

MRSA in Boston Area Hospitals

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MRSA (methicillin-resistant staphylococcus aureus) is an antibiotic-resistant bacterium that is a leading cause of hospital-acquired infection. Staphylococcus aureus usually lives symbiotically on the skin and does not cause infection until it manages to pass the body's protective barriers. Its presence in hospitals is due in part to the widespread use of antibiotics and the common surgical methods that permit the introduction of the skin flora into the body.

Though many hospitals have developed protocol to prevent MRSA infection, the specific practices vary widely. This paper addresses four spheres of influence on Boston-area hospitals by presenting case studies of Brigham and Women's Hospital, St. Elizabeth's Medical Center, Children's Hospital Boston, New England Baptist Medical Center and Tufts Medical Center. The four spheres of influence are state legislation, national organizations, media attention and societal pressure and the demographics of the specific hospital. Though the five hospitals have employed varied protocols, their decision-making process clearly reflects the aforementioned spheres of influence. The authors were able to hypothesize why each hospital was influenced the way it was, leading to the implementation of their MRSA prevention program.

INTRODUCTION

Today, medical and public health professionals are our greatest protection against epidemics; however, the tactics they use to fight epidemics are influenced by factors greater than the medical community itself. Hospitals in the Boston area, and throughout the world, are faced with an ongoing epidemic of methicillin-resistant *Staphylococcus aureus* (MRSA), an antibiotic-resistant bacterium. In an effort to stop the transmission of MRSA, many hospitals have implemented precise protocols that share certain common factors but are tailored to the specific needs of each institution.

In the 20th century one of the most powerful tools utilized by medical professionals was the antibiotic. One of the biggest challenges facing the 21st century medical community has been the emergence of organisms resistant to our greatest weapon. Chief among these pathogenic organisms is *Staphylococcus aureus*, which lives symbiotically on the skin of more than 20% of the population, but can cause infection if it manages to pass our protective barrier.¹ The structure of *Staphylococcus aureus* made it a prime target for antibiotics, specifically penicillin. Due to random mutations and the selective pressure from widespread penicillin use, *Staphylococcus aureus* evolved to be significantly resistant to penicillin by the 1940s.² In 1959, researchers invented methicillin, an antibiotic designed to target the penicillin resistant strains of *Staphylococcus aureus*.³ The same sequence of events that took place in the 1940s has created methicillin resistant *Staphylococcus aureus* (MRSA) and the medical profession is, once again, looking for a way to combat an epidemic of antibiotic resistant bacterial infections.

Since antibiotic use was common, hospitals were the perfect setting for the evolution from *Staphylococcus aureus* to

MRSA. MRSA is now a small, albeit precarious, part of ordinary hospital life. We focused our research on the techniques developed by different hospitals in the Boston area for tackling the menace of hospital acquired MRSA (HA-MRSA). We found that the measures taken to fight HA-MRSA epidemic are varied among hospitals, but are all shaped by four concentric spheres of influence.

MEDIA ATTENTION AND SOCIETAL PRESSURE

The broadest sphere of influence encompasses society and the media. Not only does the media provide limited information about MRSA to the public, but also serves as a voice for society's concerns. Though HA-MRSA was general knowledge for people working in hospitals, the emergence of community acquired MRSA and the subsequent media attention brought antibiotic-resistant bacteria to the forefront of society's collective consciousness. When the media supplies incomplete information to the often scientifically uninformed public, as was the case with MRSA, confusion results. A common misconception generated by increased media attention is that there is no difference

between the manageable HA-MRSA and the more virulent CA-MRSA. An overabundance of sensationalized stories about MRSA and this misconception have created an indiscriminate fear of MRSA, which is apparent in the increase in investigative media attention. More news outlets are responding to the public's interest in MRSA and formulate stories that inspect situations in local hospitals. These intrusions have increased pressure, on the medical community, from society (expressed,

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in this case, through the media). Boston is no exception as The Boston Globe's front-page article revealing the rates of hospital-acquired infections in local hospitals evidences.⁴ The press attention given to specific MRSA rates is an example of the media's ability to bring society's concerns to the attention of those in the medical community as well as a dispenser of information.

NATIONAL ORGANIZATIONS

The next level of influence affecting Boston area hospitals is comprised of organizations that operate at a national level such as the Centers for Disease Control and Prevention (CDC), a federal agency dedicated to protecting the health of people and communities.⁵ The CDC publishes guidelines and recommends practices health care facilities may use to treat and prevent a plethora of organisms and diseases. The recommendations most applicable to the control of MRSA feature a collection of isolation techniques called "contact precautions."⁶ Though CDC recommendations are not mandatory, many hospitals use them as guidelines in developing their specific infection-control (and MRSA control) protocols. It is due to the influence of the CDC and other national players that there are many similarities among the protocols in hospitals throughout the country.

Another of the aforementioned national players is the Joint Commission, a national non-profit organization that grants accreditations and certifications to hospitals and other health care facilities based on a variety of factors designed to indicate a certain quality of care.⁷ Among these factors is the effectiveness of their infection control protocols. Hospitals strive to obtain and maintain accreditation for the enhancement it affords their reputations. American society generally has confidence in the CDC and is often swayed by terms such as "Joint Commission Accreditations," because of the implication of legitimacy. An institution is more likely to be perceived positively when it can explain that its protocols are based on standards set by nationally recognized organizations.

Finally, Medicare has added a new dimension to federal influence by no longer reimbursing institutions for certain hospital-acquired infections such as knee, hip and central intravenous line infections (all of which can be caused by MRSA.) This financial pressure from "third party payers" has prompted a more intense effort by hospitals to prevent these infections.⁸

STATE LEGISLATION

In 2005, Illinois passed legislation requiring hospitals to screen all patients for MRSA upon admission.⁹ This example of

government intervention is more extreme than the measures taken in Massachusetts. Massachusetts state law requires that only infections and not colonizations of MRSA be reported to the state.¹⁰ Though Massachusetts does not currently require extensive testing, some in the health care community fear that legislators in the Commonwealth will soon follow Illinois's

example. There is a constant struggle over the distribution of a hospital's limited resources and health professionals are hesitant to fund a comprehensive, active screening program for a hazard that they consider to be under control.¹¹ Another consequence of mandatory testing is an increase in the amount of information available to the already apprehensive public and the ever-eager media watchdog.

BOSTON AREA HOSPITALS

The CDC's inability to enforce, the state's lack of specificity, and society's lack of clout have allowed hospitals to develop unique systems for dealing with MRSA. Case studies of five Boston area hospitals highlighted these differences.

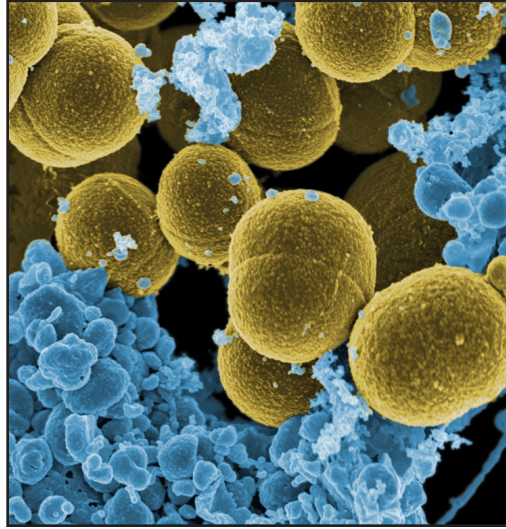
TUFTS MEDICAL CENTER

Tufts Medical Center is a 450-bed research hospital for adults and children in downtown Boston. Dr. Shira Doron, an Infectious Disease Attending Physician and the hospital's Antibiotic Steward, described the hospital's protocol as follows: Contact precautions are employed when a patient who is known to have MRSA is admitted. TMC has no universal screening program for inpatients but they do screen patients admitted to the open Neonatal Intensive Care Unit (NICU). They screen these infants upon admission and then weekly thereafter. Dr. Doron attributed TMC's low MRSA rates to a successful hand hygiene campaign, a visible commitment from top administrators, the use of marketing company, and the direct involvement of department chiefs in the enforcement process.²

The contact precautions were drawn from CDC recommendations, but the nature of TMC's NICU required the implementation of additional safeguards to protect the infected patient and the other infants in the unit.

ST. ELIZABETH'S MEDICAL CENTER

This 300-bed Tufts Medical School-affiliated teaching hospital, located in Brighton, offers a full range of medical specialties, but has been recognized for its cardiovascular prowess. Dr. Vito Iacoviello, Chief of Infectious Disease, explained that patients known to be infected or colonized with MRSA are placed in a private room on contact precautions when admitted to the hospital. Iacoviello also emphasized general infection prevention through washing hands with soap and



S. aureus bacteria escaping destruction by human white blood cells. Image courtesy of <http://www.flickr.com/photos/microbeworld/5957846000/>.

water or using an alcohol based hand sanitizer before and after each patient interaction. Currently, St. Elizabeth's only employs "passive" screening, but in the event that a specific unit shows more MRSA than expected, the protocol calls for "active" screening and isolation of all patients until a negative test rules MRSA out.⁸

This reactive protocol was chosen because St. Elizabeth has a low incidence of MRSA and the contact precautions were taken from CDC recommendations.

NEW ENGLAND BAPTIST MEDICAL CENTER

This 150-bed leader in orthopedic surgery is located in the Mission Hill neighborhood of Boston. Maureen Spencer, the Manager of Infection Control, described New England Baptist Medical Center's (NEBMC) MRSA control protocol as "intense." She explained that all people scheduled for inpatient surgery are screened for MRSA and *Staphylococcus aureus*, via nasal swab, two weeks prior to their anticipated date of admission. If a patient is colonized with MRSA, they are placed on a "decolonization" regimen, which includes anti-bacterial shower product and nasal spray, which are both used at home. Just before surgery, the patient is screened again; a positive test prompts contact precautions and a specifically tailored prophylactic (vancomycin); a negative test still provokes the use of vancomycin. Patients admitted from the emergency room are tested with a nasal swab and those with a positive test result are placed on contact precautions. NEBMC has also taken advantage of innovative technologies including anti-bacterial sutures, equipment that provides rapid MRSA test results, and washcloths impregnated with an anti-bacterial product. Finally, NEBMC has also implemented a comprehensive hand hygiene campaign that includes bi-monthly "themed" programs to continually remind staff of the importance of hand hygiene.¹²

Staphylococcus aureus is the number one cause of surgical site infections and NEBMC's preeminence as a center for orthopedic surgery makes MRSA prevention particularly important. A rash of blood stream infections that appeared to be caused by MRSA in Fall 2005 prompted the administration to support the infection control department as they increased their efforts to control MRSA. This new financial support for MRSA control facilitated the establishment of decolonization procedures and the introduction of innovative technologies.

CHILDREN'S HOSPITAL BOSTON

This 400-bed hospital in the Longwood Medical Area is one of the largest children's hospitals in the country and a forerunner in pediatric centered research. Gail Potter-Bynoe RN, of the infection control department explained that only children admitted to one of the hospitals intensive care units are screened upon admission. The patient is then

screened weekly and put on contact precautions until they have been cleared by three negative tests in the area of initial infection.¹¹

Once again, Children's Hospital follows CDC recommendations for contact precautions. However, they have targeted their program specifically at ICUs (home to the most compromised patients) because more healthy children are not as likely as adults to be colonized or infected with HA-MRSA.

BRIGHAM AND WOMEN'S HOSPITAL

Also located in the Longwood Medical Area, this 777-bed hospital is one of the nation's preeminent transplant centers as well as a leader in women's health, hematology, and cancer care. Margaret Bikowski, an infection control practitioner, described BWH's "admission surveillance system." A patient is tested via nasal swab upon admission to an ICU or the Hematology/Oncology service and weekly thereafter. A computer program sends notification of a positive test result

from BWH's laboratory to the unit where the patient is housed. The patient is then placed in a private room on contact precautions. If there are more than three positive cultures (from 3 different patients) within a single unit, the entire unit is placed on "glove precautions" for two

weeks. BWH also pays particular attention to hand hygiene, surface cleaning and environmental sanitation.⁹

Like many other Boston area hospitals, BWH follows CDC recommendations for contact precautions. The size of BWH necessitated the design of a computerized system that not only tracks general trends, but trends within specific units as well, in order to target problem areas with more stringent preventive measures.

CONCLUSIONS

The four spheres of influence acting on Boston area health professionals molded the protocols selected in each specific scenario. The media serves a dual purpose by providing information to the public about MRSA and serving as gauge of the public's concern. An increase in coverage is an indicator to hospitals that public concern has shifted to MRSA. Hospitals are affected further when this public concern manifests itself in patients' reactions to MRSA diagnoses.²

Though the CDC, Joint Commission, and Medicare have no avenue for enforcement, the effects of their actions are clearly visible in hospital protocols. The trust placed by the public in the CDC and the Joint Commission lends their recommendations credence, which makes them more valuable to hospitals. Similarly, the financial pressure from Medicare acts as a driving force behind expanded MRSA control practices. Though none of these actors have the ability to force hospitals to action, their influence is unquestionable.

The threat of mandatory testing from state legislation

"*Staphylococcus aureus* is the number one cause of surgical site infections..."

encourages hospitals to keep rates low and below the public radar, and consequently, keep infection control reform off legislators' platforms.

The specific characteristics, including size and clinical expertise, of Boston area hospitals are the most influential factors in shaping hospital protocols. A larger hospital like BWH requires a thorough surveillance system in order to find and target the locus of infection within the larger hospital. Smaller hospitals require less technologically advanced surveillance systems because there are simply not as many patients to track. The protocols of both New England Baptist Medical Center and Children's Hospital Boston reflect their clinical expertise.

Children present a particular challenge to MRSA control systems because it is difficult to restrict their mobility and their inability to control their excretions makes their confinement all the more important.¹¹ Though children are less prone to serious MRSA infections, the staff in the ICUs of Children's Hospital Boston chose to actively screen admissions without request from the infection control department, though many adult hospitals don't require such testing. This may be due to the extra scrutiny society places on the care of our children.

The fact that patients seek out NEBMC for orthopedic surgery makes the post-surgery infection rate particularly relevant. While NEBMC's preeminence as an orthopedic center makes MRSA control important, its success with MRSA control makes it an even better option. This reciprocal relationship has led to exceptionally low rates and dedication from all levels of hospital leadership at NEMBC.

As community acquired MRSA gains traction in the Boston area, medical professionals are likely to continue being swayed by the same four spheres of influence that have shaped the response to hospital acquired MRSA. Hospitals have developed effective ways of dealing with HA-MRSA, but the evolution of bacteria will continue to challenge even medicine's most innovative protections.

REFERENCES

1. Stöppler, MD, Melissa C. "Staph Infection (Staphylococcus Aureus) Symptoms, Causes and Treatment on MedicineNet.com." Web. 05 Dec. 2009. <http://www.medicinenet.com/staph_infection/article.htm>.
2. Doron, Shira. "MRSA In the Boston Area - Tufts Medical Center." Telephone interview. 18 Nov. 2009.
3. Aichinger, Christian; Reiser, Astrid; Uhl, James R.; Cockerill, Franklin R.; 2008 Composition and Methods for Detecting Methicillin-Resistant S. Aureus. United States. 20080220428. <http://www.freepatentsonline.com/y2008/0220428.html>.
4. Kowalczyk, Liz. "Hospitals make headway on patient infections." Boston Globe 22 Nov. 2009, Boston Sunday Globe ed.: A1+. Print.
5. "CDC - About CDC Home Page." Centers for Disease Control and Prevention. Web. 05 Dec. 2009. <<http://www.cdc.gov/about/>>.
6. Siegel JD, Rhinehart E, Jackson M, Chiarello L, and the Healthcare Infection Control Practices Advisory Committee, 2007 Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings. <http://www.cdc.gov/ncidod/dhqp/pdf/isolation2007.pdf>.
7. "Infection Prevention and Control - Joint Commission International." Language Select - Joint Commission International. Web. 05 Dec. 2009. <<http://www.jointcommissioninternational.org/Quality-and-safety-risk-areas/Infection-Prevention-and-Control/>>.
8. Iacoviello, Vito. "MRSA In the Boston Area - St. Elizabeth's Hospital." Telephone interview. 19 Nov. 2009.
9. Bikowski, Margaret V. "MRSA In the Boston Area." E-mail interview. 25 Nov. 2009.
10. "CA-MRSA: Public FAQs | CDC Infection Control in Healthcare." Centers for Disease Control and Prevention. Web. 05 Dec. 2009. <http://www.cdc.gov/ncidod/dhqp/ar_mrsa_ca_public.html#4>.
11. Commonwealth of Massachusetts. Department of Public Health. Bureau of Communicable Disease Control. Communicable and other infectious diseases reportable in Massachusetts by healthcare providers. Massachusetts Department of Public Health, July 2008. Web. 5 Dec. 2009. <http://www.mass.gov/?pageID=eohhs2terminal&L=5&L0=Home&L1=Provider&L2=Reporting+to+the+State&L3=Diseases+%26+Conditions&L4=Reportable+Diseases%2c+Surveillance+and+Isolation+%26+Quarantine+Requirements&sid=Eeohhs2&b=terminalcontent&f=dph_cdc_p_reporting_surveillance&csid=Eeohhs2>.

For more Information on this Topic:

- Daum, M.D., C.M., Robert S. "Skin and Soft-Tissue Infections Caused by Methicillin-Resistant Staphylococcus aureus." *New England Journal of Medicine* 357.4 (2007): 380-89. Print.
- Ou, Tai-Li. "Bactericide composition - Patent application - kills Staphylococcus aureus Escherichia coli Methicillin-resistant Staphylococcus aureus and Propionibacterium acnes and." Internet FAQ Archives - Online Education. Web. 05 Dec. 2009. <<http://www.faqs.org/patents/app/20090253785>>.
- United States of America. Centers for Disease Control and Prevention. Healthcare Infection Control Practices Advisory Committee. 2007 Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings. By Jane D. Siegel, MD, Emily Rhinehardt, RN MPH, CIC, Linda Chiarello, RN, MS, and Marguerite Jackson, PhD. CDC. Web. 5 Dec. 2009. <<http://www.cdc.gov/ncidod/dhqp/pdf/guidelines/Isolation2007.pdf>>.