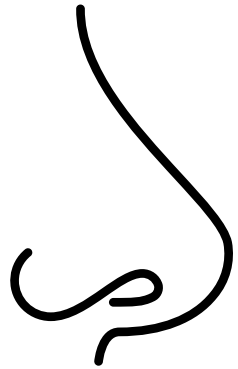
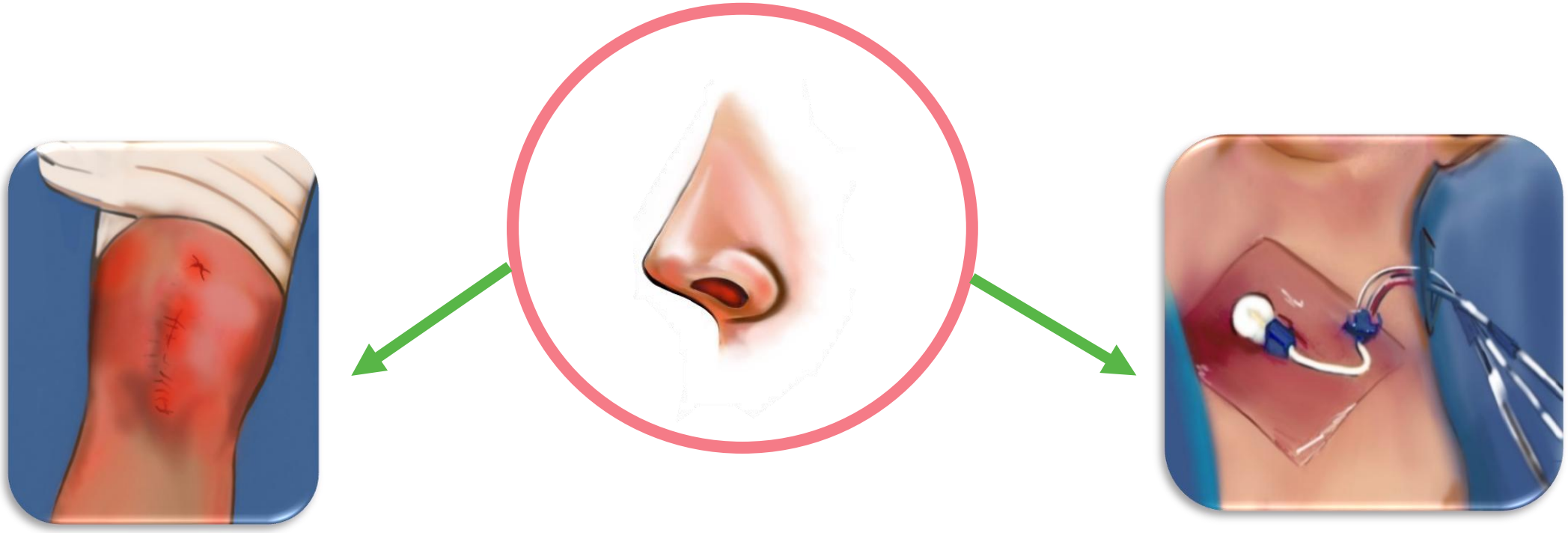
The power of Nasal Decolonization



Nasal colonization is a major risk factor for invasive disease

85% of *S. aureus* SSI[1] and **82%** BSI[2] can be traced to the patient's nasal flora.

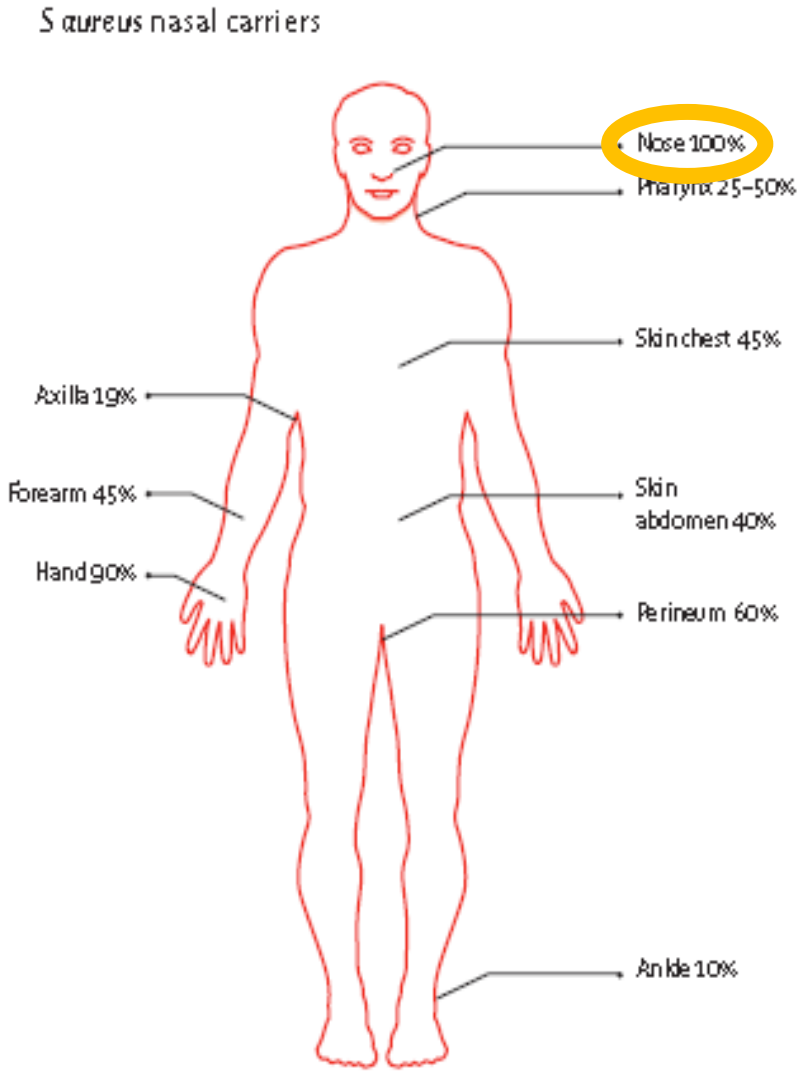


[1] Kalmeijer MD, ICHE 2000 May;21(5):319-323

[2] Von Eiff, C. N Engl J Med 2001; 344:11-16

S. aureus carriage: nose v's the body

- CHG bathing does not address the risk
- Most common *S. aureus* carriage site
- Key reservoir for transmission
- Acts as predominant source of colonization for other body sites



Poyraz, O. et al Journal of the Royal Society Interface, Vol 19, issue 191. June 14, 2022

Wertheim H., Lancet Infect Dis 2005;5:751-62

Healthcare Associated Pathogens (HAPs) colonizing the nasal vestibule

Top 10 HAI pathogens[1]	HAPs colonizing the nasal vestibule	Nasal colonization rates*	Rank order of HAI pathogens, by type (CLABSI, PVAP, SSI)[1]
#1	Escherichia spp **Escherichia coli**	 6.1%, 8%,	#1 CLABSI (hospital oncology units) #1 SSI (abdominal) / #2 SSI (all types)
#2	**Staph aureus** - Methicillin-resistant SA - Methicillin-sensitive SA	41%, 33% 5%, 17.7% 20%	#1 CLABSI (hospital wards+ ICU) #1 PVAP (ICUs) #1 SSI (all types/orthopedic/cardiac/ob-gyn)
#3	**Klebsiella spp** Klebsiella oxytoca Klebsiella pneumoniae	 6.4%, 7% 2.4%, 8.1%	#3 CLABSI (hospital wards) #3 PVAP (ICUs)
#4	Pseudomona spp **Pseudomonas aeruginosa**	 1.2%	#1 PVAP (hospital wards) / #2 PVAP (ICUs) #3 SSI (orthopedic/cardiac)
#5, #8, and #11	**Enterococci** E. faecalis, E. faecium, Other Enterococcus spp**	26% 10%, 17%	#4 CLABSI (hospital wards) / #3 CLABSI (hospital oncology units) #2 SSI (abdominal) / #3 SSI (all types/ob-gyn)
#6	**Coagulase-negative staphylococcus** - Methicillin-resistant CoNS - Methicillin-sensitive CoNS	22.5% 6.3%, 11%, 31% 18.9%	#1 CLABSI (ICU) #2 SSI (orthopedic/cardiac)
#7	**Enterobacter spp** Enterobacter aerogenes Enterobacter cloacae	 2.6%, 1.4%, 6%	#10 CLABSI (ICU & hospital wards) #3 PVAP (ICUs & hospital wards) #4 SSI (orthopedic/cardiac)
#9	**Proteus spp** Proteus mirabilis	 6.0%; 2.5%	#9 PVAP (hospital wards) #7 SSI (orthopedic)
#10	**Candida albicans**	14%	#2 CLABSI (ICU) #10 SSI (all types)

1. Weiner-Lastinger L. et al. (2020). *ICHE*, 41,1-18
2. Glück U., et al. (2000). *The Laryngoscope*, *110*(3), 426–428
3. Heckel M., et al. (2017). *PLOS ONE*, *12*(12)
4. Kaspar U. et al. (2016). *Environ. Microbiol*, 18 (7):2130-42
5. Köck R. et al. (2016). *New Microbes and New Infections*, *9*, 24–34
6. Laux C., et al. (2019) *Microbiology Spectrum*, *7*(2)
7. Liu C. et al. (2015) *Science Advances*, *1*(5)
8. Ucuncu H., et al. (2009) *Acta Otorhinolaryngol Ital*, Oct; 29(5): 251–254
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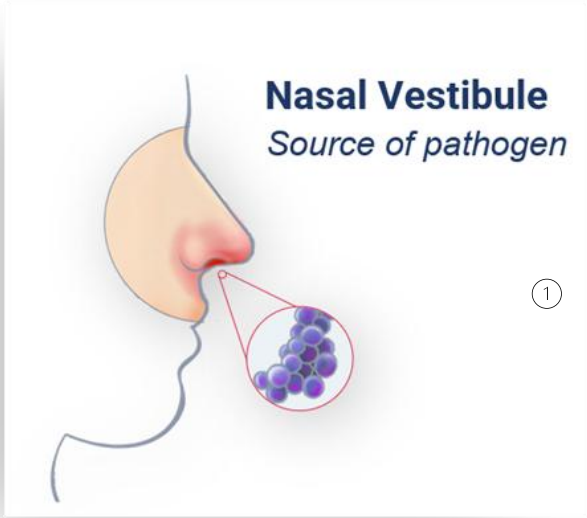
11. Ruppé, E. et al. (2009). *Antimicrob. Agents Chemother.*, 53(2), 442–449.

* *indicates colonization of nasal pathogen was identified but no colonization rate was specified in the study* (*See refs. 2-11)*

** *When analyzed at the genus level, Enterococcus ranks #2 for all HAIs*

The Chain of Infection



① **MAIN RESERVOIR**

② **PORTAL OF EXIT**

③ **TRANSMISSION**

④ **PORTAL OF ENTRY**

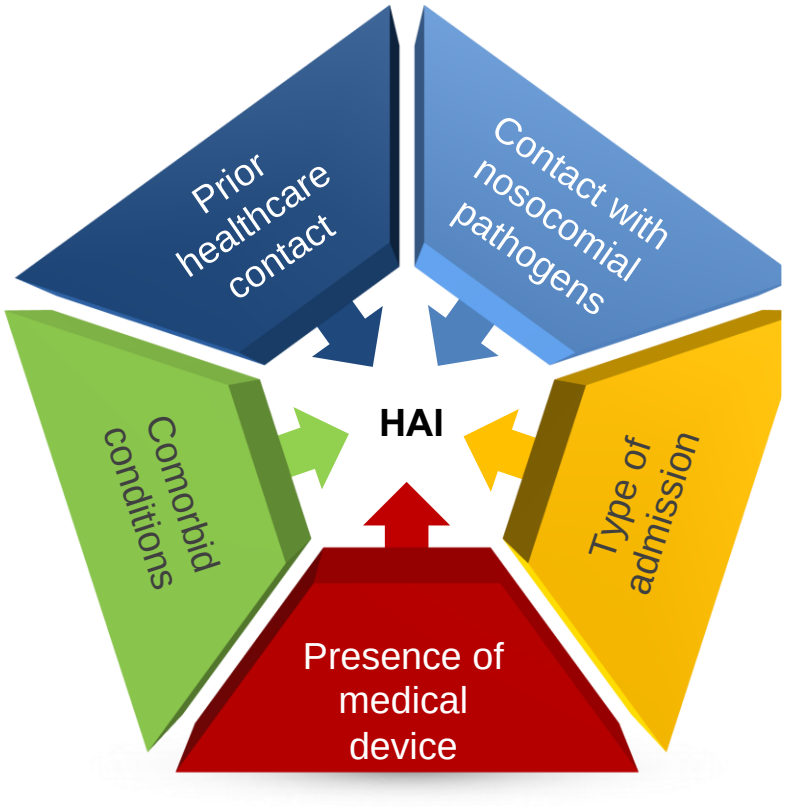
-
- **NON-INTACT SKIN**
- **DEVICES**
  - ✓ *Ports*
  - ✓ *Drains*
  - ✓ *Tubing*
  - ✓ *Hubs*
  - ✓ *Dressings*
  - ✓ *Trach sites*
  - ✓ *Surgical incisions*
  - ✓ *Wounds*
  - ✓ *Pressure sores*
- Compromised immune system

Est. HAI Treatment Costs

Estimated HAI Associated Treatment Cost	
Estimated associated treatment cost for a CLABSI	**$48,108**
Est. associated excess length of stay (LOS) days	*7.54 days*
Estimated associated treatment cost for a gram + resistant bacteremia lab ID	**$37,169**
Est. associated excess LOS days	*7.54 days*
Estimated associated treatment cost for a pneumonia	**$40,000**
Est. associated excess LOS days	*7 days*
Estimated associated treatment cost for SSI	**$28,219**
Estimated associated treatment cost for a readmission	**$12,000**
Est. associated excess LOS days	*7.8 days*

For full list of references used to make estimates, please see Reference Section. Some costs may be reimbursable.

Risk Factor for Nasal Carriage and HAIs



Devices: Intravascular catheters (CVCs, PICCs, PIVCs, arterial, ports, hemodialysis), intraosseous, VADs, other implants.

Comorbid conditions: Liver cirrhosis, psoriasis, obesity, lupus, chronic kidney disease, dialysis, diabetes, rheumatoid arthritis, cancer, HIV, transplant, COPD, autoimmune, cystic fibrosis, skin ulcers.

Prior healthcare contact: Nursing home resident, geriatric, transfers, hospitalization in past 12 months.

Contact with nosocomial pathogens: History of MRSA colonization /infection, MDRO carriage, correctional facilities, recent antibiotic use.

Type of admission: Critical care, burns, surgery (cardiothoracic, vascular, ortho, neuro, trauma, gastrointestinal, lung cancer, ob-gyn), palliative.

Recommendations for reducing hospital-onset *S aureus* infections

ICU patients: Decolonize all patients with intranasal anti-staphylococcal antibiotic/antiseptic plus topical CHG.

Non-ICU patients: Decolonize patients with CVC or midline catheter with intranasal anti-staphylococcal antibiotic/antiseptic plus topical CHG.

Surgical patients: For all patients undergoing high risk surgeries (e.g. cardiothoracic, orthopedic, and neurosurgery), unless known to be *S. aureus* negative, use an intranasal anti-staphylococcal antibiotic/antiseptic and CHG wash or wipes prior to surgery.

https://www.cdc.gov/staphylococcus-aureus/hcp/prevent-in-acute-care-facilities/

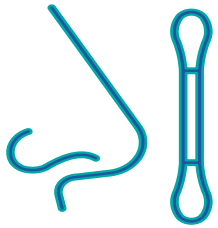
Updated AORN Guidelines on Preoperative Skin Antisepsis (2021)

*Highlights on recommendations for **nasal decolonization***:

Section 1.2.1

Universal decolonization (vs. targeted) resulted in **greater efficiency** and **lower cost** due to **SSIs prevented**.

Section 1.3.1

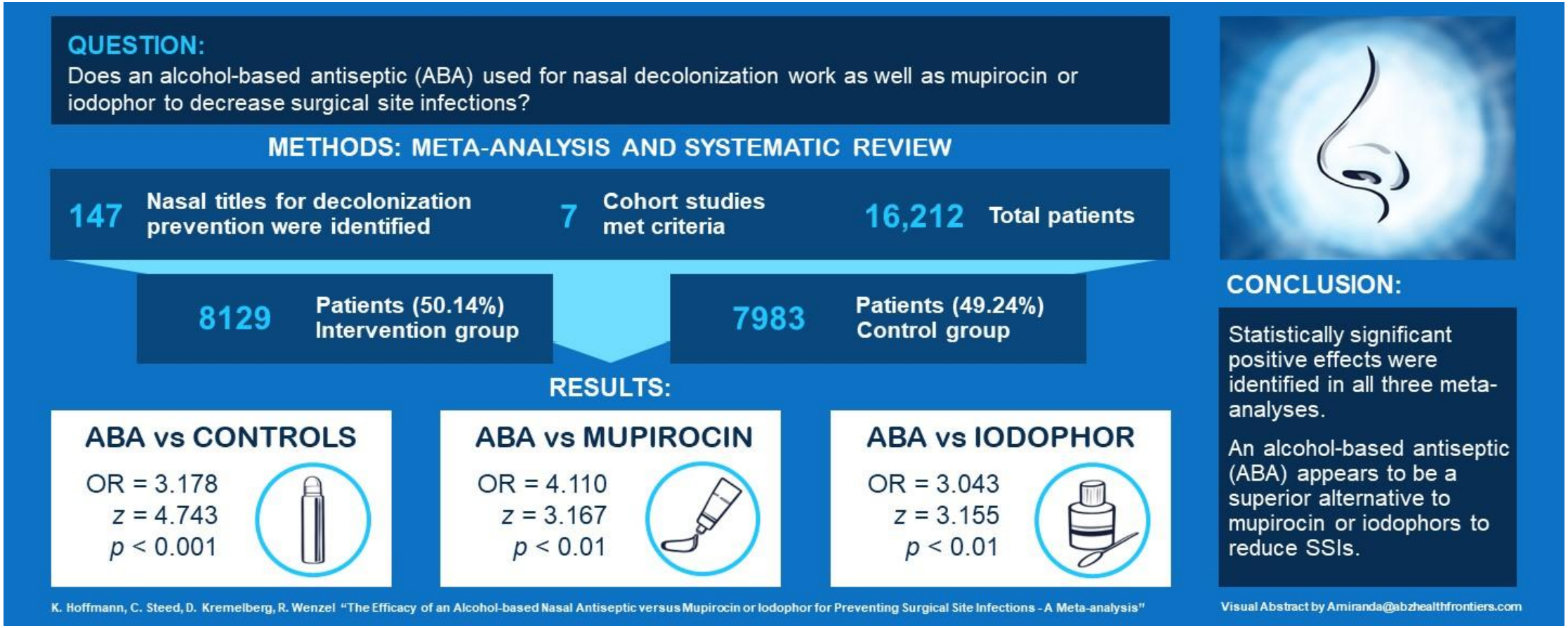


An alternative to mupirocin is the use of an antiseptic (including an **alcohol-based antiseptic**)

Section 1.4

Postop decolonization: Surgical patients may benefit from relatively short-term decolonization or **until the surgical incision has healed**

Meta-analysis: The Efficacy of an Alcohol-based Nasal Antiseptic vs Mupirocin or Iodophor for Preventing SSIs



Hoffmann K, Steed C, Kremelberg D, Wenzel R. Am J Infect Control. 2024 Oct;52(10):1202-1208. DOI: 10.1016/j.ajic.2024.07.003

SHEA 2025: ABNA vs MNO in Burn Patients

Alcohol-based nasal sanitizer provides superior protection against MRSA bacteremia compared to mupirocin nasal decolonization in burn patients

- **Retrospective** before/after study 08/01/2021 to 7/31/2024 (18 mo each MNO, ABNS intervention periods)
- **Setting**: Burn unit – 8 ICU beds for burn care + 15 regular beds (mixed acuity, burn patients 47%) in 885 bed, tertiary care, academic hospital.
- **Study arms**:
  - Mupirocin (MNO) BID for 5 days after admission
  - ABNA BID for entire stay on Burn unit
  - (n=456)

- Providing ABNS >80% of the time resulted in a significant decrease in HA-MRSA bacteremia events in burn patients compared to MNO
- Daily application of ABNS throughout hospitalization may offer additional protection against MRSA in patients hospitalized for extended periods of time

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Atrium Health

Wake Forest University School of Medicine

Evidence from surgical studies using Alcohol-Based Nasal Antiseptic (ABNA) pre-and post-op

Study	Intervention	Outcome
Bostian P et al. 2023. *Surgical Infections*, *24*(7), 651–656.	**Total joints surgery.** Universal pre and post op nasal decolonization. [CHG pre op already in use.]	41.3% reduction in all-cause SSI (p=0.048)
Franklin S. *Am. J. Infect. Control.* 2020. 48(12), 1501-1503	**Total joints surgery.** Universal pre and post op nasal decolonization. [CHG pre op already in use.]	100% reduction all-cause SSI
Mullen A et al. *Am. J. Infect. Control.* 2017. 45(5), 554--556	**Spine surgery**. Universal pre and post op nasal decolonization. [CHG pre op already in use.]	81% reduction in *S. aureus* SSI
Stegmeier H. *Op Forum Infect. Dis.* 2019. 6(S2), S446	**Total joints surgery** Universal pre and post op nasal decolonization in place of targeted mupirocin. [CHG pre op already in use.]	98% reduction in all-cause SSI
Landis-Bogus K and Belani *A. Am. J. Infect. Control*. 2019. 47(S6), S39	**All surgical procedures.** Universal pre and post op nasal decolonization in place of nasal iodophor. [CHG pre and post op already in use.]	51% reduction in *S. aureus* SSI
Arden S. O*p Forum Infect. Dis*. 2019. 6(S2), S268	**All surgical procedures**. Universal pre and post op nasal decolonization. [CHG preop already in use.]	100% reduction in all-cause SSI (from 3/4,313 to 0/4,872 procedures)

Universal decolonization: Evidence from studies using ABNA

Study	Intervention	Outcome
Klemm A. Am. J. Infect. Control. 2024. 52(6) S75	Universal decolonization protocol of skin and nares for all inpatients (CHG daily bathing and ABNA every 12 hours) and a standardized dressing change policy as part of a multidisciplinary approach to infection prevention.	CLABSI rates decreasing to zero for 3+ years.
Alderman, Set al. Open Forum Infec Dis. 2023. 10 Suppl 2	Documentation method for nasal decolonization component of existing protocol (all inpatients) was transitioned from nursing task list to electronic medication administration record (EMAR).	46% decrease in hospital-associated MRSA Lab ID events (MRSA bacteremia) after transition from nursing task list to EMAR. (statistically significant)
Schroeder J, et al. Am. J. Infect. Control. 2023. 51(7), S14	Decolonization protocols (nasal and CHG bathing) in pediatric critical care populations at an academic pediatric medical center.	41% reduction in hospital-onset MRSA rates and a 54% reduction in hospital-onset MRSA bacteremia rates
Montalvo G et al. Am J. Infect. Control. 2023. 53(7), S54	Improved compliance with existing universal decolonization for all inpatients (nasal alcohol-based antiseptic and CHG bathing).	Reduced MRSA bacteremia by almost 50% (rate decreased from 0.2404 to 0)
Pratt N et al. Am. J. Infect. Control. 2022. 50(7S), S31	Implementation of an alcohol- based nasal decolonization agent in combination with CHG bathing for ICU patients.	62.5% decrease in LabID MRSA infections (MRSA bacteremia)
Reeves L et al. Infect Control Hosp Epidemiol. 2020. 41(S1)	Universal alcohol-based nasal antiseptic in adult intensive care setting. [No CHG was added]	The rate of MRSA bacteremia decreased from 0.2404 to 0. ($P < .0001$)
Jimenez A et al. Op Forum Infect. Dis. 2019. 6(S2), S268	Replaced an ICU screen and isolate protocol with a hospital-wide universal decolonization bundle.	The HO-MRSA bacteremia SIR decreased 73.5% from 3.66 to 0.97 from baseline to postintervention periods (P = 0.003).
Arden S. Op Forum Infect. Dis. 2019. 6(S2), S268	House-wide application of alcohol-based nasal antiseptic in place of screening and contact precautions. [No CHG was added]	Reduced incidence of MRSA bacteremia from 3/1,000 patient-days to 0/1,000 patient-days.

Impact of adding nasal decolonization to existing CHG/body decolonization protocol

Reduction	Author (location)	Existing CHG
100% All cause SSI for all surgical procedures	Arden (Pinellas, FL)	
59% All cause SSI for all surgical procedures	Cernich (Bayfront, FL)	
100% All cause SSI for total joints	Franklin (Wellstar Cobb, GA)	
41.3% All cause SSI for total joints	Bostian (WVU Medicine, WV)	
74% MRSA bacteremia	Jimenez (Jackson, FL)	in ICU

Thank You

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978-289-3376

Independently conducted studies evaluating the impact of nasal decolonization with an alcohol-based nasal antiseptic.

Published Peer-Reviewed Publications

1. Hoffmann K, Steed C, Kremelberg D, Wenzel R. (2024). **The efficacy of an alcohol-based nasal antiseptic versus mupirocin or iodophor for preventing surgical site infections: A meta-analysis**. *American Journal of Infection Control*. 2024 Oct;52(10):1202-1208 https://doi.org/10.1016/j.ajic.2024.07.003

2. Bostian, P. A., Vaida, J., Brooks, W. C., Chaharbakhshi, E., Dietz, M. J., Klein, A. E., Murphy, T. R., Frye, B. M., & Lindsey, B. A. (2023). **A novel protocol for nasal decolonization using prolonged application of an alcohol-based nasal antiseptic reduces surgical site infections in total joint arthroplasty patients: A retrospective cohort study.** Surgical infections, 24(7), 651–656. https://doi.org/10.1089/sur.2022.344

3. Franklin, S. (2020). **A safer, less costly SSI prevention protocol—Universal versus targeted preoperative decolonization.** *American Journal of Infection Control,* 48(12) 1501-1503. https://doi.org/10.1016/j.ajic.2020.02.012

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5. Mullen, A., Wieland, H. J., Wieser, E. S., Spannhake, E. W., & Marinos, R. S. (2017). **Perioperative participation of orthopedic patients and surgical staff in a nasal decolonization intervention to reduce Staphylococcus spp surgical site infections.** *American Journal of Infection Control,* 45(5), 554-556. https://doi.org/10.1016/j.ajic.2016.12.021

6. Steed, L. L., Costello, J., Lohia, S., Jones, T., Spannhake, E. W., & Nguyen, S. (2014). **Reduction of nasal *Staphylococcus aureus* carriage in health care professionals by treatment with a nonantibiotic, alcohol-based nasal antiseptic.** *American Journal of Infection Control,* 42(8), 841-846. https://doi.org/10.1016/j.ajic.2014.04.008

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1. Alderman, S., Heishman, C., Skiff, R. (2023). **Impact of alcohol-based nasal decolonization's method of documentation in reducing methicillin-resistant *Staphylococcus aureus* hospital-associated infections**. *Open Forum Infectious Diseases*, Volume 10, Issue Supplement_2, December. https://doi.org/10.1093/ofid/ofad500.800

2. Candray, K. (2020). **Improving patient compliance with preoperative universal decolonization to reduce surgical infection rate and costs**. *Open Forum Infectious Diseases,* 7(S1), S479 https://doi.org/10.1093/ofid/ofaa439.1077

3. Cernich, C. (2020). **Universal Preoperative Antiseptic Nasal and Skin Decolonization for Reduction in SSI and Associated Costs**. *American Journal of Infection Control,* 48(S8), S50. https://doi.org/10.1016/j.ajic.2020.06.065

4. Hanzel, K. et al. (2024). **Comprehensive multidisciplinary performance improvement teams effectively reduce colon surgical site infections**. *American Journal of Infection Control*, Volume 52, Issue 6, S6 https://doi.org/10.1016/j.ajic.2024.04.110

5. Deatherage, N. (2016). **Impact of Reduced Isolation and Contact Precaution Procedures on Infection Rates and Facility Costs at a Non-Profit Acute Care Hospital**. *American Journal of Infection Control*, 44(S6), S101–S102. https://doi.org/10.1016/j.ajic.2016.04.091

6. Gnass, S. (2020). **Improving outcomes with revised preoperative universal decolonization protocol**. *Open Forum Infectious Diseases,* 7(S1), S479 . https://doi.org/10.1093/ofid/ofaa439.1076

7. Jimenez, A., Sposato, K., De Leon Sanchez, A., Williams, R., & Francois, R. (2019). **Reduction of Hospital-Onset Methicillin-Resistant Staphylococcus aureus (MRSA) Bacteremia in an Acute Care Hospital: Impact of Bundles and Universal Decolonization**. *Open Forum Infectious Diseases,* 6(S2), S268. https://doi.org/10.1093/ofid/ofz360.635

8. Landis-Bogush, K., & Belani, A. (2019). **Impacts of Coordinated, Hospital-wide Use of Alcohol-based Nasal Decolonization on Infection Rates, Patient Care and Cost Savings**. *American Journal of Infection Control*, 47(S6), S39. https://doi.org/10.1016/j.ajic.2019.04.091

9. Little, A.R. (2024). **Does skin and nasal decolonization reduce catheter-associated urinary tract infections?** *American Journal of Infection Control*, Volume 52, Issue 6, S40 https://doi.org/10.1016/j.ajic.2024.04.064

10. Montalvo Gonzalez, L., Macedo-Rea, M., Manos, O., et al. **Increasing compliance with hospital-wide universal decolonization protocol decreases methicillin-resistant *Staphylococcus aureus* (MRSA) bacteremia.** American Journal of Infection Control, Volume 51,Issue 7, S54 https://doi.org/10.1016/j.ajic.2023.04.111

11. Pratt N., Heishman C., Blizard K., Cissell, J. **Alcohol-based Nasal Decolonization and Chlorhexidine Bathing to Reduce Methicillin-resistant Staphylococcus Aureus Hospital-acquired Infections in Critical Patients.** *American Journal of Infection Control*, Volume 50, Issue 7, Supplement, 2022, Page S31, ISSN 0196-6553, https://doi.org/10.1016/j.ajic.2022.03.048.

12. Reeves, L., Barton, L., Williams, J., Don Guimera, Williams, B., Hysmith, N., & Morton, J. (2020). **Effectiveness of an Alcohol-Based Nasal Antiseptic in Reducing MRSA Bacteremia in an Adult Intensive Care Population**. *Infection Control & Hospital Epidemiology,* 41(S1), s206. https://doi.org/10.1017/ice.2020.748

13. Schroeder, J., Schieffelin, J., Marney, E. **Effects of decolonization protocols in pediatric critical care populations.** American Journal of Infection Control, Volume 51, Issue 7, S14 https://doi.org/10.1016/j.ajic.2023.04.153

14. Stegmeier, H. (2019). **Alcohol-Based Nasal Antiseptic as Part of a Bundle to Reduce the Incidence of Contact Precautions and Surgical Site Infections**. *Open Forum Infectious Diseases*, 6(S2), S446. https://doi.org/10.1093/ofid/ofz360.1101

15. Whitaker, J. (2019). **A Safe, More Cost-Effective Protocol: Universal Decolonization vs. MRSA Screening and Contact Precautions**. *Open Forum Infectious Disease,* 6(S2), S25. https://doi.org/10.1093/ofid/ofz359.055

16. Zalusky-Kamm, L, et al. (2024**). The addition of nasal antiseptic to universal decolonization programs reduces central line-associated bloodstream infections in intensive care units**. *American Journal of Infection Control*, Volume 52, Issue 6, S74 https://doi.org/10.1016/j.ajic.2024.04.143

Nasal decolonization reduces incidence SSIs

Preventing Surgical-Site Infections in Nasal Carriers of Staphylococcus Aureus.
Bode LG, Kluytmans JA, Wertheim HF, et al.
The New England Journal of Medicine. 2010;362(1):9-17. doi:10.1056/NEJMoa0808939.

Eradication of Staphylococcus Aureus Post-Sternotomy Mediastinitis Following the Implementation of Universal Preoperative Nasal Decontamination With Mupirocin: An Interrupted Time-Series Analysis.
San-Juan R, Gotor-Pérez CA, López-Medrano F, et al.
Clinical Infectious Diseases : An Official Publication of the Infectious Diseases Society of America. 2021;73(9):1685-1692. doi:10.1093/cid/ciab073.

Nasal carriage of Staphylococcus aureus is a major risk factor for surgical-site infections in orthopedic surgery
Kalmeijer MD, van Nieuwland-Bollen E, Bogaers-Hofman D, de Baere GA

Infect Control Hosp Epidemiol. 2000. May;21(5):319-23

Intranasal mupirocin for reduction of Staphylococcus aureus infections in surgical patients with nasal carriage: a systematic review.

van Rijen, M, Bonten, M, Wenzel, RP, Kluytmans, JA

Antimicrob Chemother 2008;61:254-2

The Efficacy of an Alcohol-Based Nasal Antiseptic Versus Mupirocin or Iodophor for Preventing Surgical Site Infections: A Meta-Analysis.
Hoffmann KK, Steed CJ, Kremelberg D, Wenzel RP.
American Journal of Infection Control. 2024;52(10):1202-1208. doi:10.1016/j.ajic.2024.07.003.

References for HAI Treatment Costs

Avg. HAI Treatment Costs

Average cost of a CLABSI and SSI

Discussion | Agency for Healthcare Research and Quality (ahrq.gov)

Average cost of a gram + bacteremia lab ID

Inagaki K, Lucar J, Blackshear C, Hobbs C. Methicillin-susceptible and Methicillin-resistant Staphylococcus aureus Bacteremia: Nationwide Estimates of 30-Day Readmission, In-hospital Mortality, Length of Stay, and Cost in the United States. *Clinical Infectious Diseases*. 2019 Dec;69(12,15):2112-2118. doi:10.1093/cid/ciz123

Average cost of a pneumonia

Limper, A. H. (2012). Overview of pneumonia. Goldman's Cecil Medicine, 587. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7151832/

Average cost of a readmission

Inagaki K, Lucar J, Blackshear C, Hobbs CV. Methicillin-susceptible and Methicillin-resistant Staphylococcus aureus Bacteremia: Nationwide Estimates of 30-Day Readmission, In-hospital Mortality, Length of Stay, and Cost in the United States. Clin Infect Dis. 2019 Nov 27;69(12):2112-2118. doi: 10.1093/cid/ciz123. PMID: 30753447.

Avg. HAI Treatment Costs

Average LOS per CLABSI and MRSA bacteremia

Bell T, O'Grady NP. Prevention of Central Line-Associated Bloodstream Infections. Infect Dis Clin North Am. 2017 Sep;31(3):551-559. doi: 10.1016/j.idc.2017.05.007. Epub 2017 Jul 5. PMID: 28687213; PMCID: PMC5666696.

Average LOS per pneumonia

Limper, A. H. (2012). Overview of pneumonia. Goldman's Cecil Medicine, 587. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7151832/

Average LOS per readmission

Stewart S, Robertson C, Pan J, Kennedy S, Haahr L, Manoukian S, Mason H, Kavanagh K, Graves N, Dancer SJ, Cook B, Reilly J. Impact of healthcare-associated infection on length of stay. J Hosp Infect. 2021 Aug; 114:23-31. doi: 10.1016/j.jhin.2021.02.026. PMID: 34301393.