Using Evidence to Develop a Local, Risk-Based Approach to Isolation of Patients with Methicillin-Resistant *Staphylococcus aureus* (MRSA)

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Purpose

Quality improvement project:

- To develop a new approach to screening and isolation of hospitalized patients with a history of MRSA, with the goal of reducing patient isolation-days without compromising patient safety.
The presence of patients colonized with MRSA is strongly associated with nosocomial acquisition of MRSA in hospitals.

- Merrer et al found “colonization pressure” (number of MRSA-carrier pt-days/total pt-days) was the only independent predictive factor on multivariate analysis for nosocomial MRSA acquisition in an ICU (p=.0002)
- Williams et al found increased colonization pressure to be associated with nosocomial MRSA acquisition, including MRSA outbreaks, in a general medicine unit (p=.008)

MRSA Flags in Electronic Medical Record

Inpatient:

After discharge, “MRSA” remains in banner:
In 2015 the protocol at UVM Medical Center was:

- To place all patients with a MRSA flag in isolation (contact precautions),
- Collect a nasal swab for MRSA PCR.
- Discontinue isolation after:
  - 2 negative nares screens 48 hours apart;
  - If history of MRSA in urine, 2 urine cultures negative for MRSA 48 hours apart
  - If chronic indwelling devices, 2 cultures of these sites negative for MRSA 48 hours apart
- To remove MRSA flag, patient needed 3 screens, as above, each one month apart
However,…

- It seemed that if the first nares screen was negative the 2nd one was almost always negative.
  - The protocol was developed when the screening method was culture.
  - PCR is much more sensitive.
- We began to notice that some patients who met criteria to have isolation discontinued had a positive screen or culture later, in particular in dialysis patients, diabetics, and IV drug users.
Example 1

- June 2011 – MRSA-positive leg wound
- Feb 2014 – negative nares
- June 2014 – negative nares
- Aug 2014 – negative nares
- Oct 2015 – considered permanently cleared, MRSA removed from banner
- Aug 2016 – MRSA-positive infected fistula

~Dialysis patient~
Example 2

- Mar 2012 – positive chin wound & nares
- Dec 2012 – negative nares
- June 28, 2016 – positive finger wound
- June 29, 2016 – negative nares
- Aug 2016 – positive nares

~no particular risk factors~
Example 3

- March 2016 positive axilla abscess
- April 4, 2016 negative nares
- May 6, 2016 negative nares and groin
- May 9, 2016 positive axilla

~no particular risk factors~
Example 4

- Oct 2013 positive nares
- Jan 1, 12, and 14, 2014 negative nares
- May 2014 negative nares
- Oct 2014 negative nares
- Was considered permanently cleared
- June 2016 positive urine via nephrostomy tube

~DM, nursing home resident, chronic indwelling catheter~
The problem:

- We felt that a one-size fits all approach was not adequate.
- We believed that some patients could come off isolation sooner, while others should stay on isolation longer.
- The key is to determine, with confidence, if a patient with a history of MRSA is currently colonized.
We drafted a new protocol based on patient risk, based on risk factors for MRSA carriage from the literature.

- Low risk patients could have isolation discontinued after one negative nares PCR.
- High risk patients would require a second nares PCR before having isolation discontinued.
- Some very high risk patients would never have isolation discontinued.

We evaluated this protocol for efficacy and safety via literature review and retrospective data analysis.
Evaluation Questions

- If the new protocol is implemented:
  - What is the risk that patients who might actually be MRSA-colonized are prematurely released from isolation?
  - How can we mitigate this risk?
  - How many patient isolation days can we save?
We analyzed patients admitted with a MRSA flag between 1/1/2013 and 9/30/2015 as follows:

- Number & percent who were screened for MRSA by nares PCR within 2 days of admission
  - Of these, number & percent who screened negative, and of these:
    - Number & percent who had a negative 2nd screen and no subsequent positive tests or screens
    - Number & percent who had a subsequent positive screen or test during the admission or after discharge
      - Of these, the number who would have had isolation discontinued if the new protocol had been in place.
Results

58,573 pts admitted

2,390 (4%) w/MRSA flag

1,027 (43%) screened w/in 2 days of admit

736 (72%) negative

299 (41%) had a 2nd test

272 (91%) negative

27 (9%) positive

In addition, 36 (5%) patients who tested neg on admission had a positive test post-discharge
Interpretation

For 91% of patients with a negative admission screen, the 2\textsuperscript{nd} screen was redundant.

14% of patients with a negative admission screen had a subsequent positive, therefore either:

- Were actually nasally colonized but had a false positive screen (possibly due to poor collection technique),
- Were colonized elsewhere on the body, or
- Became re-colonized at a later time.
What is the risk that patients who are actually colonized are prematurely released from isolation?

- In our population, we found 63 patients who tested negative on admission but were actually colonized or would become recolonized later.
- We reviewed each patient’s chart to determine if they would have had isolation discontinued under the new protocol:
  - 48 would have remained on isolation due to disqualifying conditions in the protocol
  - 15 would have been taken off isolation (annual equivalent of 6 patients)
How can we mitigate this risk?

- We reviewed the charts of these 15 patients in depth and discovered that all had at least one of the following risk factors:
  - Diabetes
  - Morbid obesity
  - Impaired skin integrity (including psoriasis, severe edema, cellulitis, or a recent toe amputation)
  - Lived in senior housing or a nursing home.
Next step

- We incorporated these risk factors into the protocol, such that persons with these (and other) risk factors would undergo additional testing before being cleared for MRSA.
- However, it was clear that getting a 2nd nares PCR would not provide the confidence we required.
In most studies nasal screening only detects approximately 60-75% of MRSA-colonized persons

- Bitterman et al: nares screen detected 71% of colonized patients; nares + perineum detected 90%.
- Collins et al: nares screen detected 59% of colonized patients; nares + perineum detected 84%.
- Datta et al: nares screen detected 78% of colonized patients; nares + axilla detected 82%.

Final step: Revised Protocol

- We revised our draft so that the final protocol is based on patient risk, not simply test results, and allows for extra-nasal testing.
- It establishes:
  - Concerning conditions
  - Disqualifying conditions
- It divides patients into 3 categories:
  - Eligible for clearance – can have isolation discontinued after one negative nares PCR.
  - Requires extra testing – needs additional testing before having isolation discontinued.
  - Ineligible for clearance – must be on isolation during all admissions.
Eligibility for MRSA clearance

**Eligible**: Patient has no concerning or disqualifying conditions.

**Requires extra testing** – patient has any of the following **concerning conditions**:
- Positive MRSA within the last 12 months
- History of negative MRSA screens followed by positive screens/tests
- History of MRSA in urine
- Morbid obesity (BMI ≥40 or BMI ≥35 with obesity-related comorbidities)
- Mildly impaired skin integrity other than a recent clean incision – e.g. one open site, eczema
- Diabetes
- Tracheostomy
- PEG tube
- Ostomy
- Nephrostomy
- Supra-pubic catheter
- In long-term recovery for a history of injection drug use or other opiate addiction
- Residence in a senior or assisted living facility
- Positive MRSA w/in last 60 days followed by active decolonization (mupirocin & CHG)

**Ineligible**: Patient has one or more of the following **disqualifying conditions**:
- Multiple concerning conditions (listed above)
- Active MRSA infection at any body site
- MRSA positive clinical culture from any site w/in prior 60 days, not followed by active decolonization
- Any bacterial cultures pending
- Significant history of negative screens followed by positive screens/tests
- More than one chronic indwelling device (tracheostomy, PEG tube, ostomy, nephrostomy, supra-pubic catheter
- Necrotic skin or soft tissue
- Significant open skin other than a recent clean incision
- Draining wound
- Wound vac
- Current or recent injection drug use or other opiate addiction
- Dialysis patient (hemo- or peritoneal)
- Cystic Fibrosis

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The following are **NOT disqualifying**:
- **Peripheral IV**
- Central venous catheter
- Arterial line
- **PICC line**
- Foley
- **NG tube**
- Endotracheal tube
- **Ventriculostomy**
MRSA Isolation Guideline 2016

**MRSA flag**

- Place in contact isolation

**Obtain nares swab for MRSA PCR**
  - **Positive**
   - Keep in isolation.
  - **Negative**
   - Determine eligibility for clearance

**Eligible**

- Requires extra testing
  - Negative: Discontinue isolation
  - Positive: Obtain MRSA infection control cultures of other sites

**Ineligible**

- Keep in isolation.
Extra testing

- Other testing sites may include:
  - Bilateral axilla and perineal fold (combined in a single swab),
  - Skin at indwelling line/trach sites,
  - Recent skin infection sites,
  - Urine if patient has a history of MRSA in the urine.
- All of the above are cultures (not PCR).
Cleared for admission vs. permanently cleared

- **Cleared for admission**: isolation can be discontinued for this admission but MRSA flag remains in banner and patient is on isolation at next admission.
- **Permanently cleared**: MRSA flag is removed from banner and patient is not on isolation at future admissions.
Implementation

- This protocol is too complex for use by staff other than Infection Preventionists.
- When a patient who has a history of MRSA is admitted, an Infection Preventionist determines the patient’s eligibility for clearance, orders tests as appropriate, and decides if isolation can be discontinued.
- The protocol is flexible and implemented on a case-by-case basis, with professional judgment playing a role.
Using assumptions based on our data, we determined that we could save approximately 1254 patient-isolation days per year based on the new protocol and,

We are confident that we can do so safely by identifying patients at risk for occult colonization or re-colonization.
Limitations

- We did not investigate any risk factors amongst the patients who had 2 negative MRSA screens.
- We did not estimate how many patients will be “ineligible” for MRSA clearance and the impact on patient isolation-days.
A word of caution

- Our protocol is based on PCR testing for nares, not culture.
- Our protocol is based on our own hospitalized population and should NOT be assumed to apply to any other population.
The question: how can we determine, with confidence, whether a patient with a history of MRSA is currently colonized or likely to become re-colonized?

The answer: use local data to:
- Identify patients with a history of MRSA who screen negative but test positive later,
- Determine common risk factors for these patients,
- Integrate these with risk factors known from the literature to develop a risk-based approach.
Thank you!

Questions?