

Date: August 10, 2015

Title: Daily Bathing of Children in Critical Care Settings with Chlorhexidine Gluconate

Clinical Question

| | |
|------------------------|---|
| P (Population/Problem) | Among children and adolescents |
| I (Intervention) | does daily bathing with chlorhexidine gluconate |
| C (Comparison) | compared to daily bathing with soap and water |
| O (Outcome) | affect rates of bloodstream infections |
| T (Time) | during an inpatient hospital admission? |

[Definitions for terms marked with * may be found in the Supporting Information section.](#)

Target Population for the Recommendation

Inclusions:

- Patients receiving inpatient hospital care
- Patients with intact skin

Exclusions:

- Patients 2 months of age or younger
- Patients with an indwelling epidural or lumbar drain
- Patients with known sensitivity to chlorhexidine gluconate

Recommendation

It is recommended that children and adolescents receiving care in an inpatient setting receive a daily bath using 2% chlorhexidine gluconate to reduce the risk of bloodstream infection (Derde et al., 2012 [1a]; Karki & Cheng, 2012 [1b]; O'Horo et al., 2012 [1b]; Sievert et al., 2011 [1b]; Milstone et al. (2013) [2a]; Climo et al., 2013 [2a]; Huang et al., 2013 [2b]; Cassir et al., 2015 [3a]; Martinez-Resendez et al., 2014 [3a]; Rupp et al., 2012 [3a]; Viray et al., 2014 [3a]; Edwards et al., 2014 [4a]; Armellino et al., 2014 [4b]; Munoz-Price et al., 2012 [4b]; and Lopez, 2011 [4b]).

Discussion/Synthesis of Evidence related to the recommendation(s)

Three studies support the intervention of daily chlorhexidine gluconate (CHG) bathing for children in critical care settings to reduce the incidence of blood stream infections (Milstone et al., 2013 [2a]; Rupp et al., 2012 [3a]; Quach et al., 2014 [4a]). Rupp and colleagues (2012 [3a]) included both adult and pediatric patients in a quasi-experimental study that found a significant decrease in *C. difficile* infections among patients received the CHG baths as compared to patients who did not receive CHG baths (Baseline soap-and-water period = 121,562 patient days, CHG bathing intervention period = 188,859 patient days, Washout period = 36.621 patient days). Milstone and colleagues (2013 [2a]) conducted a multi-site cluster-randomized, crossover trial of 10 pediatric intensive care units at five hospitals (N=4947) and found a statistically and clinically significant decrease in bacteremia among patients who received daily CHG baths as compared to patients who received daily soap and water baths. Quach and colleagues (2014 [4a]) used a retrospective cohort design to study the effectiveness of a CHG bathing protocol among 790 infants with central venous catheters who were admitted to a neonatal intensive care unit. Infants with a birth weight of greater than 1,000g were bathed using 2% CHG-impregnated washcloths. Infants with a birth weight of 1,000g or less were bathed with soap until day of life 28 when bathing with 2% CHG-impregnated washcloths was initiated. These investigators found a decrease in CLABSI rates among the infants bathed with CHG compared with those not bathed with CHG (6.00 vs 1.92/1,000 CVC-days; aIRR, 0.33 [95% CI, 0.15 to 0.73]).

Because of the small number of studies conducted with pediatric patients, the adult literature was reviewed. While pediatric patients present unique challenges, the first step in consideration of a practice change to institute CHG bathing to decrease CLABSI was to see if there is evidence in any populations that daily CHG bathing is effective at reducing CLABSI rates. In adult populations, 4 systematic reviews, 2 randomized control trials, 1 clinically controlled trial, 3 prospective cohort studies, and 4 descriptive/observational studies also support the intervention of daily CHG bathing to reduce the incidence of blood stream infections (Derde et al., 2012 [1a]; Karki & Cheng, 2012 [1b]; O'Horo et al., 2012 [1b]; Sievert et al., 2011 [1b]; Climo et al., 2013 [2a]; Huang et al., 2013 [2b]; Cassier et al., 2015 [3a]; Martinez-Resendez et al., 2014 [3a]; Rupp et al., 2012 [3a]; Viray et al., 2014 [3a]; Edwards et al., 2014 [4a]; Armellino et al., 2014 [4b]; Munoz-Price et al., 2012 [4b]; and Lopez, 2011 [4b]). There is one randomized control trial conducted among adult ICU patients that reported findings contradictory to the previously listed studies (Noto et al., 2015 [2b]). Noto and colleagues (2015 [2b]) conducted a cluster randomized crossover study of 9340 adult ICU patients to compare the daily use of 2% CHG washcloths to the daily use of non-antimicrobial cloths for bathing on a composite infection outcome variable (composite of CLABSIs, catheter-associated urinary tract infections, ventilator-associated pneumonias, and *C. difficile* infections). They reported no statistical difference in composite infection when CHG bathing was used compared to when non-antimicrobial cloth bathing was used (2.86 vs. 2.90/1,000 patient days; rate difference, -0.04; 95% CI, -1.10 to 1.01, $p=0.95$). There are two methodological considerations which may have affected this contradictory finding. First, these researchers did not measure adherence to bathing protocol. Second, the institution had relatively low infection rates at baseline which may have created a ceiling effect and possibly identifying a lower limit of infection beyond which CHG bathing does not provide a detectable change in infection rates.

The vast majority of the individual studies examined bathing using 2% CHG impregnated washcloths (Climo et al., 2013 [2a]; Milstone et al., 2013 [2a]; Huang et al., 2013 [2b]; Noto et al., 2015 [2b]; Cassir et al., 2015 [3a]; Martinez-Resendez et al., 2014 [3a]; Edwards et al., 2014 [4a]; Quach et al., 2014 [4a]; Armelleno et al., 2014 [4b]; Munoz-Price et al., 2012 [4b]; and Lopez, 2011 [4b]). Two studies examined bathing with a basin of water containing 4% CHG solution (Rupp et al., 2012 [3a]; Viray et al., 2014 [3a]). Rupp and colleagues (2012 [3a]) reported no significantly different findings when a higher concentration of CHG was diluted in water, however with only one study examining this procedure, there was not significant evidence to support using a higher concentration of CHG.

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IMPLEMENTATION

Applicability Issues

Adoption of the recommendation will involve approval through appropriate organizational structures that oversee practice changes. At Cincinnati Children's Hospital, the practice change was vetted through the shared governance structure and approved by Nursing Professional Practice Council.

A CHG Bathing procedure would need to be developed to provide staff with instructions on CHG use. Several resources were created for use by staff and to provide to patients and families including a Knowing Note (*Bathing with CHG*) and a printable resource "*RUB-A-DUB... it is bath time! Chlorhexidine Bathing!*"

Recommendation adherence will require stocking of CHG-impregnated washcloths on the inpatient critical care units and education to nursing staff that provide care in the critical care units. Education to patients and families will also be required to support family centered care. Staff at Cincinnati Children's Hospital completed a Mosby educational module titled *CCHMC Resource: Chlorhexidine Bathing*.

Relevant CCHMC Tools for Implementation

Knowing Note - *Bathing with CHG* (available in English, Spanish, Arabic and Russian)

Printable resource - *RUB-A-DUB...it is bath time!! Chlorhexidine Bathing*

Mosby module - *CCHMC Resource: Chlorhexidine Bathing*

Outcome or Process Measures

Process measures would include documentation of the daily bath using CHG in the electronic medical record will allow for communication among nursing staff that the daily bath with CHG was given and could be used as a process measure.

- The percent of persons receiving inpatient care whose medical record indicates they received a daily bath using 2% chlorhexidine gluconate.

Outcome data that may be collected are rates of bloodstream infections among patients. In addition, adverse events to CHG bathing should be collected to evaluate any negative impact of the practice change.

- The percent of persons who receive daily bathing using CHG who demonstrate a bloodstream infection.
- The percent of persons who receive daily bathing using CHG who experience an adverse event related to CHG bathing.

SUPPORTING INFORMATION**Background/Purpose of BEST Development**

Bloodstream infections are often preventable nosocomial infections that can have profound effects on patient morbidity, mortality, length of stay, and hospital costs. In an effort to decrease BSIs, Cincinnati Children's Hospital Medical Center introduced a central line insertion bundle, a central line maintenance bundle, and nursing guidelines around central venous catheter care that identified 2% chlorhexidine gluconate as the only agent that should be used for cleaning a central line site at insertion and with each dressing change. These interventions have resulted in a decrease in BSIs. To continue this decrease, a question was raised about the effectiveness of daily bathing with chlorhexidine gluconate.

Definitions

None

Search Strategy & Evidence Table – See Appendix**Relevant CCHMC Evidence-Based Documents**

None

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Conflicts of Interest were declared for each team member and

- No financial or intellectual conflicts of interest were found.
- No external funding was received for development of this BEST.
- The following conflicts of interest were disclosed.

Note: Full tables of the [LEGEND evidence evaluation system](#) are available in separate documents:

- [Table of Evidence Levels of Individual Studies by Domain, Study Design, & Quality](#) (abbreviated table below)
- [Grading a Body of Evidence to Answer a Clinical Question](#)
- [Judging the Strength of a Recommendation](#) (dimensions table below)

Table of Evidence Levels (see note above):

| Quality level | Definition |
|------------------------------------|---|
| 1a [†] or 1b [†] | Systematic review, meta-analysis, or meta-synthesis of multiple studies |
| 2a or 2b | Best study design for domain |
| 3a or 3b | Fair study design for domain |
| 4a or 4b | Weak study design for domain |
| 5a or 5b | General review, expert opinion, case report, consensus report, or guideline |
| 5 | Local Consensus |

†a = good quality study; b = lesser quality study

Table of Language and Definitions for Recommendation Strength (see note above):

| Language for Strength | Definition |
|--|---|
| It is strongly recommended that... | When the dimensions for judging the strength of the evidence are applied, there is high support that benefits clearly outweigh risks and burdens. (or <i>visa-versa</i> for negative recommendations) |
| It is strongly recommended that... not... | |
| It is recommended that... | When the dimensions for judging the strength of the evidence are applied, there is moderate support that benefits are closely balanced with risks and burdens. |
| It is recommended that... not... | |
| There is insufficient evidence and a lack of consensus to make a recommendation... | |
| <i>Given the dimensions below and that more answers to the left of the scales indicate support for a stronger recommendation, the recommendation statement above reflects the strength of the recommendation as judged by the development group. (Note that for negative recommendations, the left/right logic may be reversed for one or more dimensions.)</i> | |
| Rationale for judgment and selection of each dimension: | |
| 1. Grade of the Body of Evidence | <input type="checkbox"/> High <input checked="" type="checkbox"/> Moderate <input type="checkbox"/> Low |
| <i>Rationale:</i> Four systematic reviews and 3 RCTs report a decrease in bloodstream infections with daily CHG bathing; 1 RCT found no change in bloodstream infections with daily CHG bathing (some methodological limitations to this RCT) | |
| 2. Safety/Harm (Side Effects and Risks) | <input checked="" type="checkbox"/> Minimal <input type="checkbox"/> Moderate <input type="checkbox"/> Serious |
| <i>Rationale:</i> No serious adverse events were reported in any of the studies. The United States Food and Drug Administration (2012 [5a]) has cautioned that CHG be used with care in children 2 months of age and younger since it could cause irritation or chemical burns in this population. Additionally, only one study reviewed examined the use of CHG bathing among children under 2 months of age (Quach et al., 2014 [4a]) and while they did not report any adverse events, more research is warranted before recommending use in infants under 2 months old. Therefore the target population of this recommendation excludes this population. In addition, Milstone and colleagues (2013, [2a]) exclude: patients with an allergy to CHG (included in exclusion criteria of the recommendation), patients with an indwelling epidural or lumbar drain (included in exclusion criteria of the recommendation), patients with severe skin disease or burns (included in inclusion criteria of recommendation described as intact skin). Karki & Cheng (2012 [1b]) reported low concentrations of CHG found in the bloodstream of children who experienced daily CHG bathing however there was no cumulative tendency with repeated exposure. Milstone and colleagues (2013 [2a]) experienced a 1% attrition of children in their multicenter study due to skin irritation and a 1.12/1000 patient days incidence of CHG-related skin reactions. | |
| 3. Health benefit to patient | <input checked="" type="checkbox"/> Significant <input type="checkbox"/> Moderate <input type="checkbox"/> Minimal |
| <i>Rationale:</i> | |
| 4. Burden on patient to adhere to recommendation | <input checked="" type="checkbox"/> Low <input type="checkbox"/> Unable to determine <input type="checkbox"/> High |
| <i>Rationale:</i> | |
| 5. Cost-effectiveness to healthcare system | <input type="checkbox"/> Cost-effective <input checked="" type="checkbox"/> Inconclusive <input type="checkbox"/> Not cost-effective |
| <i>Rationale:</i> None of the studies reported cost effectiveness in terms other than decreasing costs related to bloodstream infections. | |
| 6. Directness of the evidence for this target population | <input checked="" type="checkbox"/> Directly relates <input type="checkbox"/> Some concern of directness <input type="checkbox"/> Indirectly relates |
| <i>Rationale:</i> Although the majority of the studies were of adult populations, three studies of pediatric patients also reported decreased rates of bloodstream infection | |
| 7. Impact on morbidity/mortality or quality of life | <input checked="" type="checkbox"/> High <input type="checkbox"/> Medium <input type="checkbox"/> Low |
| <i>Rationale:</i> In the majority of the reviewed articles, daily CHG bathing significantly reduced the rate of CLABSIs. CLABSIs can result in mortality, increased length of stay, and decreased quality of life. | |

Copies of this Best Evidence Statement (BEST) and related tools (if applicable, e.g., screening tools, algorithms, etc.) are available online and may be distributed by any organization for the global purpose of improving child health outcomes.

Website address: <http://www.cincinnatichildrens.org/service/i/anderson-center/evidence-based-care/bests/>

Examples of approved uses of the BEST include the following:

- Copies may be provided to anyone involved in the organization's process for developing and implementing evidence based care;
 - Hyperlinks to the CCHMC website may be placed on the organization's website;
 - The BEST may be adopted or adapted for use within the organization, provided that CCHMC receives appropriate attribution on all written or electronic documents; and
 - Copies may be provided to patients and the clinicians who manage their care.
- Notification of CCHMC at EBDMinfo@cchmc.org for any BEST adopted, adapted, implemented, or hyperlinked by the organization is appreciated.

Please cite as: Baker, R. Cincinnati Children's Hospital Medical Center: Best Evidence Statement Title, Daily Bathing of Children in Critical Care Settings with Chlorhexidine Gluconate <http://www.cincinnatichildrens.org/svc/alpha/h/health-policy/best.htm>, BEST 174, pages 1-9, 8/10/15.

This Best Evidence Statement has been reviewed against quality criteria by two independent reviewers from the CCHMC Evidence Collaboration. Conflict of interest declaration forms are filed with the CCHMC EBDM group.

Once the BEST has been in place for five years, the development team reconvenes to explore the continued validity of the recommendation. This phase can be initiated at any point that evidence indicates a critical change is needed. CCHMC EBDM staff perform a quarterly search for new evidence in an horizon scanning process. If new evidence arises related to this BEST, authors are contacted to evaluate and revise, if necessary.

For more information about CCHMC Best Evidence Statements and the development process, contact the Evidence Collaboration at EBDMinfo@cchmc.org.

Note

This Best Evidence Statement addresses only key points of care for the target population; it is not intended to be a comprehensive practice guideline. These recommendations result from review of literature and practices current at the time of their formulation. This Best Evidence Statement does not preclude using care modalities proven efficacious in studies published subsequent to the current revision of this document. This document is not intended to impose standards of care preventing selective variances from the recommendations to meet the specific and unique requirements of individual patients. Adherence to this Statement is voluntary. The clinician in light of the individual circumstances presented by the patient must make the ultimate judgment regarding the priority of any specific procedure.

APPENDIX: EVIDENCE SEARCH STRATEGY, RESULTS, & EVIDENCE TABLE

Criteria for considering studies for this review

Types of Studies

All research and quality improvement study designs were considered for inclusion.

Types of Participants

Hospitalized patients who had central lines were included.

Types of Interventions

Studies of chlorhexidine bathing as an intervention were considered for inclusion.

Types of Outcomes

Central-line associated blood stream infections.

Search Strategy: Revision

| Search Databases | Search Terms | Limits, Filters, & Search Date Parameters | Date of Most Recent Search |
|---|-------------------------|---|----------------------------|
| <input checked="" type="checkbox"/> MedLine via PubMed | • Chlorhexidine bathing | Publication Dates or Search Dates: • 04/2013 to 04/2015 <input checked="" type="checkbox"/> English Language <input type="checkbox"/> Pediatric Evidence Only: • X <input type="checkbox"/> Other Limits or Filters: | 04/01/2015 |
| <input checked="" type="checkbox"/> CINAHL | • Chlorhexidine bath | Publication Dates or Search Dates: • 04/2013 to 04/2015 <input checked="" type="checkbox"/> English Language <input type="checkbox"/> Pediatric Evidence Only: • X <input type="checkbox"/> Other: • X | 04/01/2015 |
| <input checked="" type="checkbox"/> Cochrane Database for Systematic Reviews | • Chlorhexidine bath | Publication Dates or Search Dates: • 01/2005 to 03/2015 <input type="checkbox"/> English Language <input type="checkbox"/> Pediatric Evidence Only: • X <input type="checkbox"/> Other: • X | 04/01/2015 |

Search Results & Methods

The initial search for evidence identified 46 articles.
8 articles met the inclusion criteria above.

Original Search Strategy:

Databases: PubMed

Search Terms: Chlorhexidine bathing in children, chlorhexidine bathing and infections, skin care, children

Limits & Filters: All dates considered; English language

Date Search Done: 4/22/2013

Evidence Table for Included Articles

| Citation | Sample | Intervention | Results | Evidence Level |
|---------------------------------|--|--|---|----------------|
| Derde et al. (2012) | Systematic review of 7 adult ICU studies (N=20,384 patients) | To be included, studies had to evaluate CHG body washing | ↓ Carriage of MRSA and VRE Possible ↓ BSI with MRSA and VRE | 1a |
| Karki & Cheng (2012) | Systematic review of 16 studies and 4 conference abstracts (N not reported) | To be included, studies had to compare bathing with CHG washcloths to soap and water or routine care or no intervention | ↓ CLABSI rates ↓ VRE colonization ↓ MRSA colonization ↔ MRSA, VRE, and acinetobacter infection rates <i>No serious adverse events</i> <i>No difference in isolate susceptibility</i> <i>Low concentrations in blood of children with daily bathing, no cumulative tendency with repeated exposure</i> | 1b |
| O'Horo et al. (2012) | Meta-analysis of 12 studies (N=137,392 patient-days) | To be included, studies had to evaluate daily bathing with CHG vs. soap and water or standard of care | ↓ BSI rates ↓ CLABSI rates | 1b |
| Sievert et al. (2011) | Systematic review of 5 studies (N=7,133 patients) | To be included studies had to be meta-analyses, RCTs, or experimental studies from past 10 years and had to examine CHG bathing | ↓ CLABSI rates especially in MICUs | 1b |
| Climo et al. (2013) | Adult ICU patients and adult BMT patients (N=7,727 patients) | Daily bathing with 2% CHG impregnated washcloths vs. daily bathing with non-antimicrobial washcloths | ↓ MRDO rates ↓ HA-BSI rates <i>No significant difference in skin reactions.</i> <i>No detection of MRSA or VRE isolates with high-level resistance to CHG</i> | 2a |
| Huang et al. (2013) | Adult ICU patients (N=74,256 patients) | MRSA screening and isolation vs. targeted decolonization (screening, isolation, and decolonization of MRSA carriers – twice daily intranasal mupirocin ointment + daily bathing with 2% CHG impregnated washcloths) vs. universal decolonization (no screening, decolonization of all patients – twice daily intranasal mupirocin ointment + daily bathing with 2% CHG impregnated washcloths) | ↓ Rate of all BSIs in universal decolonization group <i>Mild pruritus or rash after bathing occurred in 7 out of 74,256 patients and resolved on discontinuation of the CHG cloths</i> | 2b |
| Milstone et al. (2013) | Pediatric ICU patients (Intent to treat analyses: N=4,947 patients; Per protocol analyses: N=4,072 patients) | Daily bathing with 2% CHG impregnated washcloths vs. daily bathing with soap and water or non-medicated washcloths | ↔ Bacteremia incidence in ITT group. ↓ Bacteremia in per-protocol group <i>1% withdrew because of CHG-related skin irritation, 1.12/1000 patient days incidence of CHG-related skin reactions, no severe adverse reactions.</i> | 2a |
| Noto et al. (2015) | Adult ICU patients (N=9,340 patients) | Daily bathing with 2% CHG impregnated washcloths vs. daily bathing with non-medicated washcloths | ↔ Composite infection (CLABSI, CAUTI, VAP, and c diff) ↔ HA-BSI rate | 2b |
| Cassir et al. (2015) | Adult ICU patients (N=325 patients) | Daily bathing with 2% CHG impregnated washcloths vs. daily bathing with soap and water | ↓ Hospital acquired infections | 3a |
| Martinez-Resendez et al. (2014) | Adult ICU patients (N=1,007 patients) | Daily bathing with 2% CHG impregnated washcloths and enhanced hand hygiene vs. daily bathing with soap and water and enhanced hand hygiene vs. daily bathing with soap and water | ↓ Infection rates in the CHG bathing and enhanced hand hygiene group | 3a |

| | | | | |
|---------------------------|---|---|---|----|
| Rupp et al. (2012) | All inpatients (except neonates, infants, and L&D) (N=188,859 patient-days) | CHG bathing 3 days/week; phase 2 CHG bathing daily; phase 3 no CHG bathing (4% CHG added to basin) or scrub with CHG in shower | ↓C diff <i>No adverse events</i> | 3a |
| Viray et al. (2014) | Adult ICU patients (N=53,526 patient-days) | Daily bathing with 4% CHG-based soap vs. daily bathing with soap and water | ↓MRSA acquisition ↓All S. aureus acquisition ↓MRSA infections | 3a |
| Edwards et al. (2014) | Adult patients in a long term acute care hospital with central lines (N not reported) | Daily bathing with 2% CHG impregnated washcloths vs. bathing with soap and water | ↓CLABSI rates | 4a |
| Quach et al. (2014) | Infants with a central venous catheter admitted to a neonatal ICU (N=790 patients) | Bathing with 2% CHG impregnated washcloths vs bathing with mild soap and water | ↓CLABSI rates <i>No adverse events</i> | 4a |
| Armelleno et al. (2014) | Adult medical/surgical ICU patients who tested positive for MRSA upon ICU admission and/or had a central line (N=18,338 patient-days) | Daily bathing with 2% CHG washcloths vs. soap and water bathing | ↓ Hospital acquired MRSA transmission | 4b |
| Lopez (2011) | Adult medical/surgical ICU patients (N not reported) | Daily bathing with 2% CHG washcloths vs. standard care | ↓ CLABSI rates | 4b |
| Munoz-Price et al. (2012) | Adult SICU patients (N=42,430 central catheter days) | Bundle introduced in stages: CHG Scrub the hub; then CHG daily baths (2% CHG washcloths vs. daily soap and water); then daily RN rounds | ↓CLABSI rates | 4b |