90 percent in the medical intensive care units.[14] Twenty-nine healthcare

institutions in Iowa eliminated another drug-resistant germ, *vancomycin-resistant Enterococcus* (or VRE).[15] Unfortunately, most U.S. hospitals have not implemented these precautions. Here's what you'll find in the great unwashed majority of hospitals.

II

The Major Problem: Poor Hygiene

Over half the time, physicians and other caregivers break the most fundamental rule of hygiene by failing to clean their hands before treating patients.[16] Gloves are not the solution, because pulling them on with dirty hands contaminates the gloves.

Nearly three quarters of patients' rooms are contaminated with MRSA and VRE. These bacteria are on cabinets, counter tops, over-the-bed tables, bed rails, and other surfaces.[17] Once patients and caregivers touch these surfaces, their hands become *vectors for disease*. Ordinary cleaning solutions are effective against these bugs, but surfaces need to be drenched for several minutes, not just sprayed and wiped quickly.[18]

Astoundingly, most hospitals in the United States don't routinely test patients to determine which ones are carrying MRSA and other bacteria. Seventy to ninety percent of patients carrying MRSA are never identified. Knowing which patients are sources of infection is key to stopping the spread.[19]

Clothing is frequently a conveyor belt for infections. When doctors and nurses lean over a patient with MRSA, the white coats and uniforms pick up bacteria 65 percent of the time and carry it to other patients.[20] Hospitals that are conquering infection require their staff to put on fresh gowns or disposable aprons every time they treat patients with MRSA. (The aprons cost a nickel and are ripped off rolls like clear plastic dry-cleaning bags.)

A major academic hospital in New York City is struggling to control the spread of *Clostridium difficile*, an infection usually caused by fecal material from one patient entering another patient's mouth. How could that happen? Doctors there suspect it's because clinical nursing assistants wear the same clothes while doing two jobs: emptying bed pans and delivering food trays.[21]

The privacy curtains that surround a patient's bed are seldom changed, though they are often the last thing a caregiver touches before treating a patient, and the first thing touched afterward, when the caregiver reaches up with contaminated gloves to pull open the curtain. Stethoscopes, blood pressure monitors, and other pieces of equipment are frequently carrying live bacteria.

Does your doctor clean the stethoscope before listening to your chest? Probably not, though the American Medical Association recommends it.[22]

We have the knowledge to prevent infection. What has been lacking is the will. Most hospitals have not made fighting infection a top priority. The federal Centers for Disease Control and Prevention are also to blame. The CDC has tracked the rapid increase in drug-resistant hospital infections for a quarter century but has not advocated the rigorous steps necessary to stop them.

In 2003, the Society for Healthcare Epidemiologists of America urged hospitals to routinely test incoming patients, isolate those who test positive for MRSA and VRE, and prevent the spread of these bacteria to other patients via equipment, staff clothing, and room surfaces. "There are at least fifty studies demonstrating the effectiveness of these precautions," explains Dr. Carlene Muto, an epidemiologist at the University of Pittsburgh Medical Center, and "not one study suggesting it's possible to control MRSA without them."[23] One study shows that MRSA spreads from patient to patient 15 times as fast under CDC standards as under the more rigorous precautions advocated by the Society.[24]

Yet two years later, the CDC has still not called on hospitals to implement these precautions. Hospitals must be happy at the lack of pressure, but the public should be outraged. Every year of delay is costing thousands of lives.

III

Infections Erode Hospital Profits

Many hospital administrators say they can't afford to take these precautions. The truth is, they can't afford *not* to. Infections erode hospital profits, because rarely are hospitals fully paid for the added weeks or months patients must spend in the hospital when they get an infection. For example: Pennsylvania's Allegheny Hospital would have made a profit treating a 37-year old video programmer and father of four who was admitted with acute pancreatitis, but the economics changed when the patient developed a MRSA bloodstream infection. He had to stay in the hospital 86 days, and the hospital lost $41,813.[25] Pittsburgh's Shadyside Hospital tamed a MRSA outbreak and saved ten dollars for every dollar spent on improving hygiene, testing patients, and isolating those with MRSA.[26]

Infections add more than $30 billion annually to the nation's health costs.[27] The tab will increase rapidly, as more infections become drug-resistant.[28]

Additional research on the cost of infections shows that:

An estimated

2,000,000

infections per year

x

$15,275[29]

(Additional hospital costs when a patient contracts an infection)

=$30.5 Billion

per year spent treating hospital infections

This figure does not include doctors' bills, home nursing bills, home nursing care, lost time at work, and other non-hospital costs.)

■ Post surgical wound infections more than double a patient's hospital costs. When a patient develops an infection after surgery, the cost of care increases 119 percent, on average, at a teaching hospital, and 101 percent at a community hospital.[30]

■ Urinary tract infections increase a patient's hospital costs by **47** percent at a teaching hospital and **35** percent at a community hospital.[31]

■ The average ventilator-associated pneumonia infection (a type

of infection contracted when a patient is on a respirator) adds **$40,000** to a patient's hospital costs.[32]

■ A central catheter-related bloodstream infection increases a patient's hospital costs by about **$30,000** on average.[33]

■ *Staphylococcus aureus* infections are especially costly. According to a recent nationwide study, patients with *Staph* infections incur hospital costs that amount to more than triple the average hospital costs of other patients.[34]

If the cost is not enough to motivate hospital leaders to improve infection controls, they now face two other pressures. One is from the trial lawyers. Remember asbestos? Hospital infection is the next asbestos. The infection problem has all the hot button essentials of a successful class action lawsuit: two million helpless victims a year, copious evidence that infections are preventable, and a consistent pattern of failure to act.

Secondly, hospitals in many states will soon be compelled to come clean about their infection rates. Six states—Florida, Missouri, Pennsylvania, New York, Illinois, and Virginia—recently enacted laws to provide the public with risk-adjusted hospital infection report cards, and several other states are poised to follow.

IV

The Importance of Hospital Infection Report Cards

Maureen Daly wishes she had known more when she took her 63-year old mother to the hospital. Johanna had slipped and broken her shoulder at a restaurant, and no one expected that she would be in the hospital for more than a day or two. But a *Staph* infection ravaged her body for four months and killed her. "What happened to my mother shouldn't happen to anyone," says Daly. "If only I had had enough information to choose a hospital with a better infection record."

If you need to be hospitalized, wouldn't you want to know which hospital in your area has the lowest infection rate? Good luck getting that information!

Most states don't even collect data on hospital infections. Twenty-one states require hospitals to report infections serious enough to cause severe injury or death,[35] but the requirement is seldom enforced, and worse still, states go along with the hospital industry's demands to keep the data secret. The federal Centers for Disease Control and Prevention collect infection data from several hundred hospitals around the nation, but the CDC also promises hospitals to keep infection rates secret.[36] Government, for the most part, is not helping you choose a safe hospital.

The irony is that it's easy to get information for the less important decisions you make in life, such as where to have lunch. Most states will help you find out which restaurants and delicatessens have been cited for health violations. But you can't find out which hospital has the worst infection rate. You can go home to make your own sandwich, but you can't perform surgery on yourself.

The good news is that Florida, Missouri, Pennsylvania, Illinois, Virginia, and New York recently passed laws to provide the public with hospital infection report cards. Publicly comparing hospital performance will motivate hospitals to improve.

New York's experience with another type of hospital report card proves this. In 1989, New York became the first state to publish each hospital's risk-adjusted mortality rate for cardiac bypass surgery. The results? Deaths from bypass surgery dropped 40 percent, giving

New York the lowest mortality rate in the nation for that procedure.[37] Critics of hospital report cards speculate that deaths went down in New York because hospitals avoided treating the sickest patients, fearing that high-risk operations would bring down the hospital's grade. However, the evidence proves that's untrue. Deaths declined for a different reason: hospitals forced their worst-performing surgeons—generally, those with low volume—to stop doing the procedure. Patients of the 27 barred surgeons were more than three times as likely to die during surgery. In technical jargon, the 27 surgeons had an average risk-adjusted mortality rate of 11.9 percent, compared with a statewide average of 3.1 percent.[38] Wisconsin also found that report cards motivate poorly performing hospitals to improve, according to a 2001 study of 24 hospitals there.[39]

Is there a reason *not* to have infection report cards? The hospital industry argues that publicly comparing hospital infection rates would be unfair to hospitals that treat AIDS, cancer, and organ transplant patients who are especially vulnerable to infection. Fair enough, but reports can be risk-adjusted to reflect these differences. What is unfair is keeping the public uninformed.

Fortunately, 30 states are considering legislation to provide the public with the information they need. These states should use the model bill suggested here (Appendix A), because it improves upon the laws already passed in three ways: First, it specifies the method of risk-adjustment for surgical site infections used by the CDC, rather than leaving the risk-adjustment method to be determined by committee. This should assure hospitals that comparisons will be fair and take into account which hospitals treat especially sick and infection-prone patients.[40]

Secondly, the bill imposes civil penalties on hospitals that fail to report or flagrantly underreport their infections. These penalties are needed. For many years, some hospitals have openly ignored data collection laws with impunity. For example, in one recent year, hospitals in New York reported only 16.5 percent of the post-surgical deaths that the law required them to report.[41] In 2005, the first year of Pennsylvania's hospital infection reporting program, hospitals reported only one tenth as many infections to the new program as they billed. Some Pennsylvania hospitals implausibly claimed they had no infections at all.[42]

Thirdly, the model bill ensures that hospital infection reporting will benefit the public, not enrich trial lawyers. The bill provides that "none of the data collected and reported under this law can be used in litigation against an individual hospital."

Next time you hear an ad on the radio urging you to use a particular hospital because it has the best doctors or the latest equipment, keep in mind what you're *not* being told: how many patients get infections

while in that hospital. Hospitals are doing their best to keep that information secret. In contrast, in England hospital infection rates are posted conspicuously on the front door of the hospital. Americans deserve the same information. The legislation proposed here won't help hospitals save face, but it will help you choose a safe hospital. Let hospitals vie for your business by improving their infection rates.

V

Shouldn't Medical Students Be Taught Hygiene?

What else needs to be done? Medical schools should be teaching future doctors the precautions they must take to protect their patients from infection. It's hard to believe, but most medical schools devote virtually no time, not even one full class, to showing students how bacteria are transmitted from patient to patient on clothing, equipment, and gloves, and what specifically they should be doing to prevent it. Dr. Frank Lowey, a professor at the New York-Presbyterian Hospital at the Columbia University Medical Center says, "it's something we should have done quite a while ago." Lowey says it's ironic that "there are curriculum committees devoted to making sure that bioterrorism is covered, and the risk of nosocomial infections far outweighs that."[43]

Some medical schools are stressing the importance of curbing the use of antibiotics.[44] That's good, because overuse of antibiotics wastes money and causes bacteria to morph into new, drug-resistant strains. But limiting the use of antibiotics won't stop hospital infections. Patients who contract MRSA get it from unclean hands or contaminated equipment or clothing, not simply from taking antibiotics. No hospital has ever eradicated infection merely by controlling the use of these drugs.

When medical students put on their white coats and swear the Hippocratic Oath, they should be taught *how* to do no harm. Preventing the spread of bacteria is an essential part of that lesson. They should learn it before they go out on the hospital floors and touch their first patient.

VI

Success Stories: Infections *Can* Be Eradicated

A. Dr. Carlene Muto Describes Victory Over MSRA at the University of Pittsburgh Medical Center[45]

"It's a fabulous feeling," says Dr. Carlene Muto, reflecting on the team effort that has resulted in a 90 percent reduction in *methicillin-resistant Staphylococcus aureus* (MRSA) in the medical intensive care unit at the hospital where she is director of infection control. How long did it take? Three years. Ask her how it was done. She explains that it required total commitment from the top leadership at the hospital and caregivers.

When Muto came to UPMC-Presbyterian, the flagship hospital in the University of Pittsburgh system, in the 1990s, drug-resistant *Staphylococcus aureus* was a rapidly growing problem. In 2000, Muto launched a campaign to eradicate the "superbug" in the hospital's medical intensive care unit. Critical to the strategy was active surveillance culturing—meaning that every patient coming into the intensive care unit who might be carrying MRSA was cultured. Muto, one of the co-authors of The Society for Healthcare Epidemiologists of America's guideline, emphasizes that you can't eliminate infection until you know which patients are the sources of the bacteria. Every patient who tested positive was isolated, and doctors and nurses treating them wore gowns and masks, and kept equipment used on these patients away from others. By 2003, MRSA was almost eliminated. The strategy has worked so well that it has now been expanded to all 15 intensive care units in the hospital system.

The key, explains Muto, was to identify every patient carrying the dangerous bacteria. "We had total compliance, 98 percent to 100 percent, with culturing patients," she said, adding that she was astonished. After all, asking nurses to culture every new patient in the ICU meant adding one more thing to an already long list of tasks they have to do. The staff reaction, says Muto, "has been overwhelmingly positive." "That's essential," she adds. "You can come up with an idea, but no matter how great it is, you have

to have the buy in from the staff at the point of care."

Getting caregivers to clean their hands has been a tougher challenge, in part because at the beginning, Muto explains, some "nurses didn't realize that if they went into a room of a patient in isolation and didn't touch the patient or the bed linen but did touch other surfaces such as countertops, their hands *were* contaminated."

Now that the education process is well under way, hand cleaning compliance is about 69 percent, well above the national average but not good enough for Muto and her team. The top leadership at UPMC-Presbyterian is taking an uncompromising position on the failure of staff and doctors to clean their hands. The hospital is getting set to impose stiff penalties, including firing staff members who chronically ignore hand cleaning rules and denying doctors the privilege of practicing at the hospital.

The goal? "Our goal is 100 percent compliance with hand cleaning, 100 percent compliance with gowning, 100 percent compliance with surveillance culturing," says Muto, adding excitedly that she can only imagine what can be achieved when they reach perfection.

■

B. Dr. Richard Shannon Aims for Zero Infections

When Dr. Richard Shannon told the top executives at Allegheny Hospital that he wanted to do something about central line-associated blood stream infections (CLABs), the hospital leadership expected him to suggest reducing them by 10 or 20 percent over several years. To their surprise, Shannon said he wanted to totally eradicate these deadly infections in ninety days. And he did it! Even more amazing, he and his staff kept these infections near zero in the medical intensive care unit and coronary care unit during the entire next year, achieving a 95 percent reduction in CLAB- related deaths.[46]

Why strive for merely minor improvement when lives are at stake? Shannon's pet peeve is benchmarking—the thinking all too common in hospitals today that it's okay to have infections and medical errors so long as they don't exceed the national average. "Who volunteers to have a family member get one of the infections we plan on having this year?" The goal has to be zero infections and perfect care, says Shannon, who is Chairman of the Department of Medicine at Allegheny.[47]

How was that goal reached? By ensuring that all caregivers meticulously follow a regimen for inserting and removing central lines that includes masks, gowns, gloves, and drapes; inserting lines in the neck area rather than in the groin area, which is more difficult to keep

clean; rearranging supply closets to ensure that the supplies needed to carry out this regimen are easily accessible, even when staff are rushed; and empowering all staff members to enforce hand cleaning and other rules of hygiene. If a doctor doesn't clean his hands, the nurse working alongside can call a halt to the procedure until the doctor complies.

Shannon oversees some 800 employees and a $150 million budget. Nevertheless, he makes time to speak across the country, with PowerPoint in tow, showing his audiences that preventing infections is possible *and profitable.* Doing the right thing costs less, he says, using Allegheny's financial records to prove the point. A typical example is the tragic case of a woman who came into the hospital for stomach reduction surgery, a procedure that should have produced a $9,900 gross profit for the hospital. But when she developed a central line-associated bloodstream infection and had to spend 47 days in the hospital, that profit turned into a $16,000 loss. Preventing CLABs saved Allegheny $1.4 million the first year.[48]

The best news of all is that the success at Allegheny is being duplicated by at least a few other institutions. At Johns Hopkins, catheter-related bloodstream infections in the intensive care unit have been virtually eliminated. How? ICU staff were educated about the seriousness of catheter-related infections; a catheter-insertion cart was created to ensure that necessary equipment was readily at hand; doctors were asked daily whether catheters should be removed; bedside nurses were given a safety checklist to follow during insertion; and nurses were empowered to stop procedures if safety rules were not being followed. Peter Provonost, the intensive care physician at Johns Hopkins who developed the safety checklist, sees the success as proof that infections are not inevitable.[49]

That is Richard Shannon's mantra as well. Shannon is amazed that so little is being done nationwide to curb bloodstream infections *and* to halt the alarming rise in MRSA. Shannon asks why the procedures that reduced *Staph* infections by 85 percent in a pilot program at the V.A. Hospital in Pittsburgh are not being duplicated everywhere. "What if you had a patient with TB or SARS? Wouldn't you pull out all the stops, gloving and gowning and washing up all the time? Well, we haven't seen TB in years, and we've never seen SARS, but we have MRSA silently stalking us every day." The magnitude of the problem, he says, is "a call to action for all health-care providers to step up and get serious about all hospital-acquired infections."[50]

C. Dr. Barry Farr Recalls Early Victories at the University of Virginia Hospital[51]

Barry Farr remembers the first outbreak of MRSA at the University of Virginia Hospital. It was 1978, and Farr and his wife had recently come to the hospital to train, having just finished medical school. "MRSA was wildly out of control," he recalls, and the hospital was doing "what most American healthcare facilities are still doing today." As a result, the hospital "failed miserably to control the MRSA."

For nearly three years, as the outbreak raged on, the hospital followed a business-as-usual approach: no routine cultures were being taken to identify the patients silently carrying the bacteria. The result, recalls Farr, was that doctors were touching patients who had MRSA, or allowing their white coats to brush up against them, and then passing the bacteria on to other patients without knowing it. At the hospital infection control meetings, the mood was pessimistic and apathetic. Staff members were saying "no one has ever controlled this."

Finally, after three years of failure, the hospital took a radical step, inspired by the success of several European countries that had brought MRSA under control. The hospital began regularly testing patients for the bacteria and isolating those who tested positive. The results were stunning. Soon after the testing began, in December 1980, MRSA declined rapidly, and by the summer of 1982, the hospital was MRSA free. "It was beautiful," Farr recalls.

Surveillance culturing—identifying every patient carrying the bacteria—was the key to thwarting the outbreak and eradicating MRSA, says Farr. It was to work again a decade later.

The University of Virginia hospital was struck with MRSA a second time in the early 1990s, when a surgeon apparently walked into the neonatal intensive care unit with MRSA on his hands or clothing and transmitted it to one of the babies. Quickly it was spread to babies in the neighboring bassinettes, and then to another neonatal intensive care unit when one of the babies carrying the bacteria was moved there. The hospital immediately put into place the same precautions that had worked a decade earlier, and the outbreak was curtailed. Culturing every baby, and isolating everyone who tested positive, was once again the key.

Would this method conquer other deadly bacteria as well? Soon afterward, the hospital faced an outbreak of *vancomycin-resistant Enterococci* (VRE), which spread rapidly to 30 percent of patients on eight separate wards. After several months, the hospital brought the outbreak under control once again by testing patients, isolating the carriers, and making sure that all staff

put on gowns and gloves when treating them.

Are the University of Virginia's successes atypical? "No," says Farr. "There are over ninety studies, probably 100 by now," demonstrating that this method works. Yet antibiotic-resistant infections are "clearly out of control in the American health care setting." Why? Farr suggests that faulty cost-cutting is partly to blame.

Hospital administrators complain about the cost of these rigorous precautions, but the data proves these precautions save money. Farr compared the University of Virginia hospital with several other university hospitals of similar size. These other hospitals "are spending between $1 million and $3 million a year extra to treat antibiotic-resistant infections, far more than what UVA has had to spend on gowns, cultures, and gloves. We're taking the ounce of prevention approach. Many other hospitals are taking the pound of cure approach."

Another reason few hospitals are adopting rigorous infection control is that the public has not demanded it. "In Britain there is a public outcry over the failure to control MRSA infections in hospitals, and the British government is reportedly now considering firing hospital directors that fail to take effective measures to control MRSA," says Farr. "In this country there has been comparatively little outcry from the public and no urgent demands from the government that the spread of infections be stopped."

14 Steps You Can Take to Reduce Your Risk of a Hospital Infection

1. Ask that hospital staff clean their hands before treating you. This is the single most important way to protect yourself in the hospital. If you're worried about being too aggressive, just remember your life could be at stake. All caregivers should clean their hands before treating you. Alcohol-based hand cleaners are more effective at removing most bacteria than soap and water.[52] Do not hesitate to say the following to your doctor or caregiver: "Excuse me, but there's an alcohol dispenser right there. Would you mind using that before you touch me, so I can see it?" Don't be falsely assured by gloves. Gloves more often protect staff than patients. If caregivers have pulled on gloves without cleaning their hands first, the gloves are already contaminated before they touch you.[53]

2. Before your doctor uses a stethoscope to listen to your chest, ask that the diaphragm (or flat surface of the stethoscope) be wiped with alcohol. Numerous studies show that stethoscopes are often contaminated with *Staphylococcus aureus* and other dangerous bacteria, because caregivers seldom take the time to clean them in between patient use.[54] The American Medical Association recommends that stethoscopes routinely be cleaned for each patient. The same precautions should be taken for many other commonly used pieces of equipment too.

3. Ask visitors to clean their hands and avoid sitting on your bed.[55]

4. If you need surgery, choose a surgeon with a low infection rate. Surgeons know their rate of infection for various procedures. Ask for it. If they won't tell you, consider choosing another surgeon. You should be able to compare hospital infection rates too, but that information is almost impossible to get. That is why RID is working hard for hospital infection report cards in every state.

5. Beginning one week before surgery, shower frequently with Chlorhexidine soap. Various brands

can be found at drug stores. This will help remove any dangerous bacteria you may be carrying on your own skin.

6. Ask your surgeon to have you tested for *Staphylococcus aureus* at least one week before you come into the hospital. The test is simple, usually just a nasal swab. About one third of people carry *Staphylococcus aureus* on their skin, and if you are one of them, extra precautions can be taken to protect you from infection, to give you the correct antibiotic during surgery, and to prevent you from transmitting bacteria to others.

7. On the day of your operation, remind your doctor that you may need an antibiotic one hour before the first incision. For many types of surgery, a pre-surgical antibiotic is the standard of care, but it is often overlooked by busy hospital staff.[56]

8. Ask your doctor about keeping you warm during surgery. Operating rooms are often kept cold for the comfort of the staff, but research shows that for many types of surgery, patients who are kept warm resist infection better.[57] There are many ways to keep patients warm, including special blankets, hats and booties, and warmed IV liquids.

9. Do not shave the surgical site. Razors can create small nicks in the skin, through which bacteria can enter. If hair must be removed before surgery, ask that clippers be used instead of a razor.[58]

10. Ask that your surgeon limit the number of personnel (including medical students) in the operating room. Every increase in the number of people adds to your risk of infection.[59]

11. Ask your doctor about monitoring your glucose (sugar) levels continuously during and after surgery, especially if you are having cardiac surgery. The stress of surgery often makes glucose levels spike erratically. New research shows that when blood glucose levels are tightly controlled to stay between 80–110 mg/unit, heart patients resist infection better. Continue monitoring even when you are discharged from the hospital, because you are not fully healed yet.[60]

12. Avoid a urinary tract catheter if possible. It is a common cause of infection. The tube allows urine to flow from your bladder out of your body. Sometimes catheters are used when busy hospital staff don't have time to walk patients to the bathroom. Ask for a diaper or bed pan instead. They're safer.[61]

13. If you must have an IV, make sure that it is inserted and removed under clean conditions and changed every 3 to 4 days. Intravenous catheters, or IVs, are a common source of infection and are not always necessary. If you

need one, insist that it be inserted and removed under clean conditions, which means that your skin is cleaned at the site of insertion, and the person treating you is wearing clean gloves. Alert hospital staff immediately if any redness appears.

14. If you are planning to have your baby by Cesarean section, take the steps listed above as if you were having any other type of surgery.

Appendix A

RID's Model Hospital Infection Report Card Bill

The following outline is intended to help state lawmakers as they draft legislation to provide the public with hospital infection rates:

AN ACT to provide the public with information on infection rates at hospitals in the state of _____.

Section 1. Definitions.

(a) The public health law is amended to add a new section (lawmakers here should include the specific title of the public health or health department law to be amended).

(b) "Hospital" shall mean (lawmakers here should consider whether to include only acute care hospitals or also free-standing outpatient surgical centers).

(c) "Hospital-acquired infection" shall mean, as defined by the federal Centers for Disease Control and Prevention (CDC), "any localized or systemic condition resulting from an adverse reaction to the presence of an infectious agent(s) or its toxin(s) that (a) occurs in a patient in a hospital, (b) and was found not to be present or incubating at the time of admission to the hospital, unless (c) the infection was related to a previous admission to the same hospital."

(d) "Risk adjustment" shall mean a statistical procedure for comparing patient outcomes, taking into account the differences in patient populations, including risk factors such as the number of patients on central line catheters, or the number of patients undergoing specific types of surgery, as a percentage of the overall number of patients treated. For purposes of this bill, risk adjustment shall duplicate the CDC's NNIS System surgical wound infection risk index or use the number of central-catheter days as a risk-adjustment factor for central line infections.

Section 2.

(a) Using established public health surveillance methods, each hospital shall maintain a program of identifying and tracking the following types of hospital-acquired infections for the purpose of reporting such data semi-annually to the state health department (lawmakers insert the appropriate state department

here): central line-associated, laboratory confirmed primary bloodstream infections contracted by intensive care unit patients, and surgical site infections.[62]

(b) The state health department (lawmakers insert the appropriate department name here) shall establish an advisory committee that includes recognized experts in the field of hospital-acquired infection, public reporting of hospital data, and health care quality management to establish data collection and analysis methodologies and risk adjustment procedures.

(c) The state health department (lawmakers insert the appropriate department name here) shall establish a state-wide database of all risk-adjusted, hospital-specific infection rates and make it available to the public on a website and in printed materials that can be used by consumers, purchasers of healthcare, and advocacy groups to compare the performance of individual hospitals, and the aggregate performance of hospitals in the state with those in other states and nationwide.

(d) The first year of data submission under this section shall be considered the "pilot phase" of the reporting system. The pilot phase is to ensure the completeness and accuracy of hospital reporting and the fairness and completeness of the state health department's report to the public. During this pilot phase, hospital identifiers shall be encrypted, the state health department (lawmakers insert proper department name here) shall provide each hospital with an encryption key for that hospital only, and no public hospital comparisons will be available. Sixty days after the end of the second year of data submission, the state health department (appropriate department name here) will provide its first report to the public with hospital-specific infection rates included.

(e) To ensure compliance with this law and the accuracy of self-reporting by the hospitals, the department shall establish an audit process. A civil penalty of $_____ shall be imposed on any hospital that fails to report on time, or is shown to substantially underreport infections, for each semi-annual reporting period.

(f) None of the data collected and reported under this law can be used in litigation against an individual hospital.

Appendix B

Society for Healthcare Epidemiologists of America (SHEA) Guideline for Preventing Nosocomial Transmission of Multidrug-Resistant Strains of *Staphylococcus aureus* and *Entrococcus*

■

Strength of Recommendations

Category Type	Category Subtype	Recommendation
I	A	Strongly recommended for implementation and strongly supported by well-designed experimental, clinical, or epidemiologic studies.
	B	Strongly recommended for implementation and supported by some experimental, clinical, or epidemiologic studies and a strong theoretical rationale.
	C	Required for implementation, as mandated by federal regulation, state regulation, or both or standard.
II		Suggested for implementation and supported by suggestive clinical or epidemiologic studies or a theoretical rationale.
No recommendation		Unresolved issue. Practices for which insufficient evidence or no consensus regarding efficacy exists.

Recommendations

I. Active Surveillance Cultures to Identify the Reservoir for Spread

1. Implement a program of active surveillance cultures and contact precautions to control the spread of epidemiologically significant antibiotic-resistant pathogens known to be spreading in the healthcare system via direct and indirect contact.(IA)29,30,43,45-47,49,57,96,99,102,106,119,138-147,149,171-173,176

2. Surveillance cultures are indicated at the time of hospital admission for patients at high risk for carriage of MRSA, VRE, or both. (IB)71,76,177,320,321

3. Periodic (eg, weekly) surveillance cultures are indicated for patients remaining in the hospital at high risk for carriage of MRSA, VRE, or both because of ward location, antibiotic therapy, underlying disease, duration of stay, or all four. (IA)30,57,102, 137,141,147-149,174,181

4. In facilities found to have a high prevalence on initial sampling, a facility-wide culture survey is indicated to identify all colonized patients and allow implementation of contact precautions. (IB)102,145,322

5. Because transmission occurs throughout the healthcare system, these measures should be implemented in all types of healthcare facilities throughout the system. (IB)119,161,176,182,323

6. The frequency of active surveillance cultures should be based on the prevalence of the pathogen and risk factors for colonization. For example, more frequent cultures are needed in a facility where 50% of all S. aureus isolates are MRSA than in one where less than 1% of all S. aureus isolates are MRSA. (IB)29,30,43,45-47,49,57,96,99, 102,106,119,138-147,149,171-173,176

7. The goal of this program should be to identify every colonized patient, so that all colonized patients are cared for in contact (or cohort) isolation to minimize spread to other patients. (IB)29,30,43,45-47,49,57,96,99,102,106,119, 138-147,149,171-173,176

8. Surveillance cultures for VRE should use stool samples or swab samples from the rectum or perirectal area. Polymerase chain reaction, culture with broth enhancement, and quantitative stool culture have each been more sensitive than directly plated rectal or perirectal swab cultures, but the latter have been associated with control of infections and can be recommended as effective and cost-effective until less costly methods of using the other procedures become available. (IB)99,102,106,137,149,181

9. VRE patients can be routinely cohorted with other VRE patients. (II)102,106,145

10. Surveillance cultures for MRSA should always include samples from the anterior vestibule of the nose. (IB)78,315,324

11. If present, areas of skin breakdown should also be sampled for MRSA. (IB)315,324

12. Throat cultures have been shown to detect S. aureus and MRSA with sensitivity equal to or greater than that of nasal cultures in multiple patient populations. If used, the throat swab can be plated onto the same agar as the nasal swab. This would enhance sensitivity without adding the cost of an extra culture. (IB)67,74

13. Perirectal–perineal cultures have been shown to detect MRSA with high sensitivity in certain patient populations, but the perirectal–perineal area should not be selected as the only site for culture. (IB)315,324,325

14. Patients colonized or infected with MRSA isolates can be cohorted with other MRSA patients. (II)30,43,45

15. Patients with MRSA isolates that are eradicable because of known susceptibility to multiple drugs useful for eradication (eg, mupirocin, rifampin, minocycline, trimethoprim-sulfamethoxazole, or all four) should not be cohorted with those with isolates resistant to these drugs, if eradication will be used as an adjunctive measure. (II)272

16. In certain settings, such as nursing homes and psychiatric wards, identification of colonized patients is important, but contact precautions may require modification allowing for social contact while limiting physical contact. (II)119,182,323

II. Hand Hygiene

1. HCWs should be encouraged to decontaminate (clean) their hands with an antiseptic-containing preparation before and after all patient contacts. (IA)121,326-330

2. Soap and water hand washing is required when hands are visibly dirty or visibly contaminated with blood, body fluids, or body substances. (IA)331

3. When hands are not visibly contaminated with blood, body fluids, or body substances, use of an alcohol hand rub containing an emollient should be encouraged. (IB)215,332-338

4. Lotion compatible with (ie, that does not inactivate) the antiseptic being used should be provided for use by HCWs. (II)339-343

5. Monitoring of hand hygiene compliance and feedback to HCWs should be done to motivate greater compliance. (IB)215,344

III. Barrier Precautions for Patients Known or Suspected to Be Colonized or Infected With Epidemiologically Important Antibiotic-Resistant Pathogens Such as MRSA or VRE

1. Gloves should always be worn to enter the room of a patient on contact precautions for colonization or infection with antibiotic-resistant pathogens such as MRSA, VRE, VISA, or VRSA. (IA)122,132,212,225-230

2. Gowns always should be worn as part of contact precautions for all patient and environmental contact with patients known to be colonized by antibiotic-resistant pathogens such as MRSA, VRE, VISA, or VRSA, except when there is no direct contact with patient or environmental surfaces. (IA)29,30,43,4547,49,57,59,96, 99,102,106,119,122,132,135,136,138-147,149,171-173,176,345

3. Universal gown and glove use or universal gloving alone also can be considered for adjunctive control on high-risk wards among patients with surveillance cultures pending. (IB)37,44,105,316-318,346

4. Masks should be worn as part of isolation precautions when entering the room of a patient colonized or infected with MRSA, VISA, or VRSA to decrease nasal acquisition by HCWs. (II)30,123,124,129,231,232

IV. Antibiotic Stewardship

1. Avoid inappropriate or excessive antibiotic prophylaxis and therapy. (IB)194,251,347

2. Ensure correct dosage and duration of antibiotic therapy. (IB)348-350

3. Restrict the use of vancomycin (if possible and appropriate for care of the individual patient being treated) to decrease the selective pressure favoring vancomycin resistance. (IB)115,269

4. To prevent the establishment of VRE intestinal colonization, decrease the use of agents with little or no activity against enterococci, such as third-generation and fourth-generation cephalosporins, in patients not known to be VRE colonized (if possible and appropriate for care of the individual patient being treated). (IB)115,267,268,351,352

5. To prevent persistent high-density VRE colonization, decrease the use of antianaerobic agents in patients with known VRE intestinal colonization (if possible and appropriate for care of the individual patient being treated). (II)102,113,159,270

6. To help prevent persistent carriage of MRSA, reduce the use of antibiotics and particularly fluoroquinolones to the minimum necessary in institutions where MRSA is endemic. (IB)251-258

7. Avoid therapy for colonization except when suppression or eradication of colonization is being attempted using an evidence-based approach for infection prevention, for psychological benefit of the patient, or for cost benefit (ie, by reducing the need for long-term isolation). (IB)5,272,285,286

V. Decolonization or Suppression of Colonized Patients

1. Consider MRSA decolonization therapy for both patients and HCWs as an adjunctive measure for controlling spread of MRSA in selected populations when appropriate. (IB)30,176,271,272,275-277

2. Any program of decolonization therapy should incorporate routine susceptibility testing, as selection of inactive agents is less likely to achieve eradication. (II)272,353

3. Widespread use, prolonged use, or both of decolonization therapy should be avoided, because this has been associated with the evolution and spread of antibiotic- resistant strains, undermining the effectiveness of the control effort. (IB)285,286

VI. Other

1. Educational programs should be conducted to ensure that HCWs understand why antibiotic-resistant pathogens are epidemiologically important, why prevention of spread is critically necessary for control, and which measures for preventing spread have proven effective. (IB)215,220

2. Ensure that the hospital method of disinfecting hospital surfaces for antibiotic-resistant organisms (especially VRE) has been shown to be adequate based on the results of studies of such methods in the healthcare setting or perform cultures in the room of discharged patients to confirm the adequacy of terminal cleaning. This requires review of the disinfectant agent, method and meticulousness of cleaning, dilutions, and contact time. (IB)102,161,169,294

3. Use the hospital computer system to record longterm isolation indicators for patients colonized with MRSA, VRE, VISA, or VRSA so that on return the computer will provide an alert regarding the need for isolation. (IB)297

4. Dedicate the use of noncritical patient-care equipment to a single patient (or cohort of patients infected or colonized with the pathogen requiring precautions) to avoid sharing between patients. If use of common equipment or items is unavoidable, then adequately clean and disinfect them before use for another patient. (IB)99,150-155,296

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Appendix C

The Institute for Healthcare Improvement's

100,000 Lives Campaign

The Institute for Healthcare Improvement aims to enlist thousands of hospitals across the country in its 100,000 Lives Campaign. The goal is to save 100,000 lives a year by reducing nosocomial infections and medical errors. Three of the six elements of that campaign call on hospitals to implement procedures proven effective in reducing surgical site infections, central line infections, and ventilator-associated pneumonia. The three elements are summarized here. For the complete "How-To-Guide" to preventing these infections, consult the Institute's Web site at: http://www.ihi.org/IHI/Programs/Campaign.

I. The Four Key Components of Preventing Ventilator-Associated Pneumonia:

1. Elevation of the head of the bed to between 30 and 45 degrees

2. Daily "sedation vacation" and daily assessment of the readiness to extubate

3. Peptic ulcer disease prophylaxis

4. Deep venous thrombosis prophylaxis (unless contraindicated)

II. The Four Key Components for Preventing Surgical Site Infections:

1. Appropriate use of antibiotics, including administering antibiotics within one hour before surgical incision, selecting an antibiotic consistent with national guidelines, and discontinuing prophylactic antibiotics within 24 hours after surgery

2. No shaving. Appropriate hair removal, if necessary, with clippers or a depilatory, but not with a razor

3. Monitor and maintain patient's glucose levels after surgery, particularly for cardiovascular surgery patients.

4. Keep patients' body temperatures at normal levels during and after surgery, especially colorectal surgery, with warmed IV fluids, warming blankets, hats and booties, and other means.

III. The Five Key Components of Preventing Catheter-Related Bloodstream Infections:

1. Appropriate hand hygiene, including cleaning hands before and after palpating catheter insertion sites, before and after inserting, replacing, accessing, repairing or dressing an intravascular catheter, whenever hands are soiled or contaminated, before and after removing gloves, etc.

2. Maximal barrier protection—meaning wearing a cap, mask, sterile gown, and gloves—when placing or assisting in the placement of a central line, and ensuring that the patient is covered head to toe in a sterile drape with one small opening for the site of insertion

3. Chlorhexidine skin antisepsis before insertion

4. Optimal catheter site selection, with the subclavian vein as the preferred site instead of the jugular or femoral sites for non-tunneled catheters in adult patients

5. Daily review of central line necessity to prevent unnecessary, prolonged use

About the Author

Dr. Betsy McCaughey is a health policy expert who has won many prizes for her writings, lectures widely, and appears frequently on television and radio. One year ago she launched a nationwide crusade to stop hospital infection deaths. She is founder and Chairman of the Committee to Reduce Infection Deaths (http://www.hospitalinfection.org).

Dr. McCaughey's research on how to prevent infection deaths has been featured on *Good Morning America*, the *CBS Morning Show*, ABC's *20/20,* and many other national programs. She has also appeared on Fox News Network's *Hannity & Colmes*, *The O'Reilly Factor,* CNN's *Talk Back Live*, and numerous radio programs.

Dr. McCaughey is the author of over one hundred scholarly or popular articles on health policy, which have appeared in *The New York Times, The Wall Street Journal, The New York Sun, New Republic, Policy Review, Forbes Magazine, New York Law Journal, Los Angeles Times, U.S. News & World Report,* and many other national publications.

She has produced prize-winning studies while at two think tanks, the Manhattan Institute (1993-94) and later the Hudson Institute (1999-2001). Dr. McCaughey's 1994 article on the dangers of the Clinton health plan received the National Magazine Award for the best article in the nation on public policy, the H. L. Mencken Award and other prizes. As Lt. Governor of New York State (1994-98), she proposed health legislation that became models for legislation in other states and in Congress. She has also been honored by the American Society of Anesthesiologists for her writings in that field.

Prior to entering the health policy field, Dr. McCaughey taught and wrote about U.S. constitutional history. She is the author of two books, *From Loyalist to Founding Father* (Columbia University Press), winner of the Bancroft Dissertation Award, and *Government by Choice* (Basic Books). She also chaired a national commission on reforming the electoral college in 1992, wrote its report, *Electing the President,* and testified before Congress on the subject. She has taught at Vassar College (1977-78) and Columbia University (1979-83), and in 1989, she served as Guest Curator for the Bicentennial Exhibit and related events at the New York Historical Society.

She is also the proud mother of three daughters: Amanda (Yale class of 2001), Caroline (Brown class of 2003) and Diana (Manhattanville class of 2006).

Endnotes

[1] Robert Weinstein, "Nosocomial Infection Update," *Journal of Emerging Infectious Diseases*, vol.4, no. 3. The infection rate, between 5 and 6 hospital-acquired infections per 100 admissions, has been steady for over the last 28 years, according to Weinstein's research.

[2] The Centers for Disease Control and Prevention previously estimated that 90,000 people die annually from infections they contract in U.S. hospitals, but the CDC press confirms that it is "working on a new number." *The Chicago Tribune* puts the death rate even higher, at 103,000. *The Chicago Tribune* examined hospital records, court records, and federal and state agency data pertaining to 5810 hospitals to reach its estimate. The CDC based their extrapolations on data voluntarily submitted by 315 U.S. hospitals: "How the Chicago Tribune Analyzed Infection Cases," *Chicago Tribune* (July 21,2002).

[3] The Centers for Disease Control and Prevention previously estimated that 90,000 people die annually from infections they contract in U.S. hospitals, but the CDC press confirms that it is "working on a new number." Interview with Nicole Coffin, spokesperson for the CDC, Infectious Diseases Division, October 10, 2002 (404-639-2888). *The Chicago Tribune* puts the death rate even higher, at 103,000. *The Chicago Tribune* examined hospital records, court records, and federal and state agency data pertaining to 5,810 hospitals to reach its estimate. The CDC based their extrapolations on data voluntarily submitted by 315 U.S. hospitals: "How the Chicago Tribune Analyzed Infection Cases," *Chicago Tribune* (July 21,2002). See also Carlo Marena, M.D., et.al., "Assessment of Handwashing Practices with Chemical and Microbiological Agents," *American Journal of Infection Control*, (October, 2002) vol. 30., no. 6.; Didier M. Pillet, M.D., "Improving Adherence to Hand Hygiene," Journal of Emerging Infectious Diseases vol. 4, no. 3.; Leela C. Blanbt, E. Louise Teare, William W. Williams, Jeremy D. Tuite, "Eradication of Methicillin Resistant Staphylococcus Aureus by 'ring fencing' of elective orthopedic beds," *British Medical Journal* vol. 329 (July 17, 2004).

[4] Institute of Medicine, Insuring America's Health (Washington, D.C., National Academies Press, 2004) 46.

[5] The Centers for Disease Control and Prevention previously estimated that 90,000 people die annually from infections they contract in U.S. hospitals, but the CDC press confirms that it is "working on a new number." Interview with Nicole Coffin, spokesperson for the CDC, Infectious Diseases Division, October 10, 2002 (404-639-2888). *The Chicago Tribune* puts the death rate even higher, at 103,000. *The Chicago Tribune* examined hospital records, court records, and federal and state agency data pertaining to 5,810 hospitals to reach its estimate. The CDC based their extrapolations on data voluntarily submitted by 315 U.S. hospitals: "How the Chicago Tribune Analyzed Infection Cases," *Chicago Tribune* (July 21,2002). See also Carlo Marena, M.D., et.al., "Assessment of Handwashing Practices with Chemical and Microbiological Agents," *American Journal of Infection Control,* (October, 2002) vol. 30., no. 6.

[6] See the "Cost of Hospital Infections" section of this booklet.

[7] Institute of Medicine, *Insuring America's Health* (Washington, D.C., National Academies Press, 2004) 46.

[8] Infectious Disease Society of America, *Bad Bugs, No Drugs,* (July, 2004) p. 3. Data are from the Centers for Disease Control and Prevention. National Nosocomial Infections Surveillance (NNIS) system report, data summary from January 1992 to June 2003, issued August 2003.

[9] "SHEA Guideline for Preventing Nosocomial Transmission of Multidrug-Resistant Strains of *Staphylococcus aureus* and *Enterococcus*," *Infection Control and Hospital Epidemiology,* 2003: vol. 24: pp. 362-386. See p.362.

[10] Infectious Disease Society of America, *Bad Bugs, No Drugs,* Table 3, p. 11. Data are drawn from the CDC National Nosocomial Infections Surveillance System.

[11] "SHEA Guideline for Preventing Nosocomial Transmission of Multidrug-Resistant Strains of Staphylococcus aureus and Enterococcus," *Infection Control and Hospital Epidemiology*. See p. 364.

[12] Cassandra D. Salgado and Barry M. Farr, "MRSA and VRE: Preventing Patient-to-Patient Spread," *Infections in Medicine* (2003) vol: 20; pp. 192-200; "Epidemiology of nosocomial infections caused by *methicillin-resistant Staphylococcus aureus*," *Annals of Internal Medicine* (1982), vol. 97: pp. 309-317.

[13] Pittsburgh Regional Healthcare Initiative, *PRHI in Progress: 2004 in Review* (January 2005) p. 5.

[14] Telephone interview with Dr. Carlene Muto, University of Pittsburgh Medical Center-Presbyterian Hospital, July 15, 2005 (412-629-2566).

[15] "Control of *vancomycin-resistant Enterococcus* in a region," *New England Journal of Medicine,* 2001:vol. 344: pp.1427-1433; also "MRSA and VRE: Preventing Patient-to-Patient Spread," *Infections in Medicine*, 2003: vol. 20: pp. 194-200.

[16] Hand Hygiene in Healthcare Settings Core, slide 3 of a slide presentation dated June 6, 2003, and currently available on the CDC Web site at http://cdc.gov/handhygiene/download/hand_hygiene_core.ppt; See also: Didier M. Pillet, M.D., "Improving Adherence to Hand Hygiene," *Journal of Emerging Infectious Diseases* vol. 4, no. 3.; Leela C. Blanbt, E. Louise Teare, William W. Williams, Jeremy D. Tuite, "Eradication of *Methicillin Resistant Staphylococcus Aureus* by 'ring fencing' of elective orthopedic beds," *British Medical Journal* vol. 329 (July 17, 2004).

[17] MRSA contaminates patient care rooms 69 percent to 73 percent of the time. "Environmental contamination due to methicilliin-resistant Staphylococcus aureus: possible infection control implications," *Infection Control and Hospital Epidemiology,* 1997: vol. 9, pp. 622-7.

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[19] Salgado and Farr, "MRSA and VRE," pp. 192-200

[20] *Ibid*.; See also: "Environmental contamination due to methicillin-resistant Staphylococcus aureus: possible infection control implications," *Infection Control and Hospital Epidemiology*)(199) v01.9: 622-627; "Isolation gowns prevent health care workers (HCWs) from contaminating their clothing, and possibly their hands with methicillin-resistant Staphylococcus aureus (MRSA) and resistant enterococci, Presented to the Eighth Annual Meeting of the Society for Healthcare Epidemiology of America , April 5-7, 1998, Orlando, Florida, Abstract No. S74:52, cited in "SHEA Guideline for Preventing Nosocomial Transmission of Multidrug–Resistant Strains of Staphylococcus aureus and Enterococcus," *Infection Control and Hospital Epidemiology* (May, 2003) vol. 24: JEAs.

[21] Separate discussions with two Mt. Sinai physicians: Dr. Jennifer Glueck, 212-410-4068, resident in OB/GYN, and Dr. Douglas Dietrich, Vice Chairman of the Department of Medicine at 212-241-7270.

[22] The American Medical Association recommends it. "MRSA and VRE: Preventing Patient to Patient Spread."

[23] Telephone interview with Dr. Carlene Muto, May 19, 2005 at 412-629-2566.

[24] Jernigan, J.A., Titus, M.G., Farr B.M., Groschel, D.H.M., Getchell-White, S.I., "Effectiveness of Contact Isolation during a Hospital Outbreak of Methicillin-Resistant Staphylococcus aureus," *American Journal of Epidemiology* (1996) vol. 146, p. 496-504. Cited in "SHEA Guideline for Preventing Nosocomial Transmission of Multidrug-Resistant Strains of Staphylococcus aureus and Enterococcus," footnote 181.

[25] Presentation by Dr. Richard Shannon, Chairman of the Department of Medicine, Allegheny Hospital at the March 11, 2005 Forum, slide no. 13, "The Compelling Case for Reducing Hospital Infection," Harvard Club of New York City.

[26] "Cost-Effective Eradication of an Outbreak of Methicillin-Resistant Staphylococcus aureus in a Community Teaching Hospital," *Infection Control and Hospital Epidemiology* (1988) vol: 9: pp. 255-260.

[27] "The Use of Economic Modeling to Determine the Hospital Costs Associated with Nosocomial Infections, " *Clinical Infectious Diseases* (2003) vol. 36: pp. 1424-1432. This study puts the average cost of hospital infection at $15,275. "A Systematic Audit of Economic Evidence Linking Nosocomial Infections and Infection Control Interventions, 1990-2000," *American Journal of Infection Control,*(2002), vol 30: pp. 145-52. This study

estimates the average cost of infection to be $13,973. Both studies look at incremental hospital costs only. The national cost was reached by multiplying 2 million infections by $15,000 per infection.

[28] "The Impact of Antimicrobial Resistance on Health and Economic Outcomes," *Clinical Infectious Diseases,* 2003: vol. 36: pp. 1433-1437. The investigators found that antibiotic resistance increases length of stay, mortality rates, and costs.

[29] Rebecca R. Roberts, R. Doublas Scott II, Ralph Cordell, Steven L. Solomon, Lynn Steele, Linda M. Kampe, William E. Trick, and Robert A. Weinstein, "The Use of Economic Modeling to Determine the Hospital Costs Associated with Nosocomial Infections," *Clinical Infectious Diseases* (2003) vol. 36: 1424-1432. The figure $15,275 refers to excess hospital costs, not other patient care costs or economic losses incurred by the patient as a result of prolonged illness. The figure $15,275 is similar to findings from other analyses of average hospital care costs due to infection. MedMined, Inc. analyzed the costs of infection using data from 50 hospital clients. It found that patients contracting infections in the hospital stayed an average of eight days extra and incurred $14,000 in additional hospital costs. See: John Morrissey, "Debugging Hospitals," *Modern Healthcare* (April 26, 2004): 30.

[30] Nancy M. Kane, Richard B. Siegrist, Jr., "Understanding Rising Hospital Inpatient Costs: Key Components of Cost and the Impact of Poor Quality," (August 12, 2002), unpublished manuscript. The findings are based on Medicare Cost Reports (1999-2000) and Uniform Hospital Discharge Data Set (2000) for all acute general hospitals in ten states: Massachusetts, New York, Virginia, Florida, Texas, Illinois, Iowa, California, Washington, and Colorado. Kane and Siegrist are adjunct faculty at the Harvard School of Public Health.

[31] Ibid.

[32] Institute for Healthcare Improvement, 100,000 Lives Campaign, How-to-Guide: Prevent Ventilator-Associated Pneumonia at www.Ihi/org/IHI/Programs/Campaign.

[33] Pittsburgh Regional Healthcare Initiative, "PRHI Executive Summary,"(January, 2005). Dr. Richard Shannon found that each central line-associated bloodstream infection added $30,277 in variable costs during the hospital stay, for patients in the medical intensive care unit and coronary care unit at Allegheny Hospital, Pittsburgh.

[34] Gary A. Noskin; Robert J. Rubin; Jerome J. Schentag; Jan Kluytmans; Edwin C. Hedblom; Maartje Smulders; Elizabeth Lapetina; Eric Gemmen, "The Burden of *Staphylococcus aureus* Infections on Hospitals in the United States," *Archives of Internal Medicine* vol. 165 (2005): 1756-1761.

[35] Twenty-one states require hospitals to report "adverse events" including these serious infections. The best source for these state requirements is the National Academy for State Health Policy, Portland, Maine. At www.nashp.org

[36] The CDC's National Nosocomial Infections Surveillance System, including the guarantees of confidentiality to hospitals, is described at www.cdc.gov/ncidod/hip/SURVEILL/NNIS.HTM

[37] Mark Chassin, "Achieving and Sustaining Improved Quality: Lessons from New York State and Cardiac Surgery," *Health Affairs,* (July/August 2002) vol. 21, no. 4, 40-51.

[38] Ibid.

[39] Judith H. Hibbard, Jean Stockard, Martin Tusler, "Does Publicizing Hospital Performance Stimulate Quality Improvement Efforts," *Health Affairs* (March/ April 2003), vol. 22, no. 2, 84-94.

[40] For more information on the NNIS's methodology, consult: TC Horan & R. Gaynes, "Surveillance of nosocomial infections," *Hospital Epidemiology and Infection Control*, ed. CG. Mayhall (Philiadelphia: Lippincott, Williams & Wilkins, 2004) 1659-1702.

[41] J. Steinhauer, "Hospitals in City Faulted for Failing to Report Many Errors," *New York Times* (February 13, 2001),B1; see also Mark Chassin, "The Wrong Patient," *Annals of Internal Medicine* .(June 4, 2002) vol. 136, no. 11 836-831.

[42] "Data Show Scourge of Hospital Infections," *Washington Post,* (July 13, 2005); "Hospitals Battling Infections," *Washington Post*, (July 14, 2005).

[43] Telephone interview with Dr. Frank Lowey, Professor of Microbiology, Columbia College of Physicians and Surgeons, July 15, 2005.

[44] The CDC and the American Association of Medical Colleges are working on a Web-based curriculum that focuses largely on this issue.

[45] Based on an interview with Dr. Carlene Muto by telephone, July 15, 2005.

[46] Dr. Richard P. Shannon, PowerPoint presentations, December 7, 2004 and March 11, 2005, Harvard Club of New York City; March 11, 2005, Harvard Club of New York City; "PRHI in Progress: 2004 in Review," published by the Pittsburgh Regional Healthcare Initiative.

[47] Dr. Richard Shannon, PowerPoint presentations, December 7, 2004 and March 11, 2005.

[48] Ibid.

[49] "Reducing hospital-acquired infections," Ivanhoe Broadcast News, (9-25-2004)at www.news8austin.com; "Simple Intervention Nearly Eliminates Catheter-related Bloodstream Infections," (12-09-2004) at www.sciencedaily.com

[50] Joe Fahy, "Hospitals Able to Cut Some Kinds of Infections," *Pittsburgh Post-Gazette*, July 15, 2005, A1.

[51] Based on an interview with Dr. Barry Farr by telephone, July 21, 2005.

[52] "Impact of Ring Wearing on Hand Contamination and Comparison of Hand Hygiene Agents in a Hospital," *Clinical Infectious Diseases* 36 (2003): 1383-1390.

[53] Nearly three quarters of patients' rooms are contaminated with MRSA, and 69 percent with VRE, studies show. In one study, 42 percent of gloves worn by hospital personnel who had no direct patient contact but who touched contaminated surfaces became contaminated. "Environmental contamination due to *methicillin-resistant Staphylococcus aureus*: possible infection control implications," *Infection Control and Hospital Epidemiology* 9 (1997): 622-627. A Consensus Statement by a multidisciplinary group of experts asked by the American Medical Association to provide guidelines for infection control cautions that "In some cases caregivers actually go from patient to patient without changing their gloves, apparently confusing self-protection" with patient protection. "Strategies to Prevent and Control the Emergence and Spread of Antimicrobial-Resistant Microorganism in Hospitals," *Journal of the American Medical Association* 275 (1996): 234-240.

[54] Routine disinfection of stethoscopes between patients is recommended by the American Medical Association. "MRSA and VRE: Preventing Patient-to-Patient Spread," *Infections in Medicine* 20 (2003):194-200; "The Stethoscope: a powerful source of nosocomial infection?" *Archives of Internal Medicine,*157 (1997): 786-90; "Contamination of gowns, gloves, and stethoscopes with vancomycin-resistant Enterococci," *Infection Control and Hospital Epidemiology* 9 (2001): 560-564; "Recovery of vancomycin-resistant Enterococci on fingertips and environmental surfaces," *Infection Control and Hospital Epidemiology* 12 (1996): 770-772.

[55] "Eradication of *methicillin-resistant Staphylococcus aureus* by 'ring fencing' of elective orthopaedic beds," *British Medical Journal*.p. 149-51. Visitors who sit on a chair or lean on a cabinet, then s it on the bed are transferring bacteria to the patient's bedclothes. "MRSA and VRE," *Infections in Medicine*, p. 194-200.

[56] The Institute for Healthcare Improvement guidelines for improving infection prevention state that: "Administration of prophylactic antibiotics beginning 0 to 1 hour prior to surgical incision decreases the risk of surgical infection. *www.ini.org/IHI/Topics/PatientSafety/SurgicalSiteInfections/ImprovementStories* accessed 10-14-02.

[57] *Ibid.,* the Institute for Healthcare Improvement Guidelines for improving infection state that "surgical patients with core temperatures greater than 36 degrees C./ 98.6 degrees F are less likely to get an infection."

[58] *Ibid.,* the Institute for Healthcare Improvement states that "clipping instead of shaving results in decreased infection rates," and recommends that patients be told "not to shave the surgical site for 72 hours prior to surgery."

[59] "Operating Room Environment" *Clinical Orthopaedics and Related Research* 369 (1999): 103-109.

[60] Pittsburgh Regional Healthcare Initiative, "PRHIExecutive Summary," (June, 2005).

[61] Urinary tract infections are the most common hospital-acquired infections. Limiting their use and duration reduces risk of infection. "Catheter Associated Urinary Tract Infections in Neurology and Neurosurgical Units," *Journal of Infection* 44 (2002): 171-175.

[62] These are the types of infections that the Centers for Disease Control and Prevention recommend in a public reporting system. However, lawmakers could consider adding ventilator-related pneumonia, but these are more difficult to detect accurately, or urinary tract infections, which are common but less costly and deadly than other infections.