

# Chlorhexidine Patient Bathing as a Means to Prevent Healthcare Associated Infections

## Prof. Mark Rupp, University of Nebraska Medical Center

### A Webber Training Teleclass

**Chlorhexidine Patient Bathing as a Means to Prevent Healthcare Associated Infections**

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Hosted by Martin Kiernan  
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**Potential Conflicts of Interest**

- Dr Rupp reports the following pertinent potential conflicts of interest:
  - Prior research support in the form of contracts to UNMC from 3M & Molnlycke
  - Consultant or Advisory Board for 3M & Molnlycke


**Objectives**

At the conclusion of this program the participant should:

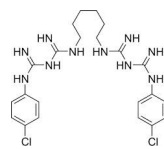



- Have a better understanding of the antiseptic activity of chlorhexidine gluconate (CHG)
- Be able to introduce a program of CHG patient bathing in a targeted or general manner
- Understand the pros and cons of CHG patient bathing

**Horizontal vs Vertical Infection Prevention Interventions**

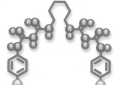
- Intervention that affects narrow group of patients (eg. Active surveillance cultures for MRSA) vs intervention that cuts across lines and affects numerous patient groups (eg. Hand Hygiene)



**Chlorhexidine Patient Bathing**

**Chlorhexidine**



1,6-di(4-chlorophenyl)-diguano hexane

- Cationic bisbiguanide first synthesized in England in 1950 during search for antimalarial drugs
- Mechanism of Action:
  - Rapid attraction to negatively-charged bacterial cell
  - Adsorption to phosphate-containing constituents of the bacterial surface
  - Attraction to cytoplasmic membranes
  - Leakage of low-MW cytoplasmic components (K<sup>+</sup>, Ca<sup>++</sup>)
  - Inhibition of membrane-bound enzymes (Adenosyl triphosphatase)
  - Precipitation of cytoplasm

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## Chlorhexidine

- **Antimicrobial Spectrum:**
  - CHG exhibits broad spectrum activity against wide variety of Gram-positive & Gram-negative bacteria, fungi, and lipid-coated viruses (HSV, HIV, RSV, flu, adeno, etc)
  - Inactive against bacterial spores
  - Inhibitory against acid-fast bacilli

## Cidal Activity of Chlorhexidine

Organism	Mean log reduction after 10 min contact with 0.5% CHG
<i>S. aureus</i>	2.5
<i>S. epidermidis</i>	>5.1
<i>E. faecalis</i>	1.1
<i>E. coli</i>	>6.4
<i>P. aeruginosa</i>	4.9
<i>B. fragilis</i>	5.2
<i>C. albicans</i>	4.2
<i>A. fumigatus</i>	2.4

Denton GW. In: Disinfection, Sterilization, and Preservation, 2001

## Clinical Applications of Chlorhexidine

- Preoperative surgical site scrub
- Preoperative shower
- Surgical hand scrub
- Hand disinfectant
- Bladder irrigant
- OB/GYN perineal antiseptic
- Devices: CVCs, dressings
- Wound irrigant
- Burn wound cleansing
- Mouthwash
- Oral care for patients on mechanical ventilation
- Body wash for prevention of MDROs
- Body wash to prevent CVC BSI

## Residual Activity and Cumulative Effect of Chlorhexidine

- Paulson, DS. Amer J Infect Control, 1993
- 4% CHG shower in 5 volunteers for 5 days.
- CHG impregnated sponges used for 60 seconds, rinse, and repeat.
- Cup-scrub culture method

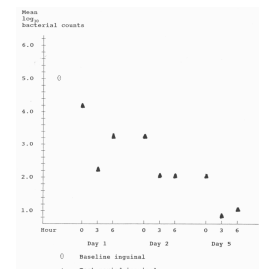
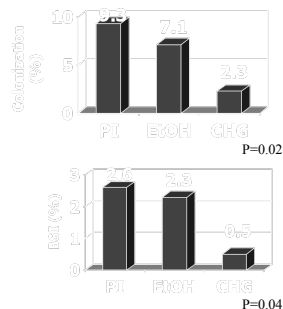


Table 2. Antimicrobial effects of CHG, inguinal region

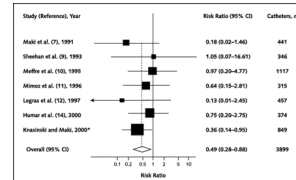
## CVC-BSI Prevention with CHG Skin Disinfection

- Maki DR, et al. Lancet, 1991.
- Prospective, randomized clinical trial involving 668 CVCs in SICU
  - 10% povidone iodine
  - 70% alcohol
  - 2% CHG



## CVC-BSI Prevention with CHG Skin Disinfection

- Chaiyakunapruk N, et al. Ann Intern Med, 2002
- Meta-analysis of RCTs comparing CHG vs PI for CVC insertion and care
- 8 studies, 4143 Catheters



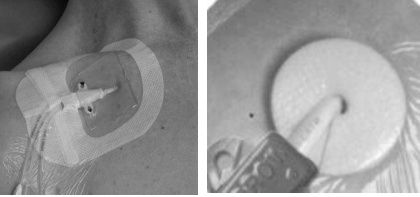
CVCs: RR 0.51 (95% CI 0.27-0.97)

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### CHG CVC DRESSINGS



- Timsit, et al. JAMA, 301:1231-41, 2009
- Timsit, et al. Am J Respir Crit Care Med. 186:1272-78

### Chlorhexidine Patient Bathing


Effectiveness of Chlorhexidine Bathing to Reduce Catheter-Associated Bloodstream Infections in Medical Intensive Care Unit Patients

Selective Use of Intranasal Mupirocin and Chlorhexidine Bathing and the Incidence of Methicillin-Resistant *Staphylococcus aureus* Colonization and Infection Among Intensive Care Unit Patients

Arch Intern Med 2007

Value of Whole-Body Washing With Chlorhexidine for the Eradication of Methicillin-Resistant *Staphylococcus aureus*: A Randomized, Placebo-Controlled, Double-Blind Clinical Trial

ICHE 2007

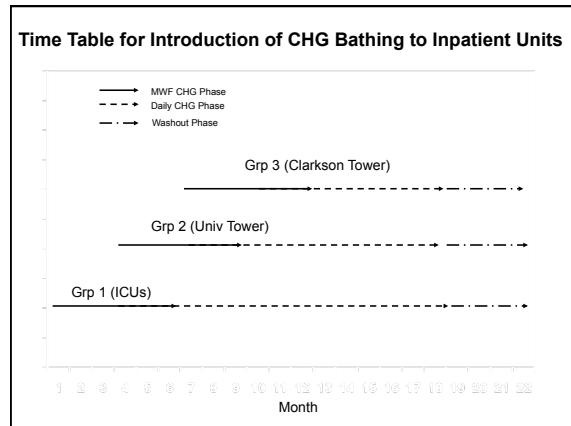


### Effect of Hospital-Wide Chlorhexidine Patient Bathing on Healthcare-Associated Infections

Mark E. Rupp, MD<sup>1,2</sup>, Jennifer Cavalieri, RN<sup>1</sup>, Elizabeth Lyden, MS<sup>1</sup>, Jennifer Kucera, MS<sup>1</sup>, MaryAnn Martin, RN<sup>2</sup>, Teresa Fitzgerald, RN<sup>1</sup>, Kate Tyson, RN<sup>1</sup>, James R. Anderson, PhD<sup>3</sup>, Trevor G. VanDuynen, MD<sup>1,4</sup>

(Infect Control Hosp Epidemiol. Nov 2012)

- Quasi-experimental, Prospective, Staggered-Initiation, Dose-escalation Study
- 3 Cohorts; 6 months M/W/F followed by every day CHG bathing
- 19 month intervention, 4 month washout period
- 188,859 patient days, 68,302 CHG baths
- HAIs monitored (CLA-BSI, CA-UTI, VAP, VRE, MRSA, CDI)



### Information and Teaching Sheets

**Just One Basin? No Problem!**

- If you use just one full bath basin for a patient bath, use 4 ounces of Hibiclens.
- Current policy (M-121) assumes that two basins are used for bathing, one for the main bath and a second for animal care.
- Note - Use 2 oz of Hibiclens for a 1/2 full basin.

**How much is 4 ounces?**

- 4 oz = 120 mL
- 4 oz = 30-40 portions from a 32 ounce bottle of Hibiclens
- 4 oz = 1 level 4 oz bottle of Hibiclens

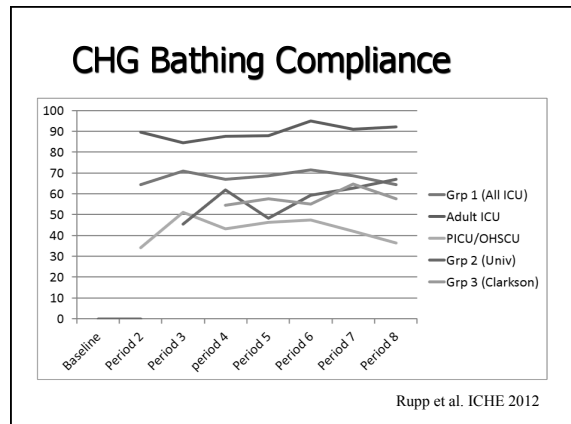
**Use Hibiclens for patient bathing.**

Your patient deserves Every Opportunity to Prevent Infection!

**Keep your patient's safety 4th.**

Additional hand hygiene supports the use of chlorhexidine bathing to prevent healthcare-associated infections.

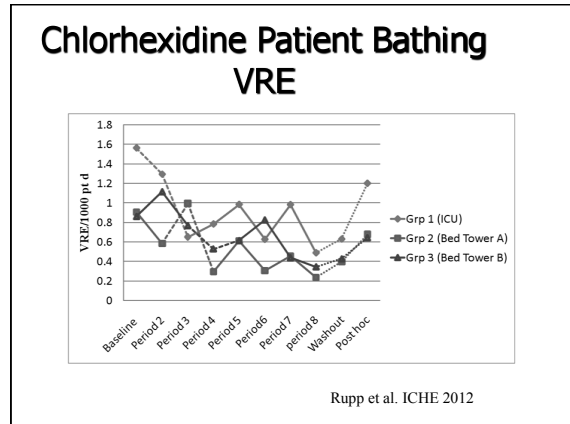
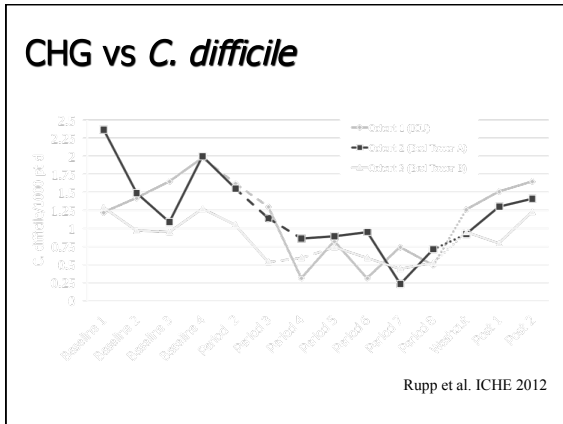
Available at Infection Control Intranet site or call 9-5276



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### Discussion

- Effect on *C. difficile* was unexpected:
  - Bactericidal vs vegetative cells
  - Inhibits spore germination
  - Bed bath and physical removal of spores (was effect of study simply to improve bathing?); Decreased environmental contamination and spread?
  - Surfactant may aid removal of spores

### Discussion

- Confounding?
  - Laboratory diagnostic changes
  - CDI control measures
    - Isolation, hand hygiene, glove use, bleach cleaning
    - Antibiotic use
    - Seasonality (increases in winter)
  - Changes in *C. difficile* strain type
- Study should be "hypothesis generating" and result in efforts to replicate our experience

### Future Directions

- Does use of CHG result in selection of qac(+) staphylococci and CHG resistance?
- What drives compliance with pt bathing?
- Cost effectiveness?

The NEW ENGLAND  
JOURNAL of MEDICINE

Effect of Daily Chlorhexidine Bathing on Hospital-Acquired Infection Feb 7, 2013

Michael W. Climo, M.D., Deborah S. Yokoe, M.D., M.P.H., David K. Warren, M.D.,  
Toshi M. Imai, M.D., Marlene Balon, M.D., Loren A. Herwaldt, M.D.,  
Robert A. Weinstein, M.D., Kent A. Sepkowitz, M.D., John A. Jernigan, M.D.,  
Kikolan Samojlik, M.S., and Edward S. Wong, M.D.

- Prospective, cluster-randomized study in 9 ICUs involving 7727 patients, 6 mo crossover
- 23% decrease in acquisition of MDROs (p= 0.03)
- 28% decrease in bloodstream infections (P = 0.007)

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The NEW ENGLAND  
JOURNAL of MEDICINE

June 13, 2013

Targeted versus Universal Decolonization to Prevent ICU Infection

Susan S. Huang, M.D., M.P.H., Edward Septimus, M.D., Ken Klennan, Sc.D., Julia Moody, M.S., Jason Hickoi, M.B.A., R.N., Taber R. Avery, M.S., Julie Lankiewicz, M.P.H., Adrijana Gombosen, B.S., Leah Teptara, B.A., Fabian Harford, M.S., Mary K. Hayden, M.D., John A. Jernigan, M.D., Robert A. Weinstein, M.D., Vinod J. Fraser, M.D., Katherine Heffernan, B.S., Eric Cui, B.S., Rebecca E. Kaganov, B.A., Karen Lolans, B.S., Jonathan B. Perin, M.D., Ph.D., and Richard Platt, M.D., for the CDC Prevention Epicenters Program and the AHRQ DECIDE Network and Healthcare-Associated Infections Program\*

- Prospective, cluster-randomized study in ICUs in 43 hospitals. Grp 1 - MRSA screening and isolation; Grp 2 - Targeted decolonization; Grp 3 - Universal decolonization (mupirocin & CHG baths)
- HR for MRSA (intervention vs baseline): 0.92 vs 0.75 vs 0.63 (P= 0.01)
- HR for BSI (intervention vs baseline): 0.99 vs 0.78 vs 0.56 (P = <0.001)

### CHG Resistance

- Multi-drug efflux pumps (*qacA/B*, *smr*) decrease susceptibility to CHG
- Prevalence surveys indicate *qacA/B* to be present in 0.5% - 80% of MRSA isolates.
- MIC CHG ~4-8 ug/mL increases to 16-32 ug/mL
- Clinical Significance?
  - Elevated MIC remains well below clinical concentration
  - *qacA/B* + mupirocin R = persistent colonization (Lee et al, CID, 2011)
  - CHG use selected for *qacA/B* (+) strains in ICU (Batra et al, CID 2010)

### Bath Basin Contamination

Hospital Basins Used to Administer Chlorhexidine Baths Are Unlikely Microbial Reservoirs

Rupp et al, ICHE 2013

- Bacterial contamination of simulated CHG bed bath solution
- 10<sup>8</sup> cfu of *E coli*, *S epi*, *E faecalis*
- Immediate and Residual experiments

### Effective Infection Prevention is a Multi-Piece Puzzle

- Education and Training
- Surveillance and Reporting
- Isolation and Source Control
- Elimination of Fomites
- Insertion and Care of Devices
- Vaccination and Presenteeism
- Environmental Cleaning
- Hand Hygiene
- CHG Bathing

Coming Soon

April 24 (Free Teleclass)  
**ARE WE TOO CLEAN FOR OUR OWN GOOD? THE HYGIENE HYPOTHESIS AND ITS IMPLICATIONS FOR HYGIENE, LIFESTYLE, AND PUBLIC HEALTH**  
Dr. Sally Bloomfield, London School of Hygiene and Tropical Medicine

May 5 (Free ... WHO Teleclass - Europe)  
**SPECIAL LECTURE FOR 5 MAY, 2014**  
Prof. Didier Pittet, World Health Organization

May 8  
**VENTILATOR-ASSOCIATED EVENTS: A PATIENT SAFETY OPPORTUNITY**  
Dr. Michael Klompas, Harvard Medical School

May 13 (British Teleclass)  
**VENTILATION IN HEALTHCARE FACILITIES**  
Dr. Peter Hoffman, Health Protection Agency, UK

May 15  
**METHODS TO EVALUATE HAND HYGIENE PRODUCTS**

[www.webbertraining.com/schedulept.php](http://www.webbertraining.com/schedulept.php)

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