Volume 93 No. 9 September 2010

Medicine & Health
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# Healthcare-Associated Infections

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*Cover:* "Caduceus," by Gil Paradis, a long-time resident of Rhode Island who has drawn, painted and written for many years. "The Caduceus was created as an alternative to the slick symmetry usually depicted in caduceus. The snakes are imperfectly twined and flawed in appearance. This is the human element of medicine." E-mail: gilparadis@hotmail.com

**Medicine & Health**
# RHODE ISLAND

VOLUME 93 NO. 8 September 2010

PUBLICATION OF THE RHODE ISLAND MEDICAL SOCIETY

## COMMENTARIES



## CONTRIBUTIONS

**Special Issue: Healthcare-Associated Infections**
**Guest Editors: Rosa R. Baier, MPH, and Stefan Gravenstein, MD, MPH**



## COLUMNS



***Medicine and Health/Rhode Island*** *(USPS 464-820), a monthly publication, is owned and published by the Rhode Island Medical Society, 235 Promenade St., Suite 500, Providence, RI 02908, Phone: (401) 331-3207. Single copies $5.00, individual subscriptions $50.00 per year, and $100 per year for institutional subscriptions. Published articles represent opinions of the authors and do not necessarily reflect the official policy of the Rhode Island Medical Society, unless clearly specified. Advertisements do not imply sponsorship or endorsement by the Rhode Island Medical Society. Periodicals postage paid at Providence, Rhode Island. ISSN 1086-5462. POSTMASTER: Send address changes to Medicine and Health/Rhode Island, 235 Promenade St., Suite 500, Providence, RI 02908. Classified Information: Cheryl Turcotte/Rhode Island Medical Society, phone: (401) 331-3207, fax: (401) 751-8050, e-mail: cturcotte@rimed.org. Production/Layout Design: John Teehan, e-mail: jdteehan@sff.net.*

**Note:** *Medicine & Health/Rhode Island* appears on www.rimed.org, under Publications.

# Commentaries

## The Admiral and the General

**The Admiral and The General never met,** nor could they. The Admiral was really a Vice Admiral and the General wasn't a person.

I was a medical intern at Mt Sinai Hospital in Manhattan. I spent my first few months on the ward service, taking care of "average" people, "regular citizens" with Blue Cross, or poor people who had Medicaid or were uninsured, but Mt Sinai also cared for the New York City elite, rich, famous, celebrities; and when I moved from the ward service to the "semi private" service, which was for wealthy patients who were ill, in contrast to the private service, which was for wealthy patients who were not ill enough to have to suffer the inconveniences of housestaff care, I expected to meet an occasional celebrity. In this context I was reviewing the charts of my new patients, and I asked a fellow intern, who had been and was staying on the service, about Mr. Smith. "Oh, you mean the Vice Admiral?" " I don't' know. I'm just picking him up. Was he a vice admiral?" "He's still active. He's a vice admiral in the Starfleet Command." Mr. Smith was very demented and unable to distinguish one galaxy from another.

The General is a place. Probably hallowed by some readers of this column, but probably not by most. Several years ago I worked with someone who, at conferences, would rarely refrain from, "at the General we did…." I was peeved. Occasionally I'd hear a reference to some other hallowed institution. "At Sloan-Kettering…," "at The Mayo…." The references to "The General" had irritated me. I did not train there and at the time I trained, we had thought their neurology program quite good, almost at our own level, but not quite, so that hearing references to that place as if it were the Mecca of neurology, was jarring, and, to be honest, a little upsetting since it suggested that this person considered it the topmost point in the pyramid, whereas my colleagues and I did not. In fact, in those days, there was one top place, and it was at Queen's Square, in London. We thought we were the next best place. I guess that a lot of places thought they were the next best place.

I still hear, from time to time, reverential references to these places in local conferences. Doctors sometimes cite their experiences with the famous, as well. I have come to feel a bit sorry for my colleagues who feel the need to toss out the names of distant colleagues, usually on a first name basis, and places they've been. "When I was at Mecca we did it this way." "Jim Famous used to say…" I'm not sure if this is meant to convey the feeling that the rest of us are lucky to have any acolyte of those programs, one step closer to heaven than the rest of us, or is meant to say that the person is so unsure of himself that he wants everyone to know that his training was top notch so that what he says must be important.

I think these references are different from those referring to "the days of the giants" I can't recall my colleagues talking about bygone days in fond terms. When my physician-daughter complains about her night on call, I never talk about what nights on call used to be like. We often marvel at the differences in decision making now compared to the old days. "What did the CAT scan show," instead of, "how did you make the decision to do….?" "So and so used to teach that…" but modern imaging or clinical trials have dispelled those theories. Time marches on, and, hopefully wisdom accrues.

I don't think it's wrong to quote the teachings of famous experts, or to describe a standardized approach taken at a distinguished center. The irritant lies in how that information is conveyed, and whether the intent is to convey clinically relevant information or to impress the listener.

The Admiral wasn't a real person and The General was neither a person nor a real place. Both represent a state of mind, in the former case a deteriorated state, a display of the force of entropy slouching towards chaos. Although I used to find references to "the General," "The Mayo", and other famous places annoying, I now find them sad. They represent an inability of speakers to separate from their last place of stature. Perhaps that's why they are annoying, that they talk as if they are now at a lesser place, and since you're there listening to them, you, too, are at a lesser place. They feel the need to cling to a reputation that they feel defines them, like some old man saying, "when I played for the Yankees." They have failed to move on because they feel they have actually failed, because, for some reason, they did move on, unable to take the road not taken.

**– Joseph H. Friedman, MD**

### Disclosure of Financial Interests

Joseph Friedman, MD, and spouse/significant other. Consultant: Acadia Pharmacy, Ovation, Transoral; Grant Research Support: Cephalon, Teva, Novartis, Boehringer-Ingelheim, Sepracor, Glaxo; Speakers' Bureau: Astra Zeneca, Teva, Novartis, Boehringer-Ingelheim, GlaxoAcadia, Sepracor, Glaxo Smith Kline, Neurogen, and EMD Serono.

Conflicts: In addition to the potential conflicts posed by my ties to industry that are listed, during the years 2001-2009 I was a paid consultant for: Eli Lilly, Bristol Myers Squibb, Janssen, Ovation, Pfizer, makers of each of the atypicals in use or being tested.

# Blackwater Fever: Divine Retribution or Genetic Happenstance?

**Imagine a remote tribe, say in sub-Saharan Africa, 700 years** ago. Its population of about 4,000 survives on a rice-based, agrarian economy. Their excess harvests are periodically traded with neighboring clans to augment the variety of their diet and to provide additional household needs. Other than rare exogamous marriages, there is virtually no immigration or emigration; hence the tribal population, except for intervals of inter-tribal warfare, gradually increases as the yearly births generally outnumber the deaths.

What medical problems might this tribe encounter? As with any sub-Saharan community, they will certainly be burdened by a full range of parasitic diseases generally insect-borne. Most of the residents will have been beset with malaria, as well as a variety of parasitic worms, and, from childhood, a host of other parasitic afflictions.

Survival was necessarily precarious, with high mortality rates particularly in childhood; but over the many generations, certain members of the tribe, endowed with variant genetic traits, overcame diseases such as malaria; they did not avoid these pestilences but rather, through genetically-enhanced resistance, managed to survive in an unremittingly hostile environment. Thus, generation by generation – empowered by the remorseless darwinian axiom that proclaims survival be granted to the fittest – an increasing number of the tribal citizenry became endowed with those inheritable traits that increased systemic resistance to certain diseases.

These genetic traits did not prevent these diseases; they merely converted them from an acute, often lethal infection, to milder, lingering disorders.

The African continent, however, could not quell the interest or avarice of those living to its north or northeast. Arabic trading posts were established along the African east coast by the 13th Century. And Dar es Salaam, now a thriving city of some 2.5 million Tanzanians, was already a commercial site over eight centuries ago. fostering limited trade with the African interior including slavery. By 1415 the Portuguese had established a small European foothold in northern Africa. And by 1434 Portuguese mariners had reached Cape Bojador (latitude 26 degrees north) and by 1441 had begun to capture Africans for slavery. In 1494, two years after Columbus's initial voyage to the West, Spain and Portugal signed the infamous Treaty of Tordesillas dividing the non-Christian world between these two nations. The other west European nations, also seeking African colonies, ignored the treaty.

What has this to do with that hypothetical village of 4,000 native Africans? Sooner or later, European colonists ventured beyond their coastal strongholds to plunge into the continental interior for purposes as varied as missionary conversion, commerce or the capture of slaves.

And sooner or later, with Europeaners dwelling in the same environment as the indigenous Africans, these latecomers to the continental interior were confronted with the same panoply of tropical afflictions; and they too were bitten by malaria-bearing mosquitoes. But the native population, having lived with the menace of malaria for a hundred generations, had inherited a modest measure of resistance to the disease; not so with the white slavers, their soldiers, missionaries or adventurers seeking precious metals.

The medical literature of 1830 carried an article by a French naval officer noting an allegedly new disease in East Africa. This illness began suddenly, with high fever, shaking chills, marked asthenia, rapid pulse, bilious vomiting, obvious jaundice, and, within days, a progressive darkening of the urine.

This disease, called blackwater fever, was originally confused with yellow fever or some sort of morbidity affecting the liver. Certainly the jaundice, the bile-stained vomitus and the darkened urine collectively pointed toward a disease of the liver. Only belatedly was it recognized as a complication of malaria.

As more and more of these cases were recognized in central Africa – and later, in India and China – it became apparent that the acute breakdown of red blood cells was the catastrophic event leading to free hemoglobin and fragmented red blood cells clogging the kidneys and discoloring the urine. And further, that this was not a new disease but rather a severe complication in a patient already burdened by the most serious form of falciparum malaria.

Blackwater fever, strangely, was largely confined to Europeaners dwelling in malarial Africa, especially blonds from northern Europe. Was this divine retribution for the European rape of the African continent? Or was it the process of natural selection which had so altered the genetic profile of resident Africans to make them slightly more resistant to the secondary ravages of the malignant form of malaria?

In 1942, just months after this nation's entrance into a global war beyond our boundaries, the United States Army issued a lengthy bulletin describing the hazards of blackwater fever, ending with this sentence: "Recurrence of blackwater fever is common, especially in the tropics. Send patient to temperate zone if possible."

– Stanley M. Aronson, MD

*Stanley M. Aronson, MD is dean of medicine emeritus, Brown University.*

### Disclosure of Financial Interests

Stanley M. Aronson, MD, and spouse/significant other have no financial interests to disclose.

**Correspondence**
e-mail: SMAMD@cox.net

# Curbing Healthcare-Associated Infections

*Rosa R. Baier, MPH, and Stefan Gravenstein, MD, MPH*

**Visiting a patient on hospital consultation yesterday, we donned** gowns and gloves following the direction of the signs announcing the patient's **methicillin-resistant *Staphylococcus aureus* (MRSA)** colonization. The encounter took no longer than 30 minutes. In that time five additional individuals visited the patient: two family members, a registered nurse who checked a blood sugar, a nurse aide, and food service delivering a tray with lunch. None donned a gown or gloves; all made contact with the patient or the table the patient used for her personal effects. Only one "foamed out," none "foamed in."

On leaving the patient's room, we wondered: Would her food trays be inoculated? Would her environment be properly cleansed? We can easily imagine the transfer of organisms to fixed and mobile hospital surfaces, from bathrooms to the cafeteria—resulting in infections throughout the hospital and, eventually, people's homes. We find it easy, too, to believe what we so often hear from physicians and nurses: the information about the patient's infection may be absent (or difficult to locate) on the forms generated at discharge, leaving her next provider ill-equipped to prepare for her arrival or prevent the spread of her MRSA or others' infections.

It is small wonder we have a growing epidemic of **healthcare-associated infections (HAIs).** Even those who are best trained and equipped to do better are not doing as well as they might—far from it, an ironic semantic twist relating to the "culture of care." How do we combat this epidemic, when we have already placed hand-cleansing foam in facility corridors and endlessly coached healthcare workers on hygiene? The approach must be multifaceted and reach from patient-level care practices to systems-level interventions that change not only the way we think, but also how we individually and collectively become accountable.

This issue gathers a series of articles that tackle HAIs from these perspectives. Mermel describes the burden of HAI and the prevention tactics we must implement to curb the transmission of these infections, while two additional articles describe specific HAIs: *Clostridium difficile* (Pop-Vicas, Butterfield and Gardner) and MRSA (McNicoll and Marsella), with the latter article including tactics to change the culture of care. From a social consciousness perspective, Marshall, Tetu-Mouradjian, and Fulton discuss how to engage healthcare workers to accept influenza vaccination, while Oliver et al. speak to accountability regarding communication during care transitions. Thomas and Viner-Brown further address accountability, describing the evolution of HAI public reporting in Rhode Island, a national leader in transparency regarding health outcomes. Altogether, these articles deal with bedside practices; practice oversight from antibiotic stewardship and communications perspectives; and systems oversight through policies and reporting rates of infection and hygiene practices.

For the culture of medicine to change, we *must* do better with regards to HAIs. Our interventions must touch personal and systems-level accountability, and we must measure what is happening to understand which interventions are improving outcomes, and which need to be further modified or abandoned. This issue points to resources and approaches deployed in Rhode Island and elsewhere toward the goal of safer and better care.

*Rosa R. Baier, MPH, is Senior Scientist, Quality Partners of Rhode Island, and Teaching Associate, The Warren Alpert Medical School of Brown University.*

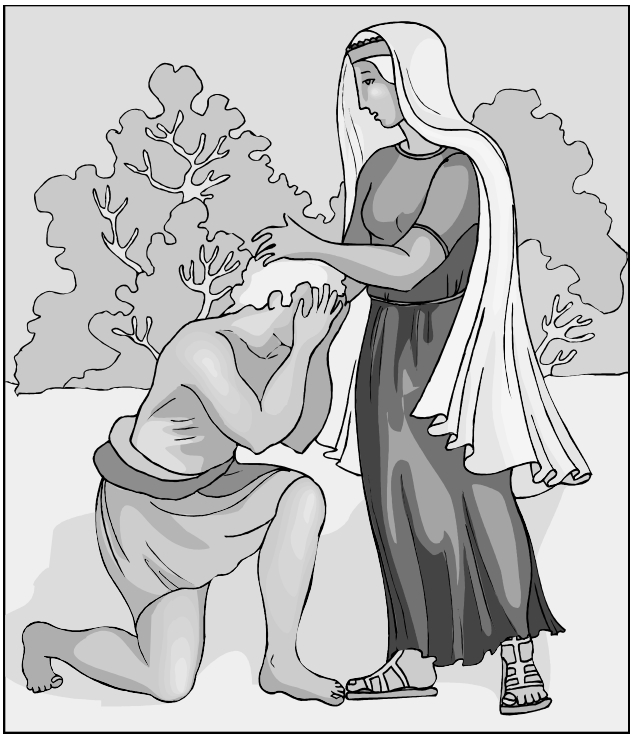
*Stefan Gravenstein, MD, MPH, is Clinical Director, Quality Partners of Rhode Island, and Professor of Medicine, The Warren Alpert Medical School of Brown University.*

**Disclosure of Financial Interests**

The authors and/or significant others have no financial interests to disclose.

**Correspondence**

Rosa Baier, MPH
Quality Partners of Rhode Island
235 Promenade Street
Suite 500, Box 18
Providence, RI 02908
Phone: (401) 528-3205
e-mail: rbaier@riqio.sdps.org



# Healthcare-Associated Infections: What Can Be Done To Reduce Risk To Our Patients?

*Leonard A. Mermel, DO, ScM, AM (Hon), FACP, FIDSA, FSHEA*

**Approximately two million patients** develop a hospital-acquired infection each year in the USA, contributing to approximately 100,000 deaths.[1] To put this into perspective, there are an estimated 70,000 deaths in the US each year due to accidents of all causes. Thus, hospital-acquired infections are one of the leading causes of death in the US. Until recently, there was little in the public domain regarding the scope of the problem and a limited amount of federal funding to improve our understanding of why such infections occur and how to prevent them. Nevertheless, most states, including Rhode Island, now mandate public reporting of hospital-acquired infections (http://www.apic.org/scriptcontent/custom/dyncontent/legislation/index.cfm?section=government_advocacy).[2,3] In October 2008, the **Centers & Medicare and Medicaid Services (CMS)** started a program of non-payment for some hospital-acquired infections, and some non-federal insurance plans are following suit. Yet hospitals have not felt the full impact of this intervention, in part due to inaccurate ICD-9 coding for hospital-acquired infections.[4]

Today, an ever increasing number of hospital-acquired infections are caused by multi-drug resistant microbes.[5] Some of these pathogens are resistant to most, if not all, FDA-approved antibiotics.[6,7] In this era of Andromeda strains of microbial pathogens, prevention of hospital-acquired infections is of paramount importance. There is convincing evidence that hospital-wide,[8] statewide,[9] and national coordinated efforts[10,11] implementing evidence-based infection control initiatives can reduce the risk of hospital-acquired infections. Most hospital epidemiologists know what to do to mitigate risk. The challenge remains to do the job in the current economic climate with competing priorities and limited dollars.

## What can we do to reduce the incidence of hospital-acquired infections?

1) The intervention with the greatest impact is hand hygiene.[12,13] Since most patient-to-patient microbe transmission occurs on the transiently-colonized hands of healthcare workers, hand hygiene is the cornerstone of an effective infection control program. In general, alcohol hand hygiene products are more effective at reducing the microbial bioburden on hands than soap and water.[12,13] Alcohol hand hygiene products also contain emollients, so there is greater moisture retention in the skin with these products rather than soap and water.[14] The Achilles heel of alcohol products, most of which contain around 60% alcohol in the USA, is the reduced efficacy against *Clostridium difficile* (*C. difficile*) spores,[15] described in a companion article in this issue, and norovirus.[16]

Nevertheless, there are many reasons to use a single agent for routine hand hygiene in hospitals, rather than recommending alcohol products for some patients and soap and water for others. Hand hygiene compliance is likely to be greatest when one agent is used routinely—and highest with alcohol products compared with soap and water.[12,13] If healthcare workers comply with isolation precautions (e.g., wearing gowns and gloves to go into rooms of patients with *C. difficile* who are in contact precautions), there should be minimal risk of *C. difficile* or other microbes on their hands after removing their gloves upon leaving the patients' rooms and then using an alcohol product for hand hygiene. Also, healthcare workers may be compliant with using soap and water, but contaminate their hands when turning off water faucets.[17] Notably, soap and water should be used if hands are visibly soiled, rather than alcohol hand hygiene products.

2) Another intervention to reduce risk to patients is compliance with isolation precautions.[18,19] The rooms of patients infected with *C. difficile*, **vancomycin-resistant enterococci** (VRE), and other microbes are often heavily contaminated with these pathogens.[20,21] As such, entering the room of a patient in contact precautions requires donning a gown and gloves, even if healthcare workers or other staff are not touching the patient, because there is a high likelihood of touching a contaminated surface, such as the bed stand, bed rail, etc., while in the room.

3) Appropriate cleaning of the environment in patient rooms and cleaning of medical equipment that comes in contact with patients are both important to prevent these surfaces from becoming microbial reservoirs, leading to transmission of microbes in the healthcare setting.[20,21]

4) Infected healthcare workers can transmit pathogens to patients,[22,23] but hospitals can minimize the risk by not allowing them to work if they have a febrile, diarrheal or respiratory illness, as well as by requiring all healthcare workers to receive influenza vaccinations yearly.[24,25]

5) Lastly, prudent antibiotic use can minimize the evolutionary pressure on microbes to develop multi-drug resistance. Recent guidelines promote antibiotic stewardship programs in hospitals—and such programs have had a significant impact.[26,27] Prudent antibiotic prescribing practice is our responsibility, as there are very few new antibiotics in the development pipeline and, as noted above, we have already entered the era in which bacterial pathogens infecting humans are resistant to our entire antibiotic armamentarium.

In closing, a pragmatic approach to infection control can make healthcare settings safer for patients and staff. Consistent hand hygiene, compliance with isolation precautions, yearly influenza vaccination, appropriate cleaning of the environment, and careful antibiotic prescribing practices improve patient safety through the reduced risk of life-threatening healthcare-associated infections.

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*Leonard A. Mermel, DO, ScM, AM (Hon), FACP, FIDSA, FSHEA, is Medical Director, Department of Epidemiology & Infection Control, Rhode Island Hospital, and Professor of Medicine, The Warren Alpert Medical School of Brown University.*



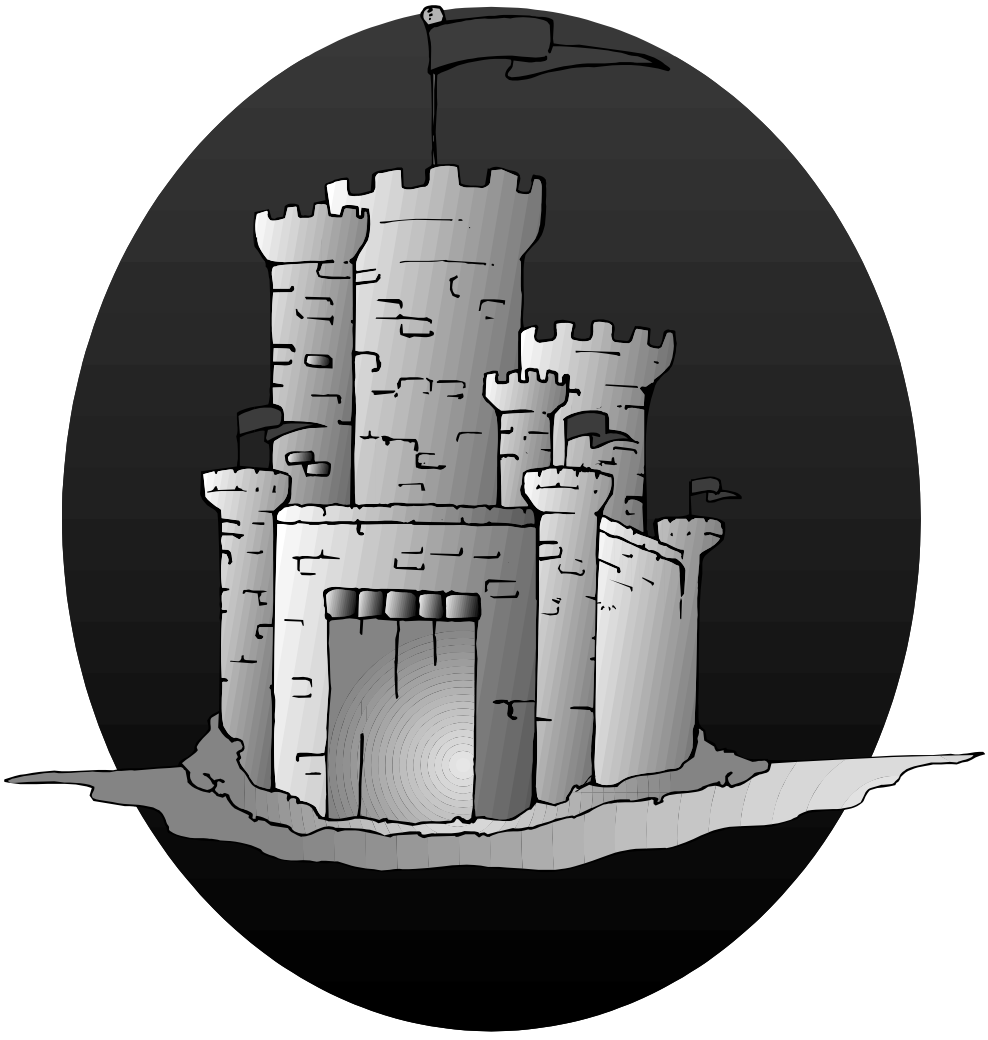
## Disclosure of Financial Interests

The author and/or significant other have no financial interests to disclose.



## Correspondence

Leonard Mermel, DO, ScM, AM (Hon), FACP, FIDSA, FSHEA
Division of Infectious Diseases
Rhode Island Hospital
593 Eddy St.
Providence, RI 02903
Phone: (401) 444-8130
e-mail:lmermel@lifespan.org

# Reducing the Incidence of *Clostridium Difficile* Infections: Can We Do It?

*Aurora Pop-Vicas, MD, MPH, Kristen Butterfield, MPH, Rebekah Gardner, MD*

**Although *Clostridium difficile* infections (CDI)** have long been recognized as the cause of antibiotic-associated diarrhea and colitis,[1] fulminant presentations with septic shock, toxic megacolon, and the need for emergent colectomies were rare until the hypervirulent NAP1/BI/027 strain[5] emerged at the center of several outbreaks of unprecedented severity in 2004-2005.[2-4]

Since then, *Clostridium difficile* (*C.difficile)* has become endemic in the US, Canada, and Europe, causing significant morbidity, mortality, and cost. The 30-day CDI mortality in a study of 12 Canadian hospitals was 6.9%,[4] whereas the attributable mortality one year after the initial CDI was as high as 16.7% in Quebec.[6] The average CDI-related hospital cost in Massachusetts was $10,212 in 2000. Patients who developed CDI in the hospital had their average stay prolonged by 2.95 days, and their hospital charges increased by a mean of $13,675.[7]

CDI have also contributed to re-hospitalization. A study of care transitions in Rhode Island shows that 2.6% of sampled Medicare patients discharged from the hospital during July 2008- June 2009 were readmitted within 30 days with a CDI diagnosis. The great majority of these readmissions occurred among patients of advanced age, with 46.5% of patients age 85 and over (unpublished data).

These data highlight an important, if uncomfortable, truth: *C.difficile*, a pathogen once difficult to isolate in the microbiology lab, has become even more difficult to eradicate from the healthcare setting. Why are CDI so persistent, and what can be done to reduce their rates?

## Infection Control Challenges

CDI present several unique challenges for infection control:

### 1. Persistence of environmental *C. difficile* spores.

Spores can survive in the environment for months to years,[8] and alcohol-containing disinfecting products will not kill the spores.[9] Therefore, effective environmental cleaning, especially when *C. difficile* is hyperendemic, is notoriously difficult. Moreover, epidemic *C. difficile* strains seem to be hyper-sporulating, compared to non-epidemic strains.[10] Nosocomial CDI transmission originating from a contaminated environment or from improperly cleaned medical equipment (such as rectal thermometers or bedpans) has been repeatedly demonstrated.[11,12]

**...achieving 100% compliance with hand-hygiene is 100% within our control.**

### 2. Asymptomatic carriers – a persistent reservoir of infection and potential transmission.

Although many patients develop typical clinical manifestations when they are infected with *C. difficile*, potentially more patients who acquire this pathogen remain asymptomatic. For example, according to a cohort study conducted over 11 months in a medicine ward, 63% of the 83 patients who became colonized with *C. difficile* during their hospital stay remained asymptomatic.[8] These asymptomatic patients served as the source of *C. difficile* transmission to their hospital roommates, who later developed symptomatic CDI with identical molecular strains. This study also evidenced substantial *C. difficile* transmission from asymptomatic carriers to their immediate hospital room environment, as well as to the hands of their healthcare workers.[8] Similar findings were reported in a study of **long-term care (LTC)** residents, where *C. difficile* spores from the skin of asymptomatic carriers were easily transferred to investigators' hands.[13] Since most hospitals do not screen for asymptomatic *C. difficile* carriage, and contact precautions are instituted only for symptomatic patients with CDI, colonized patients remain an unidentified reservoir of ongoing nosocomial transmission.

### 3. Lack of specific infection control policies in other healthcare settings, with potential for increasing CDI influx into the hospital and/or the community.

Since CDI affect primarily elderly people, and the majority of the patients hospitalized today are older and sicker than in the past,[14] more and more patients are discharged to acute rehabilitation centers and nursing homes after a CDI diagnosis.[15] Many of these patients still harbor *C. difficile* and may develop symptomatic CDI shortly after arrival. A study of nosocomial *C. difficile* acquisition found that 82% of the patients infected with *C. difficile* during their hospital stay still had positive cultures at discharge, and the majority of these patients were discharged to a LTC facility.[8] While most hospitals have relatively stringent infection control policies related to CDI and other hospital-acquired pathogens, equivalent infection control policies may not be feasible outside the hospital, and may not always exist in LTC facilities. In fact, in a recent study of CDI-related infection control policies and practices among 418 LTC facilities in Iowa, the majority (77.5%) of facilities did not test for CDI unless residents had severe diarrhea; less than half (42%) of the facilities had a specialized protocol to identify residents with CDI; and more than a third (41.5%) of the facilities did not place residents in private rooms once CDI symptoms occurred.[16] The potential for further *C. difficile* dissemination within the LTC facility setting and back into

the hospital can be significant. *C. difficile* dissemination into patients' homes and into the community after discharge from healthcare institutions is possible and deserves further study.

**4. Difficulties in diagnosing CDI, leading to delays in the institution of contact precautions, and increased potential for nosocomial transmission.**

a) *Insensitive diagnostic modalities.* The low-sensitivity of the **enzyme immunoassays (EIA)** routinely used for toxin detection in most hospitals and clinical laboratories can delay CDI diagnosis. While these tests are technically easy, produce results within hours, and are inexpensive, the proportion of false negative results can reach 10-20%,[17] requiring repeated samples. More sensitive diagnostic modalities for toxin detection, such as cell cytotoxicity assays or PCR, are more expensive, and not widely available in the clinical setting.

b) *Atypical presentations in patients with cognitive decline.* CDI is easily suspected in patients who report typical diarrheal symptoms after exposure to antimicrobials and/or contact with the healthcare setting. However, the diagnosis may remain more elusive in elderly patients with cognitive impairment, who are unable to verbalize their symptoms, and are often brought to the hospital due to increased confusion, fever, and/or leukocytosis. An abnormal urine analysis may prompt empiric antibiotics for a presumed urinary tract infection. CDI is later suspected when diarrheal symptoms become evident after admission, but the delay in diagnosis and the initial lapse in contact precautions can increase the amount of exposure and nosocomial transmission to other vulnerable patients.

c) *CDI in patients without typical risk factors for this disease.* Patients who present from the community without the traditional risk factors associated with CDI represent another group in whom the diagnosis may not be initially suspected. For example, recent reports of CDI among healthy peripartum women,[18] or among otherwise healthy patients without recent healthcare contact,[18] underscore the importance of considering this diagnosis even in populations previously thought to be at low risk for CDI.

**5. Propensity for multiple recurrences, despite adequate treatment.**

Recurrent CDI occurs in up to 25% of patients.[17] Recently, there have been reports of even more frequent CDI recurrences, affecting at least 50% of the elderly patients treated with metronidazole both in Canada,[19] as well as in Texas.[20] Recurrences after therapy with vancomycin have also been reported.[21] The pathophysiology of multiple relapsing CDI is not fully understood. Some authors attribute it to the persistence of *C. difficile* spores within the colon that may have escaped adequate antibiotic pressure during therapy.[22] The host immune responses to CDI are likely important as well. For example, asymptomatic carriers and patients who only experience a single, brief CDI episode have higher levels of antitoxin antibodies, compared to patients who develop recurrent CDI.[23] Exposure to antibiotics during or after CDI treatment seems to be a major risk factor in triggering CDI recurrences.[24]

**6. Unmodifiable risk factors.**

The majority of the risk factors associated with CDI reflect the fragile health of many patients hospitalized. Advanced age, a bedridden state, immunodeficiency (including chemotherapy-associated), multi-morbidity, gastrointestinal surgery,[17] and tube feeding[25] are not easily modifiable, increasing vulnerability to infection. Additional risk factors, such as frequent and multiple antibiotic exposures, prolonged hospitalizations, and perhaps the use of proton pump inhibitors[26] may be modifiable in part. Although all antibiotics (including metronidazole) have been associated with CDI, the recent epidemic appears to have been driven by the overuse of fluoroquinolones, as evidenced by higher level of fluoroquinolone resistance among recent *C. difficile* isolates.[2]

## Potential Solutions

Infection control efforts aim to provide practical solutions to some of the challenges listed above, as follows:

1. Environmental *C. difficile* cleaning. The 2010 IDSA and SHEA CDI guidelines recommend the use of bleach-containing cleaning products for environments where *C. difficile* is endemic since these products appear reliably sporicidal compared with other disinfectants.[21]

2. Asymptomatic carriage. Efforts to reduce asymptomatic *C. difficile* carriage have been disappointing. A randomized placebo-control trial found no difference in *C. difficile* carriage rates among patients treated with metronidazole versus those treated with placebo.[27] Although patients treated with oral vancomycin were more likely to clear *C. difficile* initially, the majority became re-colonized by day 70 of follow-up.[27] Therefore, no guidelines support the treatment of asymptomatic carriers, or screening for asymptomatic carriage at hospital admission.

3. Early CDI diagnosis. Maintaining a high index of suspicion in patients with recent hospitalizations and antibiotic exposure could avoid unnecessary morbidity and nosocomial transmission. Teaching patients and their caregivers at the time of hospital discharge how to recognize and report early CDI symptoms may avoid further clinical deterioration and reduce re-hospitalization rates.[28] Empiric CDI treatment and contact precautions should be instituted early. In cases where there is a strong suspicion for CDI, clinicians should not be deterred by a negative toxin-detection EIA test, given the suboptimal sensitivity of this assay. Further diagnostic confirmation can be sought using more sensitive diagnostic modalities, if clinically available. Sometimes, resolution of symptoms after empiric CDI treatment provides evidence in support of the suspected diagnosis.

4. CDI-related infection control policies in other healthcare settings. Enacting feasible policies in LTC facility and short-stay rehabilitation centers is especially important, given the increased transit of patients with CDI diagnosis and/or CDI risk factors between different facilities and the community.

5. Management of multiply relapsing CDI. Treating patients with recurrent infections remains frustrating, although the recently tested human monoclonal antibodies to *C. difficile* toxins as well as *C. difficile* vaccines in development[29] hold promise.[30] Until newer therapies such as

these or others enter the market, the treatment will largely remain focused on prolonged tapers and/or pulsed regimens of oral vancomycin. Patients with CDI who require ongoing or frequent antibiotic administration for concurrent infections are at risk for CDI recurrences.[21] In these instances, we have found it clinically useful to extend the duration of oral vancomycin treatment beyond the cessation of all other antimicrobials, particularly when non-modifiable host risk factors for CDI were also present. The effectiveness of probiotics as an adjunctive CDI therapy in preventing further CDI recurrences remains limited.[21]

6. Judicious use of antibiotics. Antibiotic exposure is perhaps the most important modifiable risk factor that can reduce the incidence of CDI. Antibiotic stewardship programs that encourage clinicians to minimize the number, frequency, and duration of antimicrobial use can reduce CDI rates in institutions where *C. difficile* is endemic or epidemic.[31] The approach is likely to be particularly successful when it complements infection control measures aimed at decreasing horizontal *C. difficile* transmission.

7. Hand hygiene. Correct hand washing technique is, arguably, the most effective, yet simplest method of reducing horizontal *C. difficile* transmission within healthcare institutions, and its value in preventing infections has been repeatedly proven.[32] Paradoxically, the compliance among healthcare workers is disconcertingly low. At this time, it is unclear whether complete eradication of *C. difficile* from the healthcare environment will ever be achievable. It is, however, clear that achieving 100% compliance with hand-hygiene is 100% within our control. It is, in fact, "in our hands."

## Conclusions

We can reduce the incidence of *C. difficile* infections in the healthcare setting. Increasing our compliance with basic infection control policies, instituting specific measures aimed at eradicating environmental spores, and promptly initiating *C. difficile* treatment as soon as symptoms develop can greatly decrease the *C. difficile* burden in the healthcare environment. Increasing our communication between different healthcare settings and providers during transitions of care, and teaching patients and caregivers to recognize and report relapsing *C. difficile* early can reduce the burden of readmissions due to this pathogen.

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*Aurora Pop-Vicas, MD, MPH, is Assistant Professor of Medicine, The Warren Alpert Medical School of Brown University.*

*Kristen Butterfield, MPH, is Manager of Analytic Services, Quality Partners of Rhode Island.*

*Rebekah Gardner, MD, is Senior Medical Scientist, Quality Partners of Rhode Island, and Assistant Professor of Medicine, The Warren Alpert Medical School of Brown University.*

### Disclosure of Financial Interests

The authors and/or significant others have no financial interests to disclose.

### Correspondence

Aurora Pop-Vicas, MD, MPH
Memorial Hospital of Rhode Island
Division of Infectious Diseases
111 Brewster Street
Pawtucket, RI 02860
Phone: (401) 729-2959
e-mail: Aurora_Pop-Vicas@brown.edu

# The Growing Problem of Methicillin-resistant *Staphylococcus aureus*: Will Hospitals Prevail?

*Lynn McNicoll, MD, and Maureen Marsella, RN, CCM, CPC*

**Mr. B, a 76-year old previously healthy** and active white man, suffered a severe burn to his back when his shirt caught fire. He had a history of hypertension and mild emphysema from a 40 pack-year smoking history. His only medications at baseline were a diuretic and inhalers. After a few weeks on the trauma service, he transferred to the medicine service. Pain management remained difficult, and multiple trials of different narcotics did not relieve his suffering without significant side effects. His respiratory status worsened slightly and he developed delirium. On hospital day 18, his respiratory status continued to worsen, a sputum culture grew **Methicillin-resistant *Staphylococcus aureus* (MRSA)**, and he was started on Vancomycin. The following day, his respiratory status deteriorated further, prompting transfer to the intensive care unit and intubation. He developed sepsis followed by multi-organ failure, and died two days later despite aggressive critical care management.

**Hospital-acquired healthcare-associated infections (HAIs)** such as MRSA increasingly surface in acute care in hospitals worldwide; Rhode Island is no exception. This review will discuss the epidemiology of MRSA, its consequences, and several strategies for dealing with this escalating problem.

## Epidemiology of MRSA

### Prevalence

First described in the early 1960s, Staphylococcus Aureus quickly spread, causing outbreaks worldwide, and has since evolved into five different strains, including MRSA. In the early 1970s, MRSA accounted for only 2% of all Staphylococcus Aureus hospital-acquired HAIs. However, according to recent estimates, MRSA now accounts for 60%-70% of these infections,[1,2] and a 10-state study of emergency room patients reports that *Staphylococcus aureus* caused 76% of soft tissue infections, 59% from MRSA.[3] Although 1997-2007 data show that MRSA central line-associated blood stream infections have declined by 50%, the percentage of MRSA Staphylococcus infections has increased to almost 70%.[9] Nationally, of the more than 94,000 patients who developed invasive MRSA infections in 2005 (a rate of 32 per 100,000 patients), about 20% died of MRSA during a hospital stay.[4]

### Incidence

There is significant inter-state variability in MRSA incidence.[3,5,6] A large prevalence study of 1,187 healthcare facilities in the US in 2006 showed the increasingly high MRSA colonization/infection rates in New Hampshire, New York, South Carolina, Maine, Delaware, Rhode Island, and Hawaii.[5] Rhode Island's rate of MRSA colonization or infection was 83.5 per 10,000 inpatients with 12 hospitals participating, while the national rate of MRSA colonization or infection was 46.3 per 10,000 inpatients. Importantly, hospital-acquired MRSA tends to be more virulent compared to community-acquired MRSA and has more drug resistance.

### Risk Factors

Even among patients not colonized with MRSA, the greater their antibiotic exposure, the greater their risk for the subsequent development of MRSA colonization or infection. Cephalosporins and fluoroquinolones are particularly implicated.[7] Once present, MRSA forms a biofilm on foreign objects, increasing the difficulty in eradicating the organism. For example, MRSA can form a biofilm and replicate on surfaces such as urinary catheters and endotracheal tubes, thus increasing the duration of antibiotic exposure needed to clear it, further increasing the risk of antibiotic resistance.[7]

Several patient populations present a high risk for MRSA colonization or infection. Although Klemens et al. found that most MRSA infections were healthcare-associated (85%), the majority began in the community among people with health risk factors such as: (1) the presence of an invasive device, (2) a history of MRSA, or (3) a history of surgery, hospitalization, dialysis, or nursing home stay in the previous 12 months.[4] Additional patient risk factors for invasive MRSA infections included age 65 years or older, black race, and male gender.[4] Additionally, Mermel et al.'s multicenter study identified the following risk factors for MRSA colonization: older persons living in long-term care facilities (20%), HIV-infected patients (16%), and patients on hemodialysis (15%).[8] One reason for the higher MRSA risk in these patient populations as compared to the general population derives from their propensity to carry MRSA in their nares.

### Burden of Infection

MRSA infections can be both deadly and costly: patients with MRSA have a higher risk of skin and soft tissue infections, surgical site infections, pneumonia, longer hospital stays, healthcare costs, and mortality.[3,4,5,6,9] One study estimates that 19,000 people died of MRSA during hospital stays in 2005;[4] another calculates that the standardized mortality rate for invasive MRSA in 2005 to be 6.3 patients per 100,000.[7] A hospital-acquired MRSA infection costs about $35,367, as compared with $13,973 for other hospital-acquired HAIs.[10]

## Management of MRSA

The inter-state variability in MRSA incidence[3,5,6] may partially relate to the different strategies used to identify MRSA colonization or infection (e.g., targeted screening vs. active surveillance), but also suggests significant opportunity to improve MRSA management using the tactics below.

### Prevention

Strategies to prevent the spread of MRSA are summarized in Table 1 and referenced in Mermel's companion article.[11] These strategies are included in several evidence-based guidelines and

**Table 1: MRSA Prevention Strategies**

| STRATEGY | DETAILS |
|---|---|
| **Hand Hygiene** | • Use alcohol-base hand rub before and after patient contact<br>• Wash with soap and water if:<br>– hands are soiled, after using the restroom, before eating, or if contact with a patient contaminated or infected with clostridium difficile<br>• Gloves when appropriate and wash hands after glove use<br>• Educate on importance of hand hygiene and address barriers<br>• Audit hand hygiene compliance, and provide feedback |
| **Isolation / Barriers with Identified Patients** | • Use universal precautions for handling body fluids<br>• Wear gowns/gloves<br>• Use masks for respiratory MRSA infections |
| **Clothing/Personal Attire** | • Avoid ties<br>• Avoid loose fitting long sleeves<br>• Do not allow fake nails<br>• Launder lab coats frequently (or avoid them altogether)<br>• Clean medical equipment often, especially stethoscopes |
| **Environment** | • Follow strict room decontamination procedures as 75% of surfaces in patient rooms are contaminated with MRSA |
| **Active Surveillance of MRSA** | • Screen most patients on admission, prior to joint replacement surgery, and on admission to a critical care unit<br>• Ideally, screening upon discharge from the hospital (may be cost prohibitive)<br>• Active treatment for nares decolonization of MRSA patients may be initiated with Mupirocin to each nostril twice daily for five days |
| **Antibiotic Stewardship** | • Avoid antibiotics for viral or benign processes (e.g. viral sinusitis, asymptomatic bacteriuria in older persons)<br>• Use narrow-spectrum antibiotics when appropriate (avoid cephalosporins and fluoroquinolones)<br>• Reduce the duration of antibiotics when appropriate (e.g. typical urinary tract infections only require three days of treatment or less than 24 hours post surgical intervention) |
| **Culture Change** | • Implement TeamSTEPPS™ (see Table 2) |

supported by all the relevant infectious disease and healthcare organizations.[10,12,13] Experts agree that, among prevention strategies, hand hygiene persists as the single most important to prevent transmission of MRSA and other hospital-acquired HAIs.[13] Most hospital patient-to-patient MRSA transmissions occur via the contaminated hands of direct care workers.[13] Although hand hygiene seems intuitively important, compliance rates remain below 50% in general for healthcare providers.[13] As detailed by Mermel,[11] alcohol-based hand rubs are comparatively more effective against MRSA than hand-washing, easier to accomplish, and lead to greater compliance; they do not work well for *Clostridium difficile*, the organism responsible for antibiotic-related diarrhea (and discussed in Pop-Vicas's companion article),[14] resulting in some confusion among healthcare providers about the best hand hygiene method. Studies have shown that hand hygiene quality improvement initiatives can effectively improve hand hygiene compliance and result in a concomitant decrease in hospital-acquired HAIs.[12,13]

### Active Surveillance

Most studies related to MRSA prevalence refer to infection, rather than colonization, because of limited MRSA active surveillance. Hospitals now usually screen only select populations of patients on admission, and only retest for certain indications. Targeted populations include patients admitted to a critical care unit or awaiting elective joint replacement surgery and other high-risk elective surgeries where foreign objects remain in the body. Due to the absence of universal active surveillance at admission or discharge, the true incidence and prevalence of hospital-acquired MRSA colonization remains unknown.

Active surveillance benefits patients by identifying those who need decolonization and isolation precautions to reduce spread to others. During a hospital outbreak or a cluster of surgical site infections, hospitals must implement more aggressive active screening in a systemic manner within the hospital and perhaps the surrounding healthcare community, such as receiving facilities. However, experts' debate about the cost-benefit proposition regarding screening healthy community-dwelling patients at low risk for MRSA colonization continues, with opponents citing hospitals' shrinking resources and financial struggles. Proponents argue that the cost to the hospital for surveillance will be outweighed by the substantial costs avoided by the reduction in surgical site infections and hospital-acquired HAIs; and so the debate rages on.

### Culture Change

Many studies have demonstrated comparatively greater success when quality improvement initiatives use adaptive activities and interventions in conjunction with concrete policies and measures, and optimized institutional culture ensures that all participants incorporate new policies into practice and recognize their empowerment to make change. This change in culture often proves to be the most difficult aspect of any qual-

**Table 2: TeamSTEPPS™ Strategies for Culture Change**

| STRATEGY | DESCRIPTION |
|---|---|
| **CUS**<br>**"Stop the line"** | • I am **C**oncerned<br>• I am **U**ncomfortable<br>• This is a **S**afety issues |
| **Two-Challenge Rule** | • Assertively voice concern at least *two times*<br>• Team member must acknowledge concern<br>• If the outcome is unacceptable: take a stronger course of action |
| **DESC** | • **D**escribe the specific situation<br>• **E**xpress how the situation makes you feel<br>• **S**uggest other alternatives – seek agreement<br>• **C**onsequences should be stated in terms of impact – strive for consensus |
| **SBAR** | • **Situation** – What is going on with the patient?<br>• **Background** – What is the clinical background?<br>• **Assessment** – What do I think the problem is?<br>• **Recommendation**/Request – What would I do to correct it? |
| **Other Communication Strategies** | • **Call-Out** – used for critical information such as patient identification<br>**Check Back** – assuring that receiver has understood the message and provides repeat-back of the message<br>**Hand-Off** - "I PASS THE BATON" |

ity improvement initiative to achieve, but also the most important to realize sustainable behavior and process change. As part of the **Centers for Medicare & Medicaid Services' (CMS's)** national patient safety initiative to reduce MRSA infections, hospitals across the country have implemented the TeamSTEPPS™ approach to improve culture.[15] TeamSTEPPS™ is an evidence-based teamwork system aimed at improving communication and teamwork skills among healthcare professionals. Developed by the Department of Defense's Patient Safety Program in collaboration with the Agency for Healthcare Research and Quality, TeamSTEPPS™'s scientific roots come from more than 20 years of research and lessons from the application of teamwork principles. Its key principles include optimizing leadership, delineating team structure, enhancing situation monitoring and mutual support, and optimizing communication. Although not specific to MRSA prevention, the core strategies outlined in Table 2 are associated with reduced MRSA prevalence in hospitals participating in CMS's initiative.[15]

## Rhode Island Initiatives

Although incidence and prevalence of MRSA increasingly result in concern from healthcare professionals and the lay public, alcohol-based hand rubs effectively kill MRSA thus making it, theoretically, controllable. Rhode Island hospitals have implemented numerous formal and informal initiatives to reduce hospital-acquired colonization and infection.

### Surgical Care Improvement Project

For nearly a decade, all 11 of Rhode Island's acute care hospitals have participated in the **Surgical Care Improvement Project (SCIP)**, a national partnership of organizations interested in improving surgical care by significantly reducing surgical complications. SCIP uses an interdisciplinary team approach to reduce surgical site infections, and CMS publicly reports results for a series of related metrics on the website of Hospital Compare.[16] Overall, Rhode Island hospitals' aggregate results rank high nationally in ensuring timely and accurate antibiotic administration and discontinuation relative to surgical procedures. Rhode Island hospitals have accomplished particularly remarkable results regarding: the provision of the right antibiotic for the surgical intervention (98%); antibiotic administration within one hour of surgical incision (95%); and antibiotic discontinuation within 24 hours of a surgical intervention (94%), designed to reduce the antibiotic burden.[16] The Commonwealth Fund ranks Rhode Island in the top 10 states in the US for surgical site infection prevention measure performance.[17]

### Patient Safety Initiative

As part of the CMS's national patient safety initiative (described above), two area hospitals are collaborating with Quality Partners of Rhode Island, the state's Medicare Quality Improvement Organization, to pilot a project to reduce the rates of MRSA colonization, transmission, and infection. Both hospitals' teams have received extensive TeamSTEPPS™ training and are using a MRSA change package to focus improvement efforts primarily on their critical care units. The intervention includes: (1) initiating active surveillance, as well as pre-admission active surveillance and decolonization for high risk populations and procedures, (2) following aggressive hand hygiene protocols, (3) ensuring adherence to strict contact precautions, (4) improving antibiotic stewardship, (5) improving equipment and environment decontamination, and (6) promoting cultural transformation. This pilot aligns with many national health care improvement initiatives and requirements related to reducing or eliminating hospital-acquired HAIs.

### Audit and Feedback

All of Rhode Island's hospitals have rigorous infection control programs that include audit and feedback of hand hygiene practices, providing feedback to both healthcare professionals and hospital leadership. The Rhode Island Department of Health's HAI public reporting program, described in Thomas's article,[18] releases information about hospitals' hand hygiene processes annually to focus public attention on this topic and encourage hospitals to improve. In addition to performing audit and feedback in a proactive, blameless manner (consistent with quality improvement principles), hospitals increasingly are reporting individual offenders to their supervisors.

## Conclusions

Although MRSA is an increasing focus in the literature, lay press, and the state's public reporting efforts, it poses several challenges for hospitals. Financial constraints, increasing demands, and overworked and stressed workforces are common barriers to quality improvement initiatives; and physician, nursing, and executive champions are required for the successful implementation of any hospital-wide initiative, such as the control of MRSA. The pessimists will say that the battle will never be won, that we will never eliminate multidrug-resistant organisms and these organisms are getting stronger and more virulent by the day.

However, because MRSA-related deaths are preventable, the optimists counter that we have no choice but to do our best to implement system-wide strategies to control MRSA. Patients like Mr. B deserve our best efforts. Even the best protocols and policies are ineffective unless the culture in the institution does not allow these scenarios to occur. Ideally, the medical resident would feel empowered to inform the attending that she had not used the alcohol rub to disinfect her hands, or the nurse would stop the surgeon from gowning because she noticed that he contaminated his hands after scrubbing. With the specter of Vancomycin-resistant *Staphylococcus aureus* in the horizon, the issue becomes even more pressing and the race to control MRSA and other *Staphylococcus aureus* strains even more imperative.

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*Lynn McNicoll, MD, is Assistant Professor of Medicine, The Warren Alpert Medical School of Brown University.*

*Maureen Marsella, RN, CCM, CPC, is Senior Program Program Coordinator, Quality Partners of RI.*


### Disclosure of Financial Interests

The authors and/or significant others have no financial interests to disclose.


## Correspondence

Lynn McNicoll, MD
Division of Geriatrics
Rhode Island Hospital
593 Eddy Street, POB 438
Providence, RI 02903
Phone: (401) 444-5248

# Increasing Annual Influenza Vaccinations Among Healthcare Workers In Rhode Island: A Social Marketing Approach

*Robert J. Marshall, PhD, Linda M. Tetu-Mouradjian, RN, John P. Fulton, PhD*

**Approximately 226,000 excess hospitalizations** and 36,000 deaths occur each year in the US due to influenza-related illness.[1] In addition to their own risk of disease, unvaccinated healthcare workers can transmit influenza virus unknowingly to high-risk patients prior to the onset of symptoms.[1] Annual influenza vaccinations for healthcare workers can prevent workers from becoming ill and may decrease morbidity and mortality among patients at high risk for complications.

For the past 20 years, the **Centers for Disease Control and Prevention's (CDC)**'s Advisory Committee on Immunization Practices[1] has recommended healthcare worker annual influenza vaccination to protect both healthcare workers and patients from infection.[1] Despite repeated urgings, uptake of influenza vaccination remains low.[2] In 2004 and 2006, vaccination rates among healthcare workers were 42% nationally[3] and 33.9% among nursing home healthcare workers in Rhode Island.[4] Studies show that education alone has little effect.[5] A social marketing strategy[6] combined with "stages of change" theory may facilitate influenza immunization among healthcare workers by reducing the barriers and increasing the benefits of behavior change.

John and Cheney (2007) used data from 74 participants in eight focus groups to assess the psychographics of healthcare workers (age 30+ years) who did *not* receive influenza vaccine in 2006-2007.[7] The researchers found that most respondents perceived influenza as a "mild" disease and demonstrate a "low level of concern," despite the fact that 81% had one of the "high-risk" characteristics or health conditions for which CDC indicates high priority for annual influenza vaccination and 23% worked in a healthcare setting or with children. Nearly two-thirds of these healthcare workers either *never* had a flu shot or had not had one *for more than 10 years!* One-third of all participants believed the vaccine "made them sick." Another one-third distrusted the vaccine's value or "safety." The final third were not resistant, but cited some "inconvenience" as a barrier.

The authors identified three audience segments: "Plans to Get," "Needs More Information," and "Makes You Sick." They proposed new messages to promote increased participation in the first two segments, and asserted that no special efforts should be directed to members of the "makes you sick" group, who would probably not get a shot "until the price of resistance becomes too high." The authors argued that strategic use of the marketing mix (product, price, place, promotion)—usually available to social marketers—was severely limited in this case, since it is impossible to change the physical nature of the flu vaccine product, except, perhaps, for the injection and nasal methods of administration.

The Stages of Change theory[8, 9] regards behavior change as a process, rather than an event. By understanding the stage in which each subject resides (precontemplation, contemplation, preparation, action, maintenance and relapse), practitioners can design interventions tailored to the subject's status in the process. Doing so, rather than using the "one size fits all approach," improves movement to the target behavior.

Our project combines the social marketing approach with stages of change theory to explore ways to increase the uptake of influenza vaccine among healthcare workers. Social marketing helps to identify past and present behavior of healthcare workers and the underlying dimensions of their "decisional balance," "self-efficacy," and intentions toward annual vaccine use. These characterizations can fit into stages of change theory to develop strategies for increasing vaccination rates among healthcare workers.

**Table 1. Focus group participants by credentials and type of workplace**

| | RNs | LPNs | CNAs | Students | Total |
|---|---|---|---|---|---|
| Hospital | 14 | 0 | 0 | 0 | 14 |
| Nursing Home | 10 | 2 | 8 | 0 | 20 |
| College | 0 | 0 | 0 | 12 | 12 |
| TOTAL | 24 | 2 | 8 | 12 | 46 |

**Table 2a. Survey respondents by type of workplace**

| Site | Number | Percent |
|---|---|---|
| Hospital | 253 | 29.9 |
| Nursing Home | 372 | 44.0 |
| Physician Office | 22 | 2.6 |
| Assisted Living | 14 | 1.7 |
| Home Care | 39 | 4.6 |
| Home Nursing Care | 13 | 1.5 |
| Hospice | 7 | 0.8 |
| Other* (school nurse, etc.) | 126 | 14.9 |
| **TOTAL** | 846 | 100.0 |

**Table 2b. Survey respondents by patient content**

| Patient Content | Percent |
|---|---|
| Face-to-face contact with patients? | 94 |
| **Patients served?** | |
| Infants | 9 |
| 01-18 years | 22 |
| 19-64 years | 52 |
| 65+ years | 79 |
| Immuno-compromised | 35 |
| Pregnant women | 9 |

## Methods

In 2007, the **Rhode Island Department of Health (HEALTH),** in cooperation with the **Rhode Island Adult Immunization Coalition (RIAIC)** and local health care facilities, surveyed **registered nurses (RNs), licensed practical nurses (LPNs),** and **certified nursing assistants (CNAs)** about influenza vaccination. To begin, HEALTH conducted key informant interviews with 12 employee representatives of local healthcare facilities, asking about their experiences with staff vaccination campaigns. Based on those interviews, HEALTH organized five focus groups, stratified by setting (nursing homes vs. hospitals) (total N=46, Table 1). Later in 2007, HEALTH surveyed 846 RNs, LPNs, and CNAs, drawn from a range of settings. (Table 2a) A convenience sample was used to minimize costs. Nearly all respondents (94%) reported face-to-face contact with patients. (Table 2b)

## Results

Focus group results mirrored previous studies.[7] Many respondents perceived influenza as a mild disease or severe only for a few "high-risk" groups. Some believed that they had developed "natural immunity" to influenza. Others believed they could avoid influenza by adhering to universal precautions, hand-washing and other healthy habits. Many perceived the vaccine as ineffective. Some thought it made them sick.

About two-thirds of respondents had received influenza vaccine in the previous year and about the same proportion intended to get it next year. (Table 3) Nearly half the respondents got influenza vaccine every year. Twenty percent of respondents had not received influenza vaccine in the past five years. The same proportion did not intend to get it next year. Based on these results, we sorted respondents into groups defined by stages of change theory. (Table 4)

Ninety-three percent (N=783) of respondents could be assigned to one of six stages of change. "Maintenance" comprised the largest group (N=343), followed by "action" (N=165), "relapse" (N=135), "precontemplation" (N=95), "contemplation" (N=35), and "preparation" (N=8). From the perspective of public health, respondents in "maintenance" are optimally situated, respondents in "action" are positioned to join them; and respondents in "relapse" are positioned to re-join them. Respondents in "contemplation" and "preparation" show promise of moving to action and—if their trajectory is unimpeded—to "maintenance." Unfortunately, some respondents—those 12% in "precontemplation"—neither received vaccine in the past nor intend to seek it in future. In short, these subjects would seem to require targeted interventions to assure compliance with influenza vaccine guidelines for healthcare workers. Accordingly, we focused analysis of survey responses on two groups: respondents in "maintenance," who represent the ideal, and respondents in "precontemplation," who represent those least likely—on their own, without intervention—to conform to the ideal in future.

**Table 3. Survey respondents' influenza vaccine history**

| Influenza Vaccine History | Percent |
|---|---|
| Did you receive influenza vaccine last year? | 69 |
| How many times in the past 5 years have you received influenza vaccine? | |
| Never | 20 |
| Once | 12 |
| A few times | 22 |
| Every year | 46 |
| How likely are you to get influenza vaccine next year? | |
| Likely | 62 |
| 50-50 chance | 18 |
| Unlikely | 20 |

In addition to questions on vaccine history and intended use, the survey sought to measure respondents' perceptions of susceptibility to influenza, seriousness of influenza and its sequelae, costs and benefits of influenza vaccine, and influenza vaccine guidelines. Table 5 shows the average scores on several of the individual items for respondents in "maintenance" and "precontemplation."

Respondents were asked to rate the "severity" of influenza for oneself and others. Workers in "maintenance" and "precontemplation" perceived the severity of influenza rather similarly for infants, the elderly, persons with chronic illnesses or compromised immunity, "people who don't take care of themselves," and "people my age." That both groups perceived influenza as a lesser threat for "people my age" than others suggests that healthcare workers, regardless of stage, do not apply general risk or severity criteria to themselves. Nonetheless, respondents in both stages agreed that getting the flu themselves could have serious consequences for others—for family, coworkers, patients and the workplace generally.

Respondents were asked to comment on circumstances that might increase the likelihood of getting flu vaccine next year. Most respondents in "maintenance" did not answer these questions affirmatively, as most intended to receive the vaccine, regardless of circumstance. However, respondents in "precontemplation" indicated that they would be more likely to get the vaccine under particular circumstances, e.g., de-

**Table 4. Stages of change by influenza vaccine history**

| | VACCINE HISTORY | | | |
|---|---|---|---|---|
| **Stage** | **Last 5 years** | **Last year** | **Next year** | **Frequency** |
| Precontemplation | Never | N/A | Unlikely | 95 |
| Contemplation | Never | N/A | 50/50 | 35 |
| Preparation | Never | N/A | Likely | 8 |
| Action | Once - few | Yes | 50/50 - Likely | 167 |
| Maintenance | Every | Yes | 50/50 - Likely | 343 |
| Relapse | Once - every | No | N/A | 135 |
| **TOTAL** | | | | 783 |

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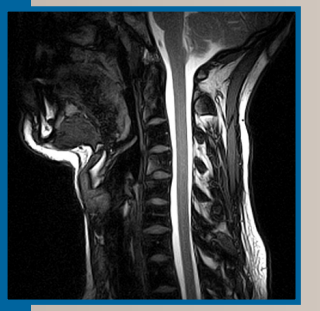

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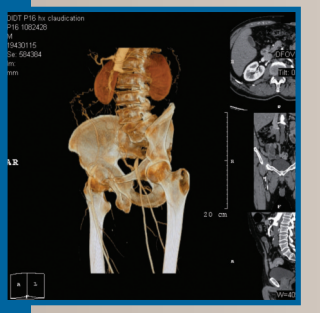

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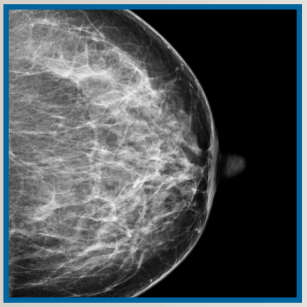

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**Table 5. Perceptions about influenza and influenza vaccine by stages of change (Precontemplation vs. Maintenance)**

| **How severe are the potential health consequences of influenza? [Response range: From 1, "mild," to 3, "severe"]** | **Precon** | **Maint** |
|---|---|---|
| For infants? | 2.5 | 2.6 |
| For elderly? | 2.8 | 2.9 |
| For people who are immuno-compromised or chronically ill? | 2.9 | 2.9 |
| For people who don't take care of themselves? | 2.5 | 2.5 |
| For people my age? | 1.6 | 1.8 |
| **How important are the following consequences of influenza for you? [Response range: From 1, "not important," to 3, "important"]** | | |
| The burden on my co-workers when I am sick and can't go to work | 2.6 | 2.8 |
| The financial burden when I have to miss work | 2.3 | 2.4 |
| The possibility of spreading the flu to patients | 2.8 | 3.0 |
| The possibility of spreading the flu to family members or co-workers | 2.9 | 3.0 |
| The burden on my family when I can't take care of them | 2.5 | 2.6 |
| Having to stay home and miss out on life | 2.1 | 2.3 |
| The financial burden on the healthcare system | 2.3 | 2.5 |
| **Would you be more likely to get the flu vaccine next year if: [Response range: From 0, "no," to 1, "yes"]** | | |
| *Lessen Barriers to Receipt of Vaccine?* | | |
| The vaccine was offered to you free, or covered by your insurance. | 0.04 | 0.05 |
| You had more time to get the vaccine or it was more easily accessed. | 0.03 | 0.02 |
| It was offered in another form, rather than a shot. | 0.03 | 0.00 |
| *Personal Contingencies?* | | |
| Someone close to you was immuno-compromised. | 0.22 | 0.02 |
| You had a bad case of the flu in the past. | 0.16 | 0.03 |
| You were diagnosed with a serious chronic disease. | 0.33 | 0.02 |
| *General Contingencies?* | | |
| There was a really bad flu season. | 0.06 | 0.03 |
| Your doctor recommended it. | 0.05 | 0.02 |
| *Summary Position* | | |
| It was required for all direct care healthcare workers. | 0.37 | 0.03 |
| Nothing would make me more likely to get vaccinated next year. | 0.45 | 0.00 |
| **Do you agree or disagree with the following statements? [Response range: From 1, "disagree," to 3, "agree"]** | **Pre-con** | **Maint** |
| **Influenza Vaccine vs. Other Preventive Measures** | | |
| It's better to build up natural immunity than to take flu vaccine. | 3.6 | 1.7 |
| Taking good care of myself is as good or better than getting flu vacc. | 4.0 | 2.7 |
| **Side Effects of Influenza Vaccine** | | |
| I'm worried about the possible side effects of vaccine… | 3.8 | 2.8 |
| The flu vaccine can cause the flu. | 2.9 | 1.8 |
| **Mandating the Use of Influenza Vaccine** | | |
| Vaccines should be mandated for healthcare workers. | 2.0 | 4.1 |
| All patients over 50 should get the flu vaccine. | 3.2 | 4.5 |
| Vaccines should be mandated for school entry. | 2.8 | 4.3 |

veloping high risk chronic illnesses or having a family member with compromised immunity. Notably, respondents in "precontemplation" resisted the idea of getting flu vaccine if it were required: 45% said that "nothing" would make them more likely to get influenza vaccine next year. On the basis of these responses, it is possible to divide respondents in "precontemplation" into three groups: 1) those who would accept vaccine if vulnerability of self or family increased; 2) those who would accept vaccine if it were mandated; and 3) those who would *not* accept vaccine under any circumstances.

**Table 6: Evaluation of common vaccines by stages of change (Precontemplation vs. Maintenance)**

| Rate the usefulness of each of the following vaccines. [Response range: From 1, "not useful," to 3, "useful"] | Pre-con | Maint |
|---|---|---|
| Smallpox vaccine | 2.8 | 2.8 |
| Hepatitis B vaccine | 2.7 | 2.9 |
| Chickenpox vaccine | 2.6 | 2.8 |
| HPV vaccine | 2.5 | 2.8 |
| Pneumococcal vaccine | 2.3 | 2.9 |
| Influenza vaccine | 2.1 | 2.9 |

We also asked respondents to evaluate influenza vaccine in relation to other preventives, such as good hygiene and healthy life style. Respondents in "precontemplation" were *more likely* than respondents in "maintenance" *to agree* that "natural immunity" and "taking good care of myself" were preferable to getting vaccine, that they "worried about side-effects" of influenza vaccine, and that "flu vaccine causes the flu." They were *less likely* than respondents in "maintenance" *to support* vaccine mandates for health care workers, people over 50, and school entry.

Finally, we asked respondents to evaluate influenza vaccine in relation to other vaccines. Most respondents thought that all the vaccines (smallpox, hepatitis-B, chickenpox, HPV, pneumococcus, influenza) were useful. However, respondents in "maintenance" were more likely to rate influenza vaccine as "useful" compared to respondents in "precontemplation." (Table 6)

## Discussions and Recommendations

Our results indicate that the attitudes, perceptions and behaviors of healthcare workers in Rhode Island mirrored those reported among healthcare workers in other national studies.[5] On the one hand, workers who regularly took annual flu vaccine perceived a beneficial exchange, involving few barriers and many benefits— such as protecting oneself, loved ones, patients and even co-workers from influenza. They were even likely to support policies requiring annual vaccination for themselves and other health professionals — an exchange of individual choice for achievement of a larger good. On the other hand, those who did not get flu vaccine every year anticipated a poor exchange, involving few benefits and several substantial risks. They did not see themselves as susceptible to influenza (some, because they perceived themselves as "naturally immune"), or they perceived themselves as sufficiently protected because they practiced healthy behaviors and good hygiene. Many worried about the efficacy, safety and side effects of the vaccine; some believed it "caused" the flu.

The dynamics of the exchange for those in the vaccine non-use group permits the differentiation of three "audiences." One audience would receive influenza vaccine if there were a significant change in personal susceptibility or seriousness — such as when they themselves or a family member became "high risk" for the sequelae of influenza. Another audience would receive vaccine if mandated by some public or corporate policy — an exchange of individual discretion for ability to continue working in a specific setting. The third audience would not receive the vaccine, even if it were mandated for work — demonstrating an unwillingness to exchange personal choice for benefits that they regard as dubious, unnecessary, or even harmful.

The combination of a social marketing approach with Stages of Change theory points to plausible strategies to achieve the target behavior. Without making any recommendation, we suggest three possible approaches. An *information/education/promotion campaign* may be sufficient to change some of the underlying misconceptions about influenza and vaccine use — such as the notion that influenza vaccine transmits influenza. However, research indicates that information *alone* will not result in significant changes in behavior —even if misconceptions are resolved. Nevertheless, by becoming aware of these misconceptions, physicians may address concerns about vaccine side-effects and safety among their healthcare colleagues. A second approach involves *strengthening the organizational commitment and active support for annual vaccine use in the workplace*. Most healthcare settings in Rhode Island already support annual flu vaccination; however, their vaccination campaign strategies vary. The re-doubling of efforts involving top-down organizational support and participation, a strong culture of immunization expectation, and free/convenient access to vaccine may bolster compliance. Healthcare workers tend to have strong occupational ties due to the extensive social and professional support they provide each other at work. Physician groups can play an instrumental role in workforce immunization efforts by means of strong, obvious support. Finally, *public or private policies requiring annual flu vaccine use as a condition of employment* may be the most effective — albeit politically difficult — way to protect patients, co-workers and institutional financial viability from the annual effects of influenza. There is strong support for vaccine use in the occupational culture of health care workers. As our nation addresses the "global economy," "worldwide population," "emerging infectious diseases" and pandemics, the trade-offs between individual choice and public health will sharpen. Physician professional associations can have a decisive voice in this discussion through advocacy efforts with their own members and colleagues in other professions.

In effect, mandates "change the offer" of the product. (Note: Each product has three components: the "actual" product or service, e.g., influenza vaccine; the "behavior" product, e.g., routine annual immunization; and the "benefits" product, e.g., personal immunity, continuity of work, or assurance that one will not infect vulnerable patients or family members.)[10] Mandates switch the key "benefits" of influenza vaccine from "immunity" to "ability to continue in the profession and/or work setting." Work-related mandates for influenza vaccine would move many resistant workers from "precontemplation" to "action" and then "maintenance" stages of behavior change. In the words of one behavior change expert, "those who are prone will easily respond to educational messages, while those who are resistant will need the force of law imposed upon them."[11] Mandates

may induce *some* healthcare workers to change professions (or work settings) to avoid the vaccine; but over time, this effect could benefit society by realigning the values and perceptions of healthcare workers with the requirements of healthcare work.


## Acknowledgements

With assistance from Andrea Bagnall-Degos, MPH, RI Department of Health; Becky Bessette, MS, RD, RI Department of Education; Stacie Hogan, MPH, Policy Studies, Inc.; Patricia Raymond, RN, MPH, RI Department of Health; Maria WahFitta, MPH, formerly with the RI Department of Health; and Lee Ann Quinn, RN, BS., South County Hospital.


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*Robert J. Marshall, PhD, is Assistant Director of Health, RI Department of Health, and Clinical Associate Professor of Community Health, The Warren Alpert Medical School of Brown University.*

*Linda M. TetuMouradjian, RN, is Consultant Public Health Nurse, RI Department of Health, and Cooperating Instructor, RI College, School of Nursing.*

*John P. Fulton, PhD, is Chief Health Program Evaluator, RI Department of Health, and Clinical Associate Professor of Community Health, The Warren Alpert Medical School of Brown University.*



### Disclosure of Financial Interests of Authors

The authors and/or significant others have no financial interests to disclose.



## Correspondence

Robert J. Marshall, PhD
Assistant Director of Health
RI Department of Health
3 Capitol Hill
Providence, RI 02908
Phone: (401) 222-2589
E-mail: Robert.Marshall@health.ri.gov


# Prevention and Control of Multi-Drug Resistant Organisms Using Standardized Cross-Setting Communication

*Linda Oliver, RN, Liz Martino, MT, MBA, CIC, Debbie Maaz, RN, BSN, Michelle Cahill, LPN, Paula Foster RN, BSN*

**Mrs. A's father was hospitalized multiple** times over several months. During that time he developed a **multi-drug resistant organism** (**MDRO**) infection. Upon transfer to an acute care facility, the MDRO information was inadvertently omitted from the Continuity of Care Form, required of all discharging facilities in Rhode Island. When Mrs. A noted that the healthcare workers in this new facility were not gowned and gloved upon entering his room, she mentioned her father's positive MDRO diagnosis to the nurse. The acute care facility workers immediately implemented measures to ensure the safety of their staff and patients, expressing dismay to one another that their hospital colleagues had not shared the information they needed to care for this individual and prevent transmitting the MDRO to others.

While anecdotal, Mrs. A's story resonates with healthcare providers: when a patient with an MDRO is discharged, the receiving provider—whether a hospital, **long-term care** (**LTC**) facility, home health agency, or physician's office—frequently does not receive information about existing MDROs. Only by knowing the colonization or infection status of patients can receiving providers implement proper isolation precautions and ensure that direct care workers don **personal protective equipment** (**PPE**). In this article, we discuss how Rhode Island's mandated Continuity of Care Form can help providers consistently communicate the status of patients with MDROs.

## Multi-Drug Resistant Organisms (MDROs)

MDROs are microorganisms resistant to one or more therapeutic classes of antimicrobial agents, and include **methicillin-resistant *Staphylococcus aureus*** (**MRSA**)—described in a companion article[1] and frequently mentioned in the lay press—**vancomycin-resistant *enterococcus*** (**VRE**) and certain **Gram-negative bacilli** (**GNB**) that are resistant to **extended-spectrum beta lactamases** (**ESBLs**). MDRs affect patients and healthcare workers in all healthcare settings, causing a spectrum of disease, ranging from asymptomatic carriage (e.g., colonization) to symptomatic illness (e.g., clinical disease or infection), depending largely on the baseline health status of the individual.

### Impact of MDROs

The burden of **healthcare-associated infections** (**HAIs**) caused by MDROs is significant in terms of increased patient morbidity, mortality, and cost. In this issue, Mermel cites nearly 100,000 deaths each year from hospital-acquired infections HAIs,[2] making them the most common cause of death resulting from infections and one of the top 10 leading causes of death overall.[3] Included in these troubling statistics are at least 350,000 infections and 12,000 deaths caused by MRSA, VRE, and other MDROs, specifically. Estimates place the cost of MDRO infections at more than $3.5 billion in excess healthcare costs annually,[3] due to treatment costs and increased hospital lengths of stay.[3] Yet many MDROs are preventable: direct care workers can successfully control person-to-person and facility-to-facility transmission through compliance with standard protocols (e.g., PPE, hand hygiene, and isolation precautions) and adequate and timely communication between healthcare settings and providers, including physicians. We describe these tactics below.

### Prevention of MDRO Transmission

MDROs are transmitted from one patient to another via the contaminated hands of direct care workers.[4] As a result, healthcare facilities have evidence-based recommendations for implementing precautions and hand hygiene. These guidelines are intended to interrupt transmission from direct or indirect contact with infected patients and their environment, and also to establish when precautions should be implemented and discontinued. As indicated in Mermel's companion article,[2] hand hygiene compliance is essential to prevent the spread of HAIs, including MDROs. The Healthcare Infection Control Practices Advisory Committee strongly recommends that direct care workers entering the room of a patient with a known colonization or infection wear both gowns and gloves, as well as perform hand hygiene before and after patient contact.[4] This includes following glove removal, due to the potential for minute glove leakage. (Estimates of vinyl glove leakage range from 4% to 63%; latex gloves, 3% to 52%.[5]) Healthcare facilities also clean the rooms of colonized or infected patients thoroughly, using special equipment and processes.

However, these recommendations apply to *known* MDRO infections; a patient's MDRO status may remain unknown unless the facility performs active surveillance or until staff complete the chart review, which may occur up to two days after admission. Active surveillance, in particular, enables facilities to improve disease control by quickly identifying MDRO-positive patients and then implementing guidelines, policies and procedures. A 1993-2007 study in France found a 30% decrease in MRSA infections in 38 hospitals, following the implementation of rapid notification and feedback on patients with MDROs.[6] Although direct care workers use standard precautions on all patients, these are inadequate to fully contain MDROs in colonized or infected patients, who have the ability to transmit these organisms, especially to vulnerable or immunocompromised individuals.[4]

### Treatment of MDROs

Once identified, treatment of MDROs remains problematic. Although Mupiricin and Chlorhexadine have met with success in eradicating MRSA from nares,[7] treatment of other colonized MDROs remains highly variable.[4] Patients

quickly placed on precautions and appropriately treated prove less likely to transmit organisms to direct care workers and other patients,[4] an important implication for patient safety. Treatment also decreases the chance of MDRO-related complications for the colonized or infected patient, such as re-hospitalization following hospital discharge. When a patient has previously tested positive for an MDRO, facilities usually require a number of specimens, after treatment has been discontinued for a sufficient length of time, in order to discontinue isolation precautions.

### Need for Communication about MDROs

As Mrs. A's case illustrates, too often MDRO-colonized or infected patients are transferred to the next setting of care (inpatient or outpatient) without accompanying documentation or, preferably, sufficient advance notice for the receiving provider to adequately prepare for the patient's arrival. Advance notice enables inpatient providers, for example, to ensure an appropriate room is available and to arrange for isolation and contact precautions upon admission. The first indication that a patient is colonized or infected often occurs when the patient—or in the case study, his daughter— incidentally relates his or her experience to a new nurse. Failing to communicate the MDRO colonization or infection *prior* to the patient's care transition places visiting healthcare workers in jeopardy and increases the likelihood of inadvertent transmission to those workers, a subsequent patient, or visitors. Conversely, it follows that communicating a patient's status is crucial to preventing transmission and maintaining continuity of care during care transitions.[3]

With the incidental discovery of a potential MDRO, the receiving nurse must initiate a lengthy investigative process to confirm the diagnosis with the discharging provider, implement barrier precautions, and educate the patient. Although standard precautions are used on all patients, more stringent contact precautions (e.g., gown and glove) and hand hygiene are required for patients with MDROs—not only to reduce the chance of person-to-person transmission, but also to improve the patient's ongoing treatment.[4] In the absence of treatment, contact precautions, including isolation of colonized or infected patients, still provides the most successful strategy for containment.[4]

## Continuity of Care Form

The Rhode Island Department of Health requires discharging providers to communicate critical patient care information at the time of patient transfer from one health environment to another. The Department's standardized inter-agency report, the Continuity of Care Form, is a five-page, paper-based tool (Table 1) that meets all of the Joint Commission's requirements for information-sharing upon discharge.[8] The Department of Health developed and revised the form over time, using a consensus-based stakeholder process. Some local institutions have incorporated the form into their electronic health record systems, generating it automatically.

Pages 1 and 2 meet all of the necessary discharge requirements; pages 3-4 include adjunct information to provide a clear description of the patient's status and needs; page 5 is strictly for consults and referrals. Although the Department mandate specifies transfer from one licensed healthcare facility (e.g., home health agencies, hospital, and SNFs) to another, local healthcare providers and stakeholders are collaborating to ensure that community physicians consistently receive a copy—recognizing that infor-

**Table 1: Rhode Island Continuity of Care Form**

| Page | Content | Key MDRO Information |
|---|---|---|
| 1 | Legally-binding orders for the next setting of care (Solely the responsibility of the physician or Licensed Independent Practitioner) | Provides information about the patient's diagnoses, current medications, and any active infections (e.g., MRSA, VRE or ESBL) or disease alerts, as well as information about physician initiation or completion of MDRO treatment, and when subsequent culturing should occur |
| 2 | Status (Assessed by nursing in collaboration with the physician, providing dual accountability) | Helps to provide a clear and comprehensive description of the patient's status, including MDROs, from the physician and nursing perspectives |
| 3 | Physical and functional status | Informs providers about any effects of the patient's condition (e.g., skin or genitourinary assessments), requiring the next setting of care to address known limitations (such as muscular deconditioning) and maximize activities of daily living |
| 4 | Multi-disciplinary discharge summary notes | As with p. 2, helps to provide a clear and comprehensive description of the patient's condition, (e.g., respiratory status) this time from the ancillary providers' perspective |
| 5 | Consultations and referrals | If applicable, serves as the necessary background information regarding next steps in patient care (e.g., an infectious disease consult), both for (1) the provider performing the consult or referral and (2) the provider assuming responsibility for the patient's care or aspects of the patient's care, if different from the consulting provider<br>May be the only page completed on transfer from a LTC facility to the Emergency Department prior to an inpatient admission |

**Table 2: Continuity of Care Form MDRO Audit (N=44)**

| Information on the Form | Documentation | n (%) |
|---|---|---|
| Had known MDRO colonization/ infection listed | 30 | (68.2%) |
| Had known MDRO site listed | 20 | (45.0%) |
| Current antibiotic therapy was noted | 15 | (34.1%) |
| Result dates of (+) MDRO cultures listed | 8 | (18.2%) |

mation about a patient's health event and status (including MDROs) is vital to community physicians' ability to care for their patients. Some providers also give copies to patients and their caregivers, recognizing that the information can help them understand their conditions.

Despite the fact that accurate information (e.g., follow-up culture information) about MDRO colonization or infection on the Continuity of Care Form has the potential to ensure the timely communication of pertinent information needed to discontinue the patient's disease alert status, the authors find that documentation of a patient's MDRO status is often incomplete or absent. In March 2010, we conducted a random audit of Continuity of Care Forms on 44 patients with known MDRO colonization or infection who had been transferred from one Rhode Island healthcare facility to another. Approximately two in five patients were discharged from hospital to home with home care services (n=18, 41%) or hospital to a LTC facility (n=19, 43%), while seven (16%) were admitted to a hospital from a LTC facility. Of the 44 forms, 14 did not contain any information alerting the facility that the patient had an MDRO. Complete information from the audit can be found in Table 2.

Informal interviews with physicians, discharge planners and department heads suggest there is little understanding of the seriousness of MDRO transmission, or the importance of accurate information on the Continuity of Care Forms. One interviewee believed that forms were more likely to be complete when a patient was being discharged to a LTC facility, due to the receiving facility's requirements, but said that for a patient discharged home, the hospital does not complete the same process. LTC facilities receiving patients from an acute care facility may have to re-admit residents to a private room, and not their previous locale. Private isolation rooms are limited in most LTC facilities, making cohorting necessary in order to receive the returning patient with an MDRO.

The above results clearly indicate, both formally and informally, substantial opportunity for improvement in the local use of the Continuity of Care Form to communicate MDROs. Failure to disclose a MDRO can delay the initiation of proper transmission-based precautions, resulting in a period of time during which the transmission risk to others remains heightened because appropriate barrier precautions have not been implemented.[9]

**Although direct care workers use standard precautions on all patients, these are inadequate to fully contain MDROs in colonized or infected patients...**

## Recommendations

Due to the gaps between evidence-based strategies for preventing MDRO transmission and the timely communication necessary to ensure best practices are systematically implemented, the authors recommend that direct care workers, including physicians, use the Continuity of Care Form to improve MDRO-related patient safety. Physicians and discharge planners must ensure that MDRO information be included on all Continuity of Care Forms. The correct use of the Continuity of Care Form will give receiving providers and physicians accurate, concise and timely information. For example, knowing the positive culture dates and sites, beginning and ending treatment dates, and orders for subsequent testing will enable receiving providers to identify a patient's current status, have the opportunity to treat the patient, when appropriate, and follow-up with culturing that would potentially allow the discontinuation of contact precautions. The standardized, complete transfer of information (including MDROs) during patient care transitions:

- Ensures consistent, accurate information transfers from one facility to the next
- Improves communication (and relationships) between providers
- Alerts receiving providers of known MDRO colonization or infection, facilitating uninterrupted or early treatment/control and implementation of appropriate barrier precautions
- Helps providers determine treatment effectiveness
- Allows providers to educate the patient and/or family
- Limits complications for the patient and spread to other patients, improving patient safety
- Increases favorable outcomes among patients, including the potential to discontinue barrier precautions
- Decreases overall rates of MDRO infections

The standardized, complete transfer of MDRO information further ensures that MDRO-positive patients do not compromise the safety of others.

## Additional Information

The Rhode Island Department of Health's Continuity of Care Form is available for use or adaptation on the Department's website at www.health.ri.gov/forms/continuityofcare/index.php.

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*Linda Oliver, RN, is Infection Preventionist, Kent Hospital.*

*Debbie Maaz, RN, BSN, is Director, Infection Prevention & Control, Kent Hospital.*

*Michelle Cahill, LPN, is Infection Preventionist/ Wound Nurse, Oakland Grove Health Care Center, Woonsocket, RI.*

*Liz Martino, MT, MBA, CIC, is Infection Preventionist, Roger Williams Medical Center.*

*Paula Foster, RN, BSN, is Occupational Health Specialist/ Infection Preventionist, VNA of Care New England, Warwick, RI*

**Disclosure of Financial Interests**

The authors and/or significant others have no financial interests to disclose.

**Correspondence**
Linda Oliver, RN
Kent Hospital
Infection Prevention & Control Department
455 Toll Gate Road
Warwick, RI 02886
Phone: (401) 737-7000, x1557
e-mail: loliver@kentri.org

# Public Reporting of Hospital-Acquired Infections

*Melinda Thomas, MS, and Samara Viner-Brown, MS*

**Since 1998, the Rhode Island Department** of Health has worked in partnership with local healthcare providers and stakeholders to implement a legislatively-mandated healthcare quality reporting program.[1] The program aims to: (1) provide comparative ratings for healthcare consumers choosing amongst local healthcare facilities, such as home health agencies, hospitals, and nursing homes, and (2) facilitate inter-provider benchmarking to help mobilize quality improvement in the Rhode Island market. This article describes the recent expansion of public reporting in Rhode Island to include facility-level reports of hospital-acquired infections.

## State and Federal Efforts

### The Hospital Infection Disclosure Act

In 2008, the Hospital Infection Disclosure Act expanded Rhode Island's quality reporting legislation to include hospital-acquired infections,[2] which affect 5-10% of hospital patients and cause approximately 100,000 deaths each year.[3] Some estimates place the per-infection cost at $20,000-$25,000, resulting in added costs of more than $33 billion to the healthcare system as a whole.[4] However, as discussed in Mermel's article,[5] hospital-acquired infections are considered largely preventable with the delivery of high-quality care and implementation of effective, consistent infection control practices, such as hand hygiene.[6] The legislation was introduced on behalf of a constituent whose spouse died as a result of a hospital infection; the law requires the Department of Health to report hospital-acquired infections for Rhode Island's 11 acute care hospitals at least annually.

Following enactment of the legislation in October 2008, the Department of Health convened a stakeholder group (the composition outlined in the legislation), including consumers, employers, and professionals (e.g., infection control preventionists), as well as data experts, such as epidemiologists and researchers. This broad stakeholder involvement is consistent with the Department's consensus-based approach to public reporting and a key element of the program's structure. The stakeholder group leverages diverse expertise, skill sets, and viewpoints in order to obtain buy-in for proposed topics and associated measures, vet reporting formats, and disseminate public reports.

### Department of Health and Human Services Priority Topics

While Rhode Island was enacting the Hospital Infection Disclosure Act, the Federal government was beginning a coordinated effort to address the prevention of hospital-acquired infections. First, the US **General Accounting Office (GAO)** cited the importance of national leadership to prioritize and implement hospital-acquired infection prevention tactics,[7] which spurred the US **Department of Health and Human Services' (HHS's)** 2009 Action Plan.[6] The HHS Action Plan made reducing preventable HAIs a national priority and required the integration of efforts to address this priority across all HHS agencies, including the Agency for Healthcare Research and Quality, the **Centers for Disease Control and Prevention (CDC)**, and **the Centers for Medicare & Medicaid Services (CMS).** Importantly, the Action Plan emphasized public reporting "to build on the principles of transparency and consumer choice to create incentives and motivate healthcare organizations and providers to provide better, and more efficient care."[6]

In late 2009, the CDC awarded the Rhode Island Department of Health (among other health departments across the country) a 27-month American Recovery and

**Table 1: Rhode Island Hospital-Acquired Infection Topics (to date)**

| Tier | Priority Topic / Measure(s) | Date Released | Data Source |
|---|---|---|---|
| 1. | Surgical care | Jun 2009 | Quarterly Medicare Hospital Compare data |
| | • % of surgery patients given antibiotics within one hour prior to surgery | | |
| | • % of surgery patients given the right kind of antibiotics before surgery | | |
| | • % of surgery patients who stop receiving antibiotics within 24 hours of surgery | | |
| 2. | Intensive Care Unit (ICU) care | Jun 2009 | Quarterly ICU data |
| | • Central line-associated bloodstream infections | | |
| 3. | Infection control | | Annual primary data collection |
| | • Hand hygiene & glove use education (Y/N) | Feb 2010 | |
| | • Hand hygiene measurement (Y/N) | Feb 2010 | |
| | • Hand hygiene reporting (Y/N) | Feb 2010 | |
| | • % of healthcare workers vaccinated for influenza | Sept 2010* | |
| 4. | Infection rates | Dec 2010* | Quarterly primary data collection |
| | • *C. difficile* incidence | | |
| | • MRSA incidence | | |

*Anticipated release date

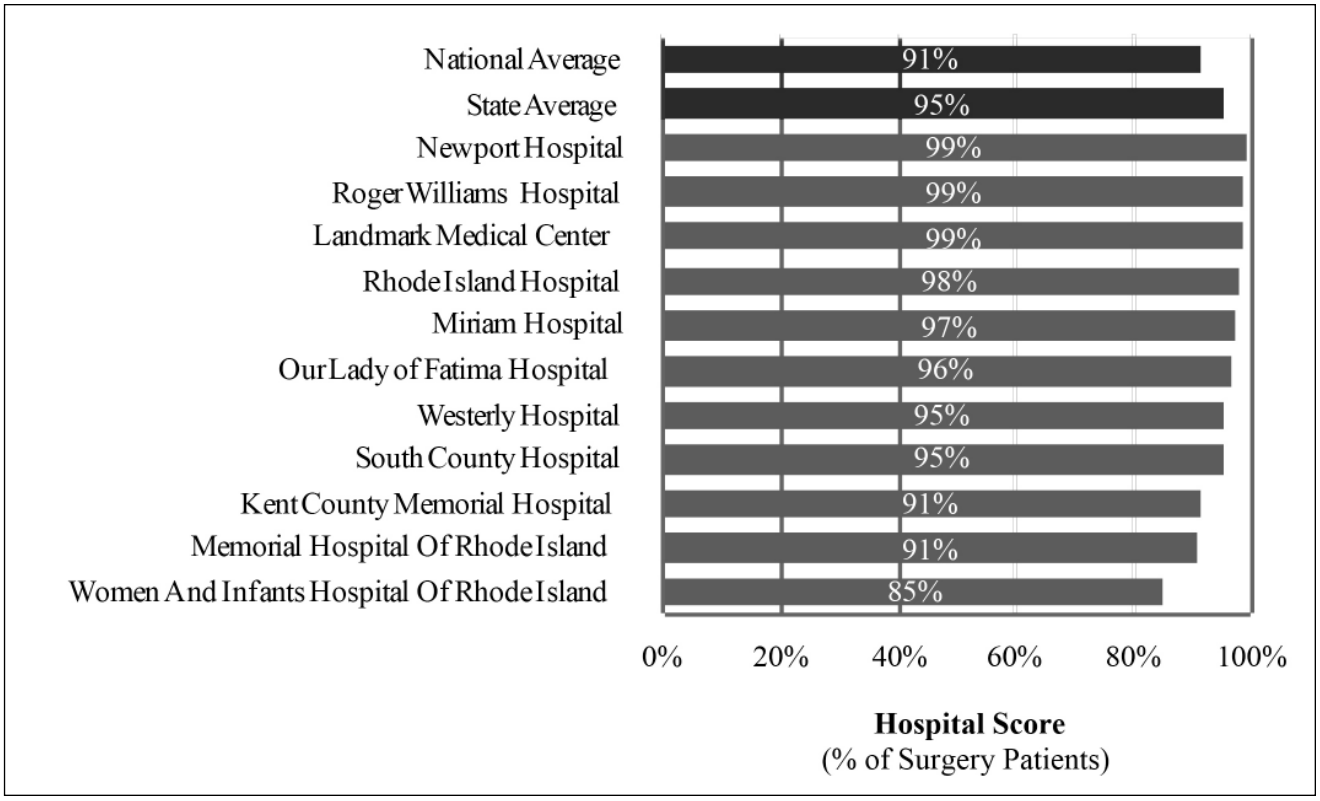


Figure 1: Percent of surgery patients who were given an antibiotic at the right time (within one hour before surgery) to help prevent infection

Reinvestment Act grant to name a coordinator, convene a multidisciplinary group, and develop a state plan for reporting hospital-acquired infections. The Department named the program's project director as the state's plan coordinator and used the existing stakeholder group, described above, to assess the state's existing prevention efforts and select two HHS priority prevention topics for public reporting. In March 2010, the group selected ***Clostridium difficile*** (***C. difficile***) and **Methicillin-resistant *Staphylococcus aureus*** (**MRSA**), described in articles in this issue.[8,9]

CMS also signaled its intentions to cease reimbursing hospitals for certain infections and add to its existing hospital-acquired infection reporting, indicating that coordinated national efforts are gaining momentum and likely to increase the spotlight on hospital (and other healthcare-associated) infections in the coming months.

## Hospital-Acquired Infection Reporting

### Prioritizing Reporting Topics

Recognizing both the public's desire for timely information and the complexity of prioritizing HAI measures, the Department of Health's stakeholder group implemented a tiered approach to reporting, with initial topics selected based on readily-available data and subsequent reports requiring additional data collection. (Table 1) This enabled Rhode Island to begin publicly reporting hospital-acquired infections in June 2009 — well in advance of the Hospital Infection Disclosure Act's October 2010 deadline—and continually add additional topics.

As the Department of Health moves from Tier 1 (surgical care) to Tier 4 (infection rates), the data sources and measurement strategies grow increasingly complex, with Tier 4 measures requiring infection preventionists across all 11 acute care hospitals to agree to common definitions and sampling methods for the incidence measures, and then devote infection control staff resources to collecting and validating these data quarterly. As a result of the increasing complexity and staff burden, the stakeholder group's measurement and policy input are particularly key for these subsequent measures.

### Creating Comparative Reports

For each of the topics in Table 1, the stakeholder group recommends a reporting format—bearing in mind that the quality reporting program's primary goal of providing comparative ratings (rather than raw scores) to healthcare consumers. Figure 1 provides an example of a report format. It includes the hospitals' July 2008-June 2009 scores for one of the surgical care measures: the percent of surgery patients who were given an antibiotic at the right time to help prevent infection.

The Department of Health aims to package information in an easily understandable format for consumers. Where possible, the reports benchmark hospitals' performance against national standards. For example, the central line-associated bloodstream infections reports compare hospitals' incidence rates to national incidence rates (expected rates), calculating "standardized incidence ratios" that demonstrate how each hospital performs compared to what is expected. [See Health by Numbers, this issue] These ratios are then translated into diamond rankings (one, two, or three diamonds) to help consumers easily interpret the results as worse than, about the same as, or better than expected. These and other hospital-acquired infection reports are available on the Department's website at www.health.ri.gov/chic/performance.

## Conclusion

Rhode Island's hospital-acquired infection reporting is equipped with authority under the law and the strong commitment of the members of its stakeholder group, which includes hospitals and their infection preventionists. Several measures related to hospital-acquired infections are reported on the Department of Health's website and the Department will add additional measures, including the two incidence rates that reflect national HHS priority topics. Now that data are becoming widely available to healthcare consumers and to hospitals themselves, the challenge is shifting from devising effective methods to validating these data and conducting surveillance over time, as well as to implementing evidence-based prevention strategies identified by HHS and discussed elsewhere in this issue.

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*Melinda Thomas, MS, is Senior Policy Advisor, Rhode Island Department of Health.*

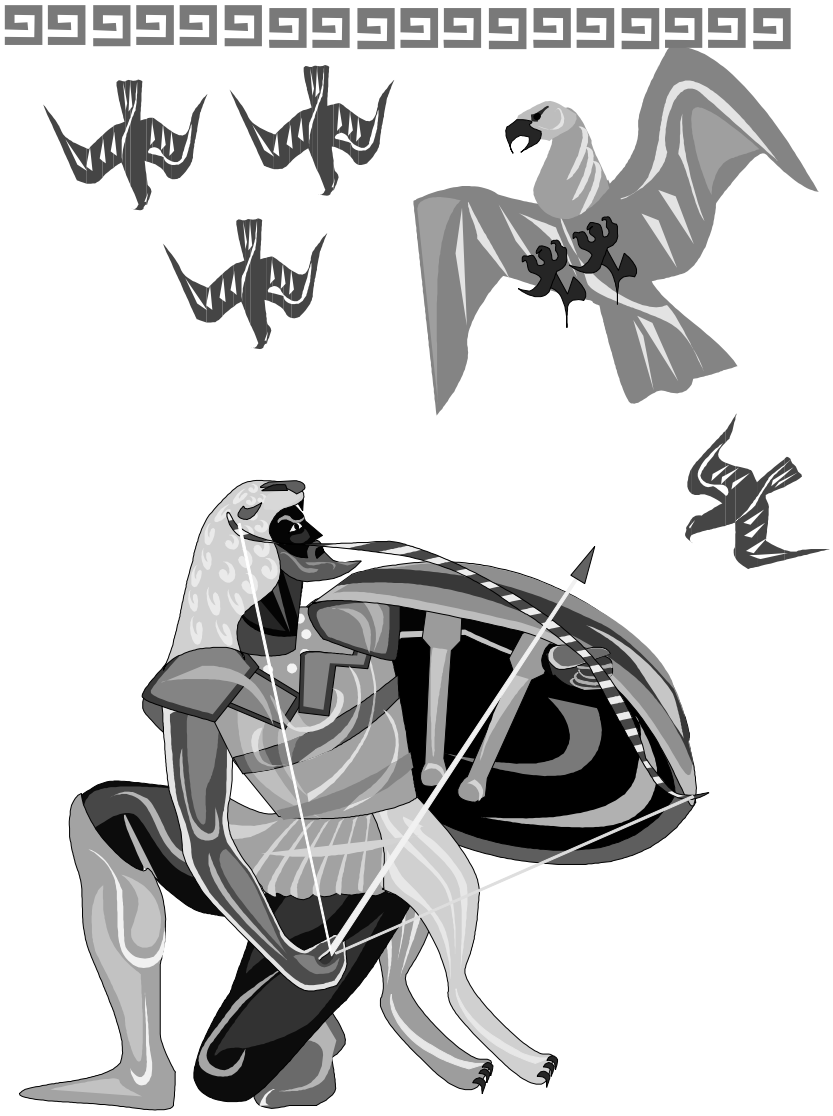
*Samara Viner-Brown, MS, is Chief, Center for Health Data and Analysis, Rhode Island Department of Health.*

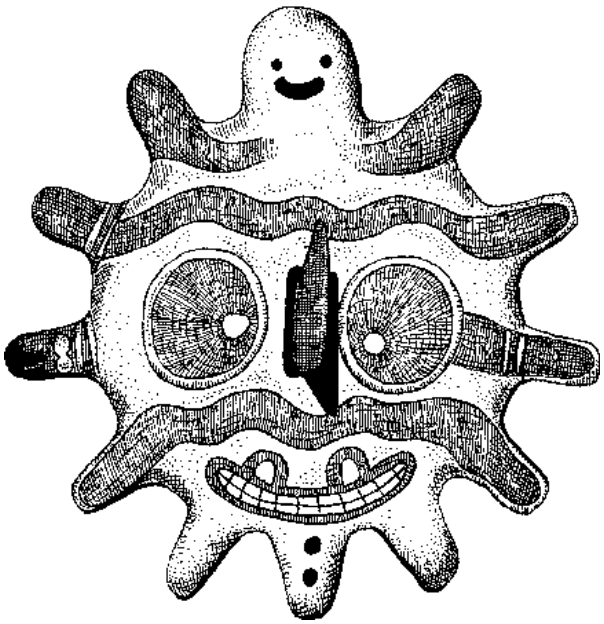

### Disclosure of Financial Interests

The authors and/or significant others have no financial interests to disclose.

## Correspondence


Melinda Thomas, MS
RI Department of Health, Room 407
Three Capitol Hill
Providence RI 02908
Phone: (401) 222-7465
e-mail: melinda.thomas@health.ri.gov



## Information for Contributors, *Medicine & Health/Rhode Island*

*Medicine & Health/Rhode Island* is peer-reviewed, and listed in the *Index Medicus*.
We welcome submissions in the following categories.

### Contributions

Contributions report on an issue of interest to clinicians in Rhode Island: new research, treatment options, collaborative interventions, review of controversies. Maximum length: 2500 words. Maximum number of references: 15. Tables, charts and figures should be submitted as separate electronic files ( jpeg, tif, or pdf ).

### Creative Clinician

Clinicians are invited to describe cases that defy textbook analysis. Maximum length: 1200 words. Maximum number of references: 6. Photographs, charts and figures may accompany the case.

### Point of View

Readers share their perspective on any issue facing clinicians (e.g., ethics, health care policy, relationships with patients). Maximum length: 1200 words.

### Advances in Pharmacology

Authors discuss new treatments. Maximum length: 1200 words.

### Advances in Laboratory Medicine

Authors discuss a new laboratory technique. Maximum length: 1200 words.

### Images in Medicine

Authors submit an interesting Image, with a 300-400 word explanation.

For the above articles: Please submit an electronic version (Microsoft Word or Text) with the author's name, mailing address, phone, fax, e-mail address, and clinical and/or academic positions to the managing editor, Joan Retsinas, PhD, e-mail: joan.retsinas@gmail.com For additional information, phone: (401) 272-0422.

# Spontaneous Pneumomediastinum: An Uncommon Cause of Chest Pain

*Tyler Harris, MD, and Thaddeus Herliczek, MD*

**A three-year old boy with a history of reactive airway disease** requiring occasional nebulizer therapy presented to the Hasbro Emergency Department with complaints of cough, dyspnea, and chest pain. His physical examination was significant for an otherwise healthy appearing but mildly distressed child with diminished breath sounds bilaterally and a bilateral expiratory wheeze. His laboratory workup was unrevealing. Imaging studies are presented in Figures 1-4.

## Diagnosis

Spontaneous pneumomediastinum, due to increased alveolar pressure related to bronchiolar constriction and cough.

## Discussion

Pneumomediastinum is gas within the anatomic space bordered by the thoracic inlet superiorly, diaphragm inferiorly, mediastinal pleura laterally, and chest wall antero-posteriorly. It is generally classified as either spontaneous, without clear antecedent event, or secondary, most commonly to trauma, interstitial lung disease, iatrogenic causes, perforated esophagus or less likely due to pneumoperitoenum or pneumoretroperitoneum. Spontaneous pneumomediastinum, as in the present case, is related to increased alveolar pressures resulting in alveolar rupture, with air tracking to the mediastinum via peribronchovascular spaces in a process known as the Macklin effect.[1] It is relatively rare, thought to represent approximately 1 in 30,000 ER visits, most commonly affecting adolescent males.[2] Purported etiologies for spontaneous pneumomediastinum include forced expiration against a closed glot-

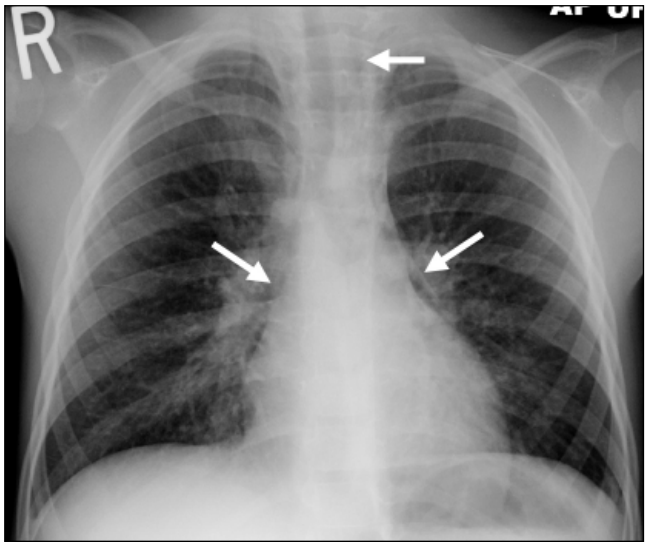



Figure 1: Presenting AP Upright chest radiograph demonstrating lucency tracking along the lateral heart borders bilaterally and into the cervical soft tissues.

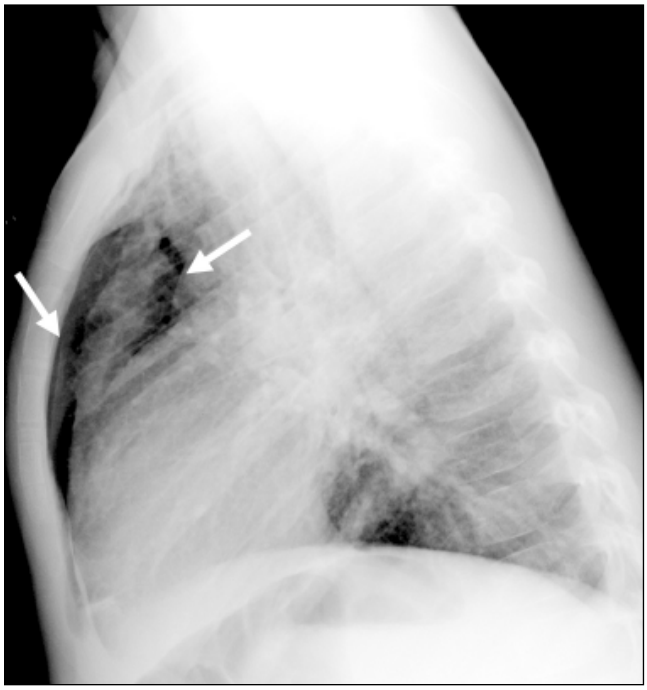


Figure 2: Presenting lateral chest radiograph demonstrating retrosternal lucency compatible with pneumomediastinum surrounding the retrosternal fat and thymus.

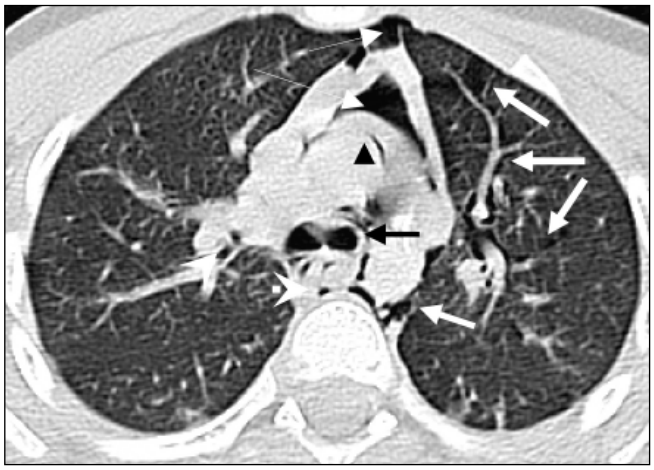


Figure 3: Axial CT image of the upper mediastinum demonstrating pulmonary interstitial emphysema of the left upper lobe (thick white arrows) as well as mediastinal air surrounding the thymus (thin white arrows), ascending aorta (black arrowhead), descending aorta (hollow white arrow), azygous (white arrowheads), and main stem bronchi (black arrow).

Figure 4: Coronal CT image demonstrating extensive cervical soft tissue subcutaneous emphysema (upper black arrow) as well as air surrounding the left jugular vein, left brachiocephalic vein (white arrow), and ascending aorta (lower black arrow).

tis (coughing, straining), aspirated foreign body, inhalational drug use, asthma, and wretching.

Clinically, the patients can present with retrosternal chest pain and dyspnea. Physical examination may reveal crepitus within the subcutaneous tissues of the chest and neck[2]. A relatively specific finding of crepitus timed to the cardiac cycle, rather than the respiratory cycle, termed Hamman's sign, may rarely be seen.

Plain radiographic features of pneumomediastinum are well demonstrated in the present case, and include air on either side of the cardiac silhouette extending into the superior mediastinum and the cervical soft tissues. Infants and young children may exhibit the "thymic sail sign" on the frontal chest radiograph in which gas outlines the thymus. The lateral radiograph is generally more sensitive than the frontal view, and demonstrates linear retrosternal gas. CT recapitulates these findings and can demonstrate air tracking along the bronchovascular tree including interstitial emphysema, air surrounding main stem bronchi, and paratracheal air. Air surrounding mediastinal vascular structures can result in a "ring around the artery" sign.[3] CT is not typically performed in the setting of spontaneous pneumomediastinum and a diagnostic radiograph. In the present case, CT was performed to assess suspected mediastinal lymph node enlargement.

While associated with startling radiographic features, spontaneous pneumomediastinum carries a benign clinical course, with resolution of findings after 7-14 days. In contrast, pneumomediastinum secondary to a perforated esophagus (Boerhaave's Syndrome), carries a grim prognosis, with a reported mortality of approximately 20-30%.[4] These latter patients are distinguished by a history of emesis, typically in the setting of excessive food or alcohol intake, with severe lower chest pain and cervical emphysema (Meckler's triad). Often, these patients experience cardiovascular collapse related to mediastinitis and subsequent shock. Historical and clinical features are often helpful in distinguishing benign causes of spontaneous pneumomediastinum from the potentially fatal pneumomediastinum secondary to esophageal rupture. Radiographically, the presence of a pleural effusion, enlarging pneumothorax, or focal air or fluid adjacent to the esophagus on cross-sectional imaging should alert the clinician to the possibility of esophageal rupture.[5,6] In clinically indeterminate cases, a contrast esophagram can be helpful in excluding esophageal tear.

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*Tyler Harris, MD, is a Diagnostic Radiology Resident, The Warren Alpert Medical School of Brown University.*

*Thaddeus Herliczek, MD, is Section Chief, Pediatric Imaging, Hasbro Children's Hospital, and Associate Professor of Diagnostic Imaging, The Warren Alpert Medical School of Brown University.*


### Disclosure of Financial Interests

The authors and/or significant others have no financial interests to disclose.

## Correspondence


Tyler Harris, MD
Department of Diagnostic Imaging
Rhode Island Hospital
593 Eddy Street
Providence, RI 02903
e-mail: tharris2@lifespan.org

Health By Numbers
Rhode Island Department of Health • David Gifford, MD, MPH, Director of Health
Edited by Samara Viner-Brown, MS

# Central Line-Associated Bloodstream Infections (CLABSI) in Rhode Island

*Samara Viner-Brown, MS, and Rosa Baier, MPH*

**Central Line-Associated Bloodstream Infections (CLABSIs)** are primary bloodstream infections in patients who had a central line in place within 48 hours before the development of the infection. Central line infections are the most common bloodstream infections and are reasonably preventable with proper care.

## Methodology

Rhode Island hospitals collect and report data on CLABSI rates in hospital **Intensive Care Units (ICUs)** to the Department of Health as part of the Health Care Quality Performance Program's public reporting mandate. Rates are based on CLABSIs that occur in the hospital ICU. Many hospitals have been collecting this information for several years as part of Rhode Island's ICU Collaborative. The CLABSI incidence rate is calculated as the number of line infections divided by the number of central line days multiplied by 1,000. Each hospital's rate is compared to the rates of other ICUs nationally that provide similar care using a **standardized incidence ratio (SIR).** The SIR is calculated based on the observed cases (the actual number of line infections) divided by the expected cases, which is based on the average national CLABSI incidence rate for that ICU type. For hospitals with SIRs calculated, each hospital's SIR is included in the public report and helps to determine its diamond category as described in the results section. Diamonds are assigned based on how different each ICU's performance is from the average performance of similar ICUs across the country.

Diamond categories are based on hospitals' SIRs. A SIR less than 1.0 means the hospital's rate is lower or better than the national average; a SIR greater than 1.0 is higher or worse than the national average. The margin of error, or 90% confidence interval, determines whether each SIR is meaningfully different from 1.0. If there is no national comparison for a hospital ICU type, then neither a SIR nor diamonds are calculated.

Diamonds are assigned as follows:

- One diamond (*): If the SIR falls above 1.0 (*is worse than expected*) AND its margin of error, or "90% confidence interval," does not include 1.0, then the hospital has one diamond.

- Two diamonds (**): If the 90% confidence interval for the score includes the Rhode Island average, then the hospital's score is not accurate enough to categorize it as better or worse than other hospitals (*is about the same as expected*). The hospital has two diamonds.

- Three diamonds (***): If the SIR falls below 1.0 (*is better than expected*) AND its margin of error, or "90% confidence interval," does not include 1.0, then the hospital has three diamonds. **Note**: The exception is when the hospital does not have any infections (where 0 is the best performance). When this occurs, a hospital is automatically given three diamonds.

## Results

Table 1 shows the number of CLABSI infections, number of central-line days, the CLABSI rate per 1,000 central-line days, the SIR based on the national benchmark, 90% confidence interval range, and diamond ratings by ICU type and hospital. There are twelve ICU types including: adult step-down units, coronary care units, medical intensive care units, medical/surgical critical care units at major teaching hospitals and all other hospitals, **Women & Infants Hospital's (WIH)** Level III **neonatal intensive care units (NICU)** by birth weight and umbilical catheter-associated infections at WIH Level III NICU by birth weight, neurosurgical intensive care units, pediatric medical/surgical intensive care units, surgical intensive care units, surgical cardiothoracic critical care units and trauma intensive care units.

During January-March 2010, there were no CLABSI infections at the adult step down units, coronary care units, surgical cardiothoracic critical care units, and trauma intensive care units, and there were no umbilical catheter-associated infections at the NICU. Among the remaining ICU types, the number of CLABSI infections ranged from 1 to 3 and the rate per 1,000 central line days ranged from 1.49 to 21.74. Among the four medical/surgical critical care units at major teaching hospitals, three received three stars and one received two stars. Among the six medical/surgical critical care units at non-teaching hospitals, three received three stars, two received two stars and one received one star.

## Discussion

Hospitals vary in the types of patients, and infection rates may be higher among those facilities that treat a high number of severely ill patients.

It is anticipated that public reporting CLABSI rates among

## Table 1. CLABSI Rates by Hospital ICU Type

| Hospital (Alphabetical by ICU type) | Number of CLABSI Infections | Number of Central Line Days | CLABSI Rate per 1,000 Central Line Days | SIR | 90% CI* Lower Limit | 90% CI* Upper Limit | Diamonds |
|---|---|---|---|---|---|---|---|
| **Adult Step-Down Units (Post-Critical Care)** | | | | | | | |
| Miriam Hospital CVTI* | 0 | 121 | 0.00 | 0.00 | - | - | *** |
| Rhode Island Hospital ISCU* | 0 | 473 | 0.00 | 0.00 | - | - | *** |
| Rhode Island Hospital ICCU* | 0 | 98 | 0.00 | 0.00 | - | - | *** |
| Rhode Island Hospital ICTU* | 0 | 272 | 0.00 | 0.00 | - | - | *** |
| **Coronary Critical Care Units (CCUs)** | | | | | | | |
| Miriam Hospital | 0 | 115 | 0.00 | 0.00 | - | - | *** |
| Rhode Island Hospital | 0 | 215 | 0.00 | 0.00 | - | - | *** |
| **Medical Intensive Care Units (CCUs)** | | | | | | | |
| Rhode Island Hospital | 3 | 924 | 3.25 | 1.35 | 0.365 | 3.493 | ** |
| **Medical/Surgical Critical Care Units (ICUs) at Major Teaching Hospitals** | | | | | | | |
| Memorial Hospital | 0 | 487 | 0.00 | 0.00 | - | - | *** |
| Miriam Hospital | 0 | 909 | 0.00 | 0.00 | - | - | *** |
| Providence VA Medical Center | 2 | 235 | 0.00 | 8.51 | 0.734 | 13.372 | ** |
| Roger Williams Medical Center | 0 | 287 | 0.00 | 0.00 | - | - | *** |
| **Medical/Surgical Critical Care Units (ICUs) at All Other (Non-Teaching) Hospitals** | | | | | | | |
| Kent County Hospital | 1 | 668 | 1.50 | 1.00 | 0.039 | 4.719 | ** |
| Landmark Medical Center | 1 | 670 | 1.49 | 1.00 | 0.039 | 4.705 | ** |
| Newport Hospital | 0 | 196 | 0.00 | 0.00 | - | - | *** |
| Our Lady of Fatima Hospital | 0 | 379 | 0.00 | 0.00 | - | - | *** |
| South County Hospital | 0 | 97 | 0.00 | 0.00 | - | - | *** |
| Westerly Hospital | 3 | 138 | 21.74 | 14.49 | 3.914 | 37.415 | * |
| **Women and Infants Hospital's Level III Neonatal Intensive Care Units (NICU), by Birthweight** | | | | | | | |
| <750 grams | 1 | 52 | 19.23 | 5.20 | 0.205 | 24.58 | ** |
| 751-1,000 grams | 0 | 158 | 0.00 | 0.00 | - | - | *** |
| 1,001-1,500 grams | 0 | 155 | 0.00 | 0.00 | - | - | *** |
| 1,501- 2,500 grams | 0 | 11 | 0.00 | 0.00 | - | - | *** |
| >2,500 grams | 1 | 156 | 6.41 | 3.21 | 0.127 | 15.155 | ** |
| **Umbilical Catheter-Associated Infections at Women and Infants Hospital's Level III NICU, by Birthweight** | | | | | | | |
| <750 grams | 0 | 70 | 0.00 | 0.00 | - | - | *** |
| 751-1,000 grams | 0 | 55 | 0.00 | 0.00 | - | - | *** |
| 1,001-1,500 grams | 0 | 100 | 0.00 | 0.00 | - | - | *** |
| 1,501- 2,500 grams | 0 | 6 | 0.00 | 0.00 | - | - | *** |
| >2,500 grams | 0 | 57 | 0.00 | 0.00 | - | - | *** |
| **Neurosurgical Intensive Care Units (INCs)** | | | | | | | |
| Rhode Island Hospital | 1 | 550 | 1.82 | 0.73 | 0.029 | 3.439 | ** |
| **Pediatric Medical/Surgical Intensive Care Units (PICUs)** | | | | | | | |
| Rhode Island Hospital | 1 | 301 | 3.32 | 1.15 | 0.045 | 5.417 | ** |
| **Surgical Intensive Care Units (SICUs)** | | | | | | | |
| Rhode Island Hospital | 1 | 499 | 2.00 | 0.87 | 0.034 | 4.120 | ** |
| **Surgical Cardiothoracic Critical Care Units** | | | | | | | |
| Miriam Hospital CVTS* | 0 | 274 | 0.00 | 0.00 | - | - | *** |
| Rhode Island Hospital CTIC* | 0 | 521 | 0.00 | 0.00 | - | - | *** |
| **Trauma Intensive Care Units (TICUs)** | | | | | | | |
| Rhode Island Hospital | 0 | 488 | 0.00 | 0.00 | - | - | *** |

***Notes:** Confidence intervals are not applicable when SIR equals 0.000.
CVTI: Cardiovascular Thoracic Intermediate Care Unit
ISCU: Surgical Care Unit
ICCU: Intermediate Coronary Care Unit
ICTU: Intermediate Cardiothoracic Unit

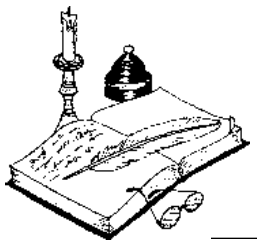
hospitals will help these facilities to identify areas for improvement and ultimately result in a reduction of central line related infections in the future. Tracking CLABSI rates will provide the opportunity for hospitals to measure and determine their progress in the prevention and reduction of CLABSIs in their facilities.

*Samara Viner-Brown, MS, is Chief of the Center for Health Data and Analysis at the Rhode Island Department of Health*

*Rosa Baier, MPH, is Senior Scientist at Quality Partners of Rhode Island.*

### Disclosure of Financial Interests

The authors and/or significant others have no financial interests to disclose.



# Physician's Lexicon

## The Cleansing of Blunt Language

**The profession of medicine has often** been accused of using big words to hide stark realities, of masking uncomfortable situations that are customarily described by less decorous, blunter, more readily understood Anglo-Saxon words. The ancient Greeks had a word for this; they called this process of employing courteous circumlocutions, *euphemy.* The *eu-* prefix denotes good, well or normal, as in words such as eucaryote, eugenic (healthy birth), euglobulin, Eugene (nobly born), euphoria (well-being) but not eunuch (derived from the Greek root *eune* meaning bed).

If euphemy defines a good word, then blasphemy describes its opposite, to speak impiously of someone or something. The Greek root, *blas-*, denotes something ill or obscene.

In the interests of clarity and availability to physicians of all nations, medicine confines most of its technical vocabulary to the two languages that were, at one time, universally understood by its practitioners: classical Greek and Latin. Still, the lay public contends that a simpler assortment of words should be employed when physicians talk to them about their immediate illnesses.

Admittedly, medicine does not deliberately offer the arcane term, endorhinocurettage as a synonym for deliberate nose-picking, although the euphemism is certainly more polite. Nor is the profession thinking of substituting "radiation enhancement device" for atom bombs. Nor yet has medicine furthered such commonly encountered circumlocutions as judicially-sanctioned execution or capital punishment for state murder; or strategic misrepresentation for diplomatic lying. We as a profession are guilty, however, of renaming plastic or reconstructive surgery as esthetic surgery, and rheumatology as articularly-challenged medicine.

And though blaspheme had its roots in ancient Greek, it wended its way through a succession of Germanic languages including Middle English as *blasfemen,* meaning to speak ill of someone. The *–pheme* root has its origins in a Greek word meaning fame, renown or voice. Aphemia, an obsolete term for motor aphasia, is the inability to express thought in articulated language it is a word coined by the neurologist Paul Broca (1824 – 1880).

George Bernard Shaw once observed that all great truths begin as blasphemies.

– Stanley M. Aronson, MD

Rhode Island Department of Health
David Gifford, MD, MPH
Director of Health

# Vital Statistics

Edited by Colleen Fontana, State Registrar

## Rhode Island Monthly Vital Statistics Report Provisional Occurrence Data from the Division of Vital Records

| Underlying Cause of Death | Reporting Period | | | |
|---|---|---|---|---|
| | September 2009 | 12 Months Ending with September 2009 | | |
| | Number (a) | Number (a) | Rates (b) | YPLL (c) |
| Diseases of the Heart | 169 | 2,359 | 224.5 | 3,150.0 |
| Malignant Neoplasms | 177 | 2,256 | 214.7 | 6,225.0 |
| Cerebrovascular Diseases | 38 | 424 | 40.4 | 877.0 |
| Injuries (Accidents/Suicide/Homicde) | 53 | 576 | 54.8 | 9,688.5 |
| COPD | 51 | 527 | 50.2 | 344.5 |

| Vital Events | Reporting Period | | |
|---|---|---|---|
| | March 2010 | 12 Months Ending with March 2010 | |
| | Number | Number | Rates |
| Live Births | 1,020 | 12,185 | 11.4* |
| Deaths | 830 | 9,109 | 8.5* |
| *Infant Deaths* | (8) | (84) | 6.9# |
| *Neonatal Deaths* | (5) | (69) | 5.7# |
| Marriages | 247 | 6,157 | 5.8* |
| Divorces | 336 | 3,157 | 3.0* |
| Induced Terminations | 406 | 4,182 | 343.2# |
| Spontaneous Fetal Deaths | 92 | 704 | 57.8# |
| *Under 20 weeks gestation* | (88) | (628) | 51.5# |
| *20+ weeks gestation* | (4) | (76) | 6.2# |

(a) Cause of death statistics were derived from the underlying cause of death reported by physicians on death certificates.

(b) Rates per 100,000 estimated population of 1,050,788

(c) Years of Potential Life Lost (YPLL)

***Note:*** *Totals represent vital events which occurred in Rhode Island for the reporting periods listed above. Monthly provisional totals should be analyzed with caution because the numbers may be small and subject to seasonal variation.*

* Rates per 1,000 estimated population
\# Rates per 1,000 live births

THE RHODE ISLAND MEDICAL JOURNAL

The Official Organ of the Rhode Island Medical Society
Issued Monthly under the direction of the Publications Committee

VOLUME 1
NUMBER 1

PROVIDENCE, R.I., JANUARY, 1917

PER YEAR $2.00
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## Ninety Years Ago, September 1920

John M. Peters, MD, in the President's Annual Address, gave his impression of "Far Eastern countries which it was my privilege recently to visit." He explained: "I return home with a better understanding of the enormous amount of good done in spiritual, physical and material ways by the missionaries. They surely have been and are the leaders in introducing modern ideas of civilization in these countries." He had visited the medical mission at Canton (opened in 1835), and the Rockefeller-funded medical school and hospital being constructed in Peking. He noted the need to train Chinese citizens in medicine and nursing, praised the cleanliness of Japan, deplored the poverty of China, and praised the General Hospital in Manila (originally staffed by American service personnel, now under the control of the local medical school).

Hilary J. Connor, MD, in "Treatment of Syphilis," discussed the long-term status of 206 patients treated at Providence City Hospital in 1914. In 1919, the clinic staff examined 37 of those patients: 33 tested negative; 4, positive.

Discussing Dr. Connor's paper, Dr. Walter M. Brunet showed instructional films on syphilis, suggested smaller doses of salvarsan. Dr. Carl Sawyer noted a decrease in the number of patients he was seeing with syphilis, due to better hygiene and wartime education. Dr. Henry McCuster discussed neurosyphilis. At Butler he had treated 4 cases with a new treatment, the intracistern injection of salvarsanized serum.

The Editorial, "A Mental Clinic in Our Courts," urged Providence to follow the example of other cities and establish Mental Clinics in connection with courts. "A court psychiatrist will solve many a family problem,…will send many individuals with a diseased nervous system to a hospital instead of a jail or reform school, and will compile valuable data that will…guide…future action of the courts."

## Fifty Years Ago, September 1960

James T. Keenan, MD, contributed "Diagnosis and Management of Acute Small Bowel Obstruction," the prize essay for 1960 of the Providence Surgical Society.

Ezra Sharp, MD, and Alberto Mazzoleni, MD, in "Traumatic Myocarditis, A Case of Subepicardial Injury," described a 53-year old bookkeeper, caught between two men who were fighting. The patient suffered bruises on the shoulders, arms, thighs, face, finger. In the Emergency Room, there was no exam of the heart. The next morning, the patient was "anxious, pale and in distress." An EKG showed a t-wave inversion. After 23 days in the hospital, the patient was almost free of pain when at rest. Three months later, an EKG was normal, but pain persisted. There was a question of cardiac neurosis.

Bencel L. Schiff, MD, in "Carcinoma developing in Psoriatic Lesions," described a 77-year old man with basal and squamous carcinoma cells.

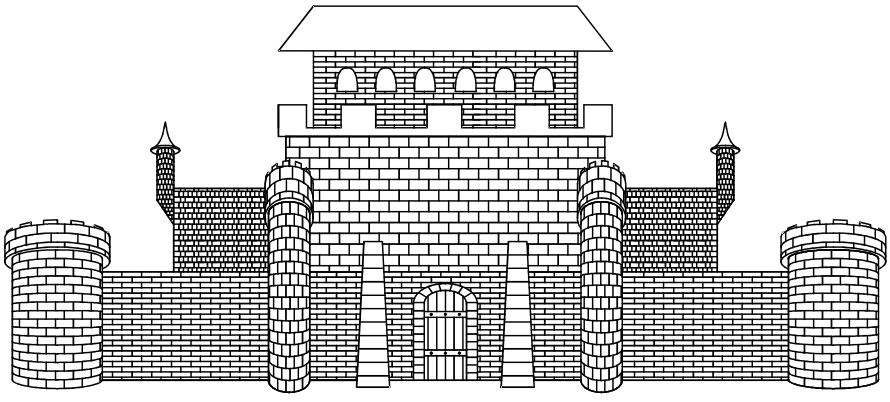
J. John Yashar, MD, John DeFeo, PhD, David DeFanti, MS, and Nathan Kiven, MD, in "Experimental Use of Cardioplegic Agents in Open-Heart Surgery," anesthetized dogs to test various agents. They reported that after 20-25 minutes of cardiac arrest, the dogs recovered.

## Twenty-Five Years Ago, September 1985

The Editor, Seebert J Goldowsky, MD, argued for prohibitions against smoking in hospital common areas, including conference rooms ("unless designated") in "No Smoking Progress".

Francis L. McNelis, MD, and Anthony J. Barone, MD, in "Metastatic Malignant Melanoma in the Mandible," noted the rare spread of this tumor in a 53-year old woman referred by her dentist.

Kenneth W. Burchard, MD, Joseph J. Lambiase, MD, Pardon R. Kenney, MD, and Gus J. Slotman, MD, called "Standard T-Tube Choloangiogram: A Safe Method of Cholangiography."



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