Decolonization of Non-ICU Patients With Devices

Section 5 – Decision Making and Readiness for Implementation

Assessing the Quality of the Evidence

There are several factors for hospitals to consider when assessing whether to adopt a new intervention. Often, new literature or growing literature around a strategy with a strong rationale for positive impact can propel hospitals to adopt that strategy, especially in the setting of a perceived need. The balance between early adoption before definitive clinical trials and adoption after definitive trials must be determined based upon local needs and culture.

The results of the **A**ctive **Bat**hing to **E**liminate (ABATE) Infection Trial provide strong evidence for targeted decolonization in non-intensive care unit (ICU) patients with devices in order to reduce methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant enterococcus (VRE), and all-cause bloodstream infection. In assessing the quality of evidence of a new strategy, well-conducted randomized controlled trials provide the highest level of certainty about the effect of an intervention. The ABATE Infection Trial has the following high-quality features:

- **Randomized controlled trial.**
- **Large-scale trial** with 53 hospitals, 194 non-ICUs, and nearly 340,000 patients.
- **Pragmatic implementation.** The decolonization strategy was implemented by the same hospital staff and processes usually responsible for quality improvement campaigns. This means that it was rolled out in a manner that reflects how most hospitals would implement this strategy.
- **Generalizable.** Unlike many studies of hospital-based interventions conducted in major academic centers, the ABATE Infection Trial was conducted in nearly all community hospitals. Since these hospitals provide the majority of care in the United States, the results of this trial are likely to be widely applicable.
- **Comparison with current best practice.** Sometimes trials compare an intervention with older practices that are no longer considered best practice. The ABATE Infection Trial compared a decolonization strategy with current standards of care and showed a significant benefit in a subgroup of the study population, patients with specific medical devices.

It is often important to consider additional supporting evidence in the literature. This evidence usually consists of previous single-center studies that laid the foundation for a major trial. Three such studies preceded the ABATE Infection Trial.[1-3]

Assessing the Need for Targeted Decolonization in Non-ICUs

Once the evidence of the need for this targeted decolonization in your hospital is well understood, it is important to assess the likely gains that the hospital will attain if the targeted decolonization strategy is adopted. Since the ABATE Infection Trial found that decolonization impacted bloodstream infection rates, as well as MRSA-positive and VRE-positive clinical cultures attributable to non-ICUs, those outcomes should be of interest to hospitals considering adoption. In addition, because the benefit was limited to adult non-ICU patients with specific medical devices, it will be important to assess these outcomes in patient populations with devices of interest in your hospital.

- **Determining hospital-associated bloodstream infection rates for non-ICU patients with medical devices.** The ABATE Infection Trial showed a **32 percent reduction** in all-cause bacteremia in patients in community hospitals who had specific medical devices. We recommend identifying the following to help estimate the expected impact should universal decolonization be adopted in the hospital. Inpatient census data and data from the clinical microbiology laboratory are needed for this estimate. For ease of calculation, you can use one bacteremia per patient.
    - **Simplified Estimate: Bacteremia Counts (one per patient)**
      A simple estimate begins with counts of bloodstream infections. Choose a 1-year period and count the number of unique patients who have a positive blood culture from any pathogen occurring at least 2 days after admission while in a noncritical-care unit location (or having been in a noncritical-care location 2 days prior to the culture date, if that information can be obtained). Exclude any patient younger than 18 years old (or, if easier, exclude pediatric or neonatal units in addition to ICUs). Two positive blood cultures with the same skin commensal organism should be required for counting this event as a bloodstream infection. This requirement is consistent with Centers for Disease Control and Prevention (CDC) National Healthcare Safety Network definitions and should be familiar to infection prevention programs.
    - Next, the count of non-ICU bloodstream infections needs to be limited to those who have the selected medical devices studied in the ABATE Infection Trial, namely central lines, midlines, or lumbar drains. This count can be estimated in two ways:
        - In the ABATE Trial, 56 percent of all non-ICU bloodstream infections were in patients with those specific medical devices. It could be reasonably assumed that approximately half of all non-ICU bloodstream infections in your hospital would be in patients with those devices.

        - Alternatively, reported CLABSI events occurring in non-ICUs could be used as an underestimate of the bloodstream events that would occur due to devices.
    - **Comprehensive Estimate: Bacteremia Rates (one per patient)**
      The best estimate to use is the one calculated to match the targeted population with specified devices. This would be the rate of non-ICU bacteremia cases per 1,000 non-ICU days among patients with the specified medical devices. To obtain this rate, divide the count of bacteremia cases identified in the simplified estimate by the number of non-ICU days among those with those medical devices. The non-ICU days should be counted from the third day of a non-ICU stay until transfer to an ICU or until hospital discharge.
        - To change the calculated rate into a rate per 1,000 ICU patient days, multiply the rate (number of events divided by the denominator of non-ICU days among patients with the specified devices) by 1,000 = total events per 1,000 ICU patient days.
    - **Estimated Reduction Due to Targeted Decolonization**
      The ABATE Infection Trial showed a **32 percent reduction** in this bacteremia rate.
- **Determining MRSA-positive and VRE-positive clinical cultures for non-ICU patients with medical devices.** Decolonization in the ABATE Infection Trial also reduced MRSA-positive and VRE-positive clinical cultures attributable to non-ICUs **by 37 percent** in patients with the above-mentioned medical devices**.** Thus, it would be of additional value to estimate this outcome in hospitals considering adoption of targeted decolonization. This can be similarly estimated in one of two ways:
    - **Use Usual Processes for Determining MRSA Status**
      Remember, we are not asking you to change your testing/screening processes for MRSA. Use your current processes for identifying MRSA carriers using reported history, prior culture result, or information from transferring facilities to target those with devices.

- **Simplified Estimate: MRSA/VRE Counts (one per patient)**
  A simple estimate begins with identifying a year's worth of counts of new MRSA-positive or VRE-positive clinical cultures among unique patients occurring at least 2 days after admission while in a noncritical-care unit location (or having been in a noncritical-care location two days prior to the culture date, if that information can be obtained). Exclude any patient less than 18 years old (or, if easier, exclude pediatric or neonatal units in addition to ICUs).

  Next, the count of new positive MRSA/VRE clinical cultures needs to be limited to those who have medical devices (specifically central lines, midlines, or lumbar drains). This count can be estimated as follows:
  - In the ABATE Trial, 37 percent of all non-ICU new positive MRSA/VRE clinical cultures were in those with the above-mentioned medical devices. Multiplying the total non-ICU count by 0.37 would yield a reasonable estimate.
- **Comprehensive Estimate: MRSA/VRE Rates (one per patient)**
  Divide the positive MRSA/VRE clinical culture counts identified in the simplified estimate by the number of non-ICU days among those with the above-mentioned medical devices. The non-ICU days should be counted from the third day of a non-ICU stay until ICU transfer or hospital discharge.
  - To change the calculated rate into a rate per 1,000 ICU patient days, simply multiply the rate (number of events divided by the denominator of non-ICU days among patients with devices) by 1,000 = total events per 1,000 ICU patient days.
- **Estimated Reduction Due to Targeted Decolonization**
- The ABATE Infection Trial showed a **37 percent reduction** in this MRSA/VRE rate.

Decision To Implement

Once the evidence has been reviewed and baseline data on non-ICU bloodstream infections and MRSA-positive and VRE-positive clinical cultures among patients with medical devices have been collected, this information should be used to determine the need for targeted decolonization. Early involvement of potential stakeholders and decision makers as is described later in this section is important. Criteria for deciding about implementation include the following:

- **The strength of the evidence that this intervention will impact care in the hospital.** This includes the magnitude of impact found in published studies and similarities of the hospital to the patient populations studied. The latter includes case mix, hospital type, and whether the comparator groups in the studies reflect current infection prevention standards at the hospital.

- **The numbers and/or rates of non-ICU bloodstream infections and MRSA-positive and VRE-positive clinical cultures found in adult non-ICUs, and the hospital leadership's desire to target these outcomes for improvement.** Importantly, these data can also be used for internal benchmarking to assess the impact of the intervention once a decision to implement has been made.
- **Alignment with existing guidance and position statements from national committees and societies, survey requirements for accreditation, and State laws.** As evidence increases on prevention of healthcare-associated infections, legislative and regulatory requirements may change. It is important to know State legislative mandates, accreditation requirements, and guidance provided by the CDC and other national societies related to healthcare-associated infections. The following sites may be helpful for reviewing national guidance on decolonization strategies:
    - The ABATE Infection Trial Targeted Decolonization Strategy is supported by the CDC as an effective strategy to reduce MRSA bloodstream infections in patients with devices outside of ICUs https://www.cdc.gov/hai/prevent/staph-prevention-strategies.html
    - Healthcare Infection Control Practices Advisory Committee (HICPAC), Publications https://www.cdc.gov/infectioncontrol/guidelines/index.html
    - Guidelines and Resources, Society for Healthcare Epidemiology of America (SHEA) https://www.shea-online.org/index.php/practice-resources
    - SHEA Healthcare Associated Infections Compendium https://www.shea-online.org/index.php/practice-resources/priority-topics/compendium-of-strategies-to-prevent-hais

Assessing the Intervention Scope

Experience with successful implementation of prior strategies can help guide the type of rollout. Hospitals with robust experience in rolling out ICU universal decolonization strategies may be better suited to engage in rollout of targeted decolonization for medical device patients in non-ICUs. In addition, hospitals may be aided by prior experience with preoperative chlorhexidine gluconate (CHG) bathing.

- Initial decisions related to the scope of the intervention include:
    - Determining the need for a pilot launch in a single unit
    - Determining the ultimate scope of units to be included in the final launch
- Reasons to pursue a pilot launch:
    - Targeted interventions can be complicated due to the need to identify specific subgroups of patients. A pilot launch can help determine the best method to use

for your hospital. If relying on a manual approach, it may be especially wise to pilot the forms and processes on a single unit.

  - In addition to identifying selected patients with devices, targeted decolonization requires the stocking of CHG product for both bed bathing and showering and ensuring a process for providing and documenting CHG bathing. A pilot launch can help work out the logistics for both product stocking, provision, documentation, and staff training. Remember, this toolkit provides several protocols that allow you to choose which formulation of CHG or nasal product might be the most appropriate for your institution. For example, you can use the products exactly as in the ABATE Infection Trial, which included impregnated 2% CHG cloths for bed baths and 4% rinse of CHG for the shower plus nasal mupirocin. As an alternative to using impregnated cloths, we also provide a substitute protocol for bedside basin bathing, using diluted 4% liquid CHG. Similarly, we provide a protocol for nasal iodophor, that can be used as an alternative to nasal mupirocin.
  - If you have a strong champion in one non-ICU but uncertain support in other non-ICUs, you may want to pilot in the one that is most likely to demonstrate success so that that unit can serve as a beacon for others who may doubt the feasibility of high-fidelity adoption. Success in one unit can help drive additional support and adoption.
  - Hospital leadership may like to see implementation success on a single unit before expanding to others.
- Full implementation scope
  - The strength of the trial should support eventual rollout to all adult non-ICUs targeting patients with medical devices, but hospitals will differ on whether they wish to adopt an intervention based upon published trial results or await guidance from the CDC or national societies. Higher rates of non-ICU bloodstream infection and MRSA-positive and VRE-positive clinical cultures among patients with medical devices may help drive decision making. Currently, CDC supports the use of targeted decolonization as a method for *S. aureus* prevention in patients with devices: https://www.cdc.gov/hai/prevent/staph-prevention-strategies.html.

Assessing the Timing of the Decolonization Intervention

Once the evidence base is understood and baseline rates have been defined, it is important to assess whether the timing is right for a new intervention. Considerations for timing include:

- Urgency related to high bloodstream infection or MRSA/VRE rates among non-ICU patients with medical devices.
- National guidance or regulatory standards.

- Other recent campaigns or new educational training for staff. Does this intervention fit with an ongoing non-ICU campaign? If not, is there a better time in the near future to adopt this when non-ICU staff and educators have the time and availability for another campaign? Is there a scheduled training update for clinical staff to which this could be easily added?
- It may be best to avoid launching new campaigns during or immediately prior to the end-of-the-year holiday season unless all collective stakeholders determine that it is the most appropriate time.

Garnering Institutional Support From Key Stakeholders

Once the rationale, baseline data, and timing support the implementation of targeted non-ICU decolonization in patients with medical devices, it is important to ensure institutional support. Key elements of ensuring institutional support include the following:

- Develop an analysis of cost implications, such as the one included in Section 7 of the toolkit. Select pieces of the above rationale, your hospital rates for outcomes, and comments on recommended timing for a pilot study or full launch.
- Develop a **business case** for hospital leadership
    - Basic steps needed to develop a business case for infection prevention strategies are well described by Perencevich et al[9]:
    - For targeted non-ICU decolonization in patients with medical devices, the business case will require the following cost saving estimates from outcome reduction:
        - Number of prevented hospital-specific non-ICU bloodstream infections among patients with medical devices (see above). As a reminder, the ABATE Infection Trial showed a 32 percent reduction in bloodstream infections among patients with medical devices.
        - Number of prevented hospital-specific non-ICU MRSA-positive and VRE-positive clinical cultures among patients with medical devices (see above). As a reminder, the ABATE Infection Trial showed a 37 percent reduction in MRSA-positive and VRE-positive clinical cultures.
        - Estimated excess cost of a non-ICU-attributable bloodstream infection in medical device patients is $32,000.
        - Estimated excess cost of an infection due to an antibiotic-resistant bacteria (versus antibiotic-sensitive bacteria) is $18,500 to $29,000.
        - Refer commonly cited references for further guidance[4-10]
    - The business case will also require cost estimates for product use:
        - Number of patients with medical devices in adult non-ICUs and their mean non-ICU duration of stay to estimate the number of CHG baths to be given

        - Hospital-specific excess cost of CHG bathing product (bath and shower) over routine bed bath or shower soap product times number of patient days of required bathing per year.
    - Number of patients with medical devices in adult non-ICUs who are known to harbor MRSA:
        - Hospital-specific cost of a 5-day course of mupirocin (or the average length of non-ICU stay if shorter than 5 days) times number of patients per year. Most hospitals are using a single patient multidose tube of generic mupirocin.

- **Stakeholder support:** Present overview statement and protocol to key stakeholders, such as the chief medical officer, chief nursing officer, and medical and administrative directors of infection control and prevention. In addition, non-ICU nurse managers and inpatient nursing directors will be critical stakeholders for buy-in and protocol implementation. The order of approaching these key stakeholders will depend on the culture, standard processes, and existing relationships at the hospital, but they should all be included in the decision-making process. Inclusion of patient advocates can also be extremely helpful.
    - **Infection prevention program:** The hospital infection prevention and control program may be one of several groups to initiate this campaign. If so, it will be important that the initiator ensures that the entire infection prevention program (e.g., administrative director, medical director and chair of the infection prevention committee, and infection preventionist[s] providing support to adult non-ICUs) is fully supportive, understands the above rationale, and can speak to this endeavor.
    - **Non-ICU directors (nurse, physician):** The hospital inpatient leadership team may be another group to initiate this campaign and is essential for support. Nursing directors (and medical directors, if available) can inform the logistics of identifying qualifying patients and targeting CHG bathing/showering protocols and mupirocin orders for patients who are MRSA carriers.
    - **Purchasing and pharmacy:** The purchasing department can provide not only the current hospital-specific costs of CHG cloths and/or liquid for showering but may be able to engage in price negotiations due to anticipated increases in the amount of products purchased. In addition, the pharmacy department should be engaged to account for anticipated increases in mupirocin orders.
    - **Hospital administration and leadership:** Joint support is required from the Chief medical officer and Chief nursing officer to have a successful campaign. Advance preparation of the business case (including anticipated product costs and cost-savings due to prevention of bloodstream infections), description of supporting stakeholders within the hospital, and implementation strategy are important.

Common stakeholder questions regarding universal decolonization should be anticipated. These include the following:

- **What is the evidence for decolonization in non-ICU patients with medical devices?**
  See the above section on the Quality of the Evidence.
- **What is the hospital's need for this intervention?**
  See above section on assessing the Need for the Intervention. The response to this question should include consideration of hospital rates of non-ICU bloodstream infection and positive MRSA/VRE clinical cultures in adults with medical devices, as well as national guidelines, regulation, and any relevant State legislation.
- **What is the cost of this intervention and how is it justified?**
  See the above section on Developing a Business Case.
- **Who is supportive of this intervention?**
  Be prepared to demonstrate support from key stakeholders described above.
- **What is the added benefit of mupirocin over the daily CHG baths?**
  - Previous studies have demonstrated the benefit of targeted decolonization as the combination of CHG plus mupirocin in adult ICUs.[11-12]
  - *S. aureus* is one of the most common causes of healthcare-associated infections in the United States, including CLABSI.
  - The nose is the major reservoir of *S. aureus.* Evidence strongly supports the use of mupirocin as an essential component of eradication and prevention of *S. aureus* infections. Nasal decolonization has been shown to be critical to eradication of MRSA and MSSA compared with CHG alone.[13-17]
  - Even among hospitals where screening for MRSA is currently occurring or mandated by State law, it is important to recognize that MSSA is a major pathogen. Nationally, MSSA constitutes half of *S. aureus* healthcare-associated infections.

- **Are there specific formulations of CHG that should be used?**
  The benefits seen in large randomized controlled trials in ICU settings, including the **R**andomized **E**valuation of **D**ecolonization versus **U**niversal **C**learance to **E**liminate MRSA (REDUCE MRSA) Trial and now the **A**ctive **Bat**hing to **E**liminate (ABATE) Infection Trial in non-ICUs, were based upon the use of no-rinse 2% CHG-impregnated cloths. Theoretically, methods that deliver an equivalent amount of active decolonizing agent to the skin should be effective. However, the method of application may have appreciable effects on achieving appropriate residual concentrations of CHG on the skin. Specifically, no-rinse applications of CHG using a 2% cloth achieve significantly higher residual concentrations of CHG on the skin than applications of 4% with rinsing.[18] In addition, attention to skin coverage in applying CHG is critical.[19,20] Shower-based liquid applications have been shown to result in gaps in skin antisepsis compared with cloth-based applications.[21] Nevertheless, 4% rinse-off CHG solution has been associated with sizeable reductions in MRSA infections in MRSA carriers in a large randomized post-discharge trial.[22]
- **Will we need to modify our MRSA testing/screening processes to implement decolonization?**
  - No. Maintain your current processes for identifying patients with MRSA-positive clinical cultures, screening cultures, and history of MRSA to target those with devices.
- **Should we be concerned about producing antibiotic resistance?**
  The benefits and potential risks should be weighed with any strategy. As with all antibiotics, we will need to be vigilant about antibiotic resistance. We provide some discussion points below.
  - It is important to ensure that CHG and mupirocin are applied properly. Inadequate application can lead to low concentrations of the products that may increase the likelihood of selecting for resistant strains.
  - Because CHG and mupirocin are used for decolonization and are not used to treat active infection, resistance to these agents will not result in the loss of therapeutic antibiotics.
  - Many of the large randomized controlled trials listed in Section 4, Table 1 have not detected emergence of resistance to CHG or mupirocin during the trials across thousands of MRSA isolates.[23-25] Emergence of CHG resistance at this time is largely considered to be a theoretical rather than practical concern.
  - Evidence for emergence of antibiotic resistance during the use of mupirocin is mixed. The literature has reported evidence of increased mupirocin resistance with broad use of mupirocin, increased resistance to mupirocin in the absence of broad use of mupirocin, and no increase in resistance with broad use. Thus,

surveillance by researchers and national surveillance systems will be important in monitoring resistance. Alternative agents for mupirocin are also actively being studied. Since mupirocin use in this context is very targeted, we do not anticipate that resistance emergence will be a problem.

  - Since mupirocin resistance is not routinely tested by microbiology laboratories, most hospitals will not have local data to inform their decision. If the hospital does have these data, they can be used to inform the use of this agent.

- **What if our clinicians prefer to use nasal iodophor instead of mupirocin?**
  Due to U.S. regional differences in mupirocin resistance and facility preferences for mupirocin versus nasal iodophor for nasal decolonization protocols (e.g. preoperative decolonization), this toolkit will provide pragmatic directions for the use of nasal iodophor as an alternative to mupirocin.[26] Hospital choices may be further informed by the Mupirocin-Iodophor ICU Decolonization Swap Out Trial, a large-scale noninferiority pragmatic cluster-randomized trial comparing decolonization with mupirocin/CHG to iodophor/CHG in ICU patients.[27]
- **Aren't some bacteria good for us? Will this strategy remove good bacteria?**
  Even the "normal" (i.e., commensal) bacteria on the skin can become harmful during hospitalization. The use of lines and devices, as well as surgical wounds and other breaks in the skin result in a higher chance that our normal body bacteria can enter sterile places and produce infection during high-risk periods. Targeted decolonization is being advocated during high-risk hospitalizations involving medical devices that compromise skin integrity and increase risk for infection. The ABATE Infection Trial demonstrates that this use of decolonization removes highly antibiotic resistant bacteria that are unwanted on the skin and reduces the real risk of life-threatening bloodstream infection.

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