Workshop Proceedings: Developing a Research Agenda for the Prevention & Control of Healthcare-associated Infections in Dentistry

July 31 – August 1, 2006
BACKGROUND

Role of the Organization for Safety and Asepsis Procedures (OSAP)

From its formation in 1984 through today, OSAP has been dedicated to promoting infection control and safety policies and practices supported by scientific research. In 2000, this global dental organization was awarded a five-year cooperative agreement by the Centers for Disease Control and Prevention (CDC) to work on initiatives to promote infection control and safety in dental settings. As part of that agreement, OSAP was to:

1. Develop and implement innovative strategies to improve the transfer of current and accurate scientific information to dental healthcare personnel (DHCP) and the public;
2. Provide appropriate education and training regarding recommended infection control practices to DHCP; and
3. Identify risks associated with changing technology and emerging infectious diseases and propose strategies to reduce these risks.

OSAP requested supplemental funds from the CDC to develop a research agenda for dental infection control. The intent of the research agenda was to:

1. Identify and prioritize research topics that are feasible and measurable.
2. Identify the type of research (e.g., laboratory, educational, applied, cost-effectiveness) for each topic that could best provide the information needed. The type of research identified should have practical application for the practicing dentist.
3. Establish a framework to apply evidenced-based information to develop new or to support current dental infection control strategies.

OSAP’s aim is to develop a document that can be used by federal agencies, educational and research institutions, professional organizations and industry as a stimulus for research development and funding.

Existing Dental Infection Control Research

A few pioneering research studies in dental infection control were initiated during the 1970s and 1980s when hepatitis B was recognized as an occupational health risk for dental professionals and transmissible to patients. With the documented transmission of human immunodeficiency virus (HIV) from a dentist to multiple patients\textsuperscript{1}, and the enactment of the Bloodborne Pathogens Standard by the Occupational Safety and Health Administration (OSHA) in 1991\textsuperscript{2}, dental infection control practices began to evolve.

As dentists adopted new infection control practices, research studies began to examine issues of instrument sterilization, aseptic procedures and dental waterline contamination. Despite these recent efforts, overall, existing dental infection control
research is limited. While there is a substantial base of epidemiological research and data to support the effectiveness of hospital-based infection control interventions, there is a striking absence of data to support infection control interventions unique to dental practice.

The paucity of epidemiologic data regarding infectious disease transmission and infection control practice in dentistry may be due to several contributing factors:

- OSHA regulations led dentists to focus on occupational health concerns rather than on prevention of healthcare-associated infections.
- Dentists may perceive infections in the oral cavity as self-limiting with few clinical consequences.
- Case definitions for dental healthcare-associated infections have not been standardized for the profession.
- Both physicians and dentists have a limited understanding of the role of dental treatment in the transmission and management of infectious diseases.
- The dominance of individual or small group practices in dentistry creates barriers to the collection of meaningful population health data.
- Undergraduate dental education often does not prepare DHCPs to critically evaluate epidemiological evidence.

Dental Infection Control Guidelines:

The American Dental Association (ADA) published the first infection control recommendations for dentistry and the dental laboratory in 1978. The Centers for Disease Control and Prevention (CDC) published dental infection control guidelines in 1986, with updates in 1993. Due to the lack of research in dental settings, both the ADA and CDC have included many recommendations empirically derived from infection control practices used in hospitals and other medical settings.

The most recent update, *Guidelines for Infection Control in Dental Health-Care Settings* – 2003, ranked infection control recommendations based on the availability of well-designed, experimental, clinical or epidemiologic studies, theoretical rationale for the behavior and federal and/or state mandates or standards. These guidelines note that while the number of published studies concerning dental infection control has increased, many questions remained unanswered. In addition, the CDC guidelines identified a number of infection control research considerations to stimulate discussion and further investigation.

RESEARCH AGENDA DEVELOPMENT PROCESS

To initiate the process, OSAP representatives and stakeholders in dental infection control and research formed a Steering Committee. Members of this group included Dr. Ron Zentz (American Dental Association), CAPT Kathy Hayes (National Institutes of Dental and Craniofacial Research [NIDCR]), Dr. Jennifer Cleveland (CDC), Kathy Eklund ( Forsyth Institute), Dr. Shannon Mills (University of Nevada School of Medicine), Anne Mills (OSAP) and Therese Long (OSAP). Due to cost and time
constraints, the Steering Committee limited the proposed initial research agenda to dental infection control research in the United States, with the understanding that global issues will ultimately need to be considered.

To draft a research agenda, individuals, associations, businesses, and governmental agencies with a stake in dental infection control were invited to participate. This included individuals with expertise in microbiology, human behavior, regulatory affairs, public health, manufacturing, education, healthcare, clinical dentistry and dental infection control research. Workshop participants are shown in Appendix I.

The two-day facilitated workshop convened in Alexandria, Virginia on July 31, 2006. In preparation, participants were referred to the ADA’s research agenda, NIDCR’s strategic plan, the National Institute of Nursing Research’s research agenda, the National Occupational Research Agenda (NORA), and the 2003 CDC guidelines. Participants were tasked to:

- identify existing gaps in the science, and relevant research topics;
- prioritize research questions and determine the necessary scientific approaches;
- establish a framework for translational research and technology transfer in infection control & safety; and,
- begin to identify potential entities to conduct and support the research.

To provide a foundation for discussion, the workshop included three presentations:

- a dental infection control research update from 2002 to present;
- a description of dental practice-based research networks and supported research by the NICDR; and
- a progress review regarding CDC’s 7 Healthcare Safety Challenges.

The meeting agenda is included in Appendix II; presentations are shown in Appendix III.

Following the workshop, a summary of the proceedings was developed and circulated to the participants for their individual consideration and comment.

**SCOPE OF THE RESEARCH AGENDA**

Workshop participants ultimately agreed that “Research Agenda for the Prevention & Control of Healthcare-associated Infections in Dentistry” best defined the scope of the research agenda. Because of the complex, multi-dimensional nature of infection control, dental healthcare–associated infections (HAI) were further defined to exclude community acquired oral infectious diseases (e.g., periodontal disease and caries), unless possibly acquired or transmitted during dental patient care. Likewise, issues of disaster preparedness and bioterrorism were excluded unless directly related to prevention or treatment of dental HAI. However, occupational health issues that promote pathogen exposure and transmission, such as skin disease and percutaneous injury, were not excluded from the defined scope of the research agenda.
RESEARCH AGENDA FRAMEWORK

Workshop participants discussed possible frameworks for the research agenda based on Dr. Denise Cardo’s presentation “Infection Prevention Research: Where Is It Headed? How Are We Meeting CDC’s Challenges?” In plenary session, participants agreed to adopt the “Healthcare-associated Infection Prevention Complex” model developed by CDC’s Division of Healthcare Quality Promotion (DHQP), presented by Dr. Cardo during her presentation (see Figure 1). Framing the research agenda according to DHCP behavior and other clinical issues, healthcare system or infrastructure and medical devices or technology created a logical and effective means to evaluate topics for inclusion in the agenda.

Figure 1

DISCUSSION AND OBSERVATIONS

Workshop participants raised concerns regarding the limited number of existing research studies, study size, study quality, and the dilemma of formulating practice standards based on limited evidence. The importance of a thorough and systematic review of relevant literature was also discussed. The need for a significant “body of evidence” in dental infection control was repeatedly emphasized. As one participant quipped, “We don’t know what we don’t know,” succinctly stating the difficulty in proposing research studies without adequate data.

Workshop participants also commented about the difficulty of translating oral health issues between dentistry and medicine. One participant observed, “Dentists have historically separated the practice of dentistry from the rest of medicine. The questions
are not that different. For example, the neurosurgery bur is similar to the orthopedic bur and the oral surgery bur.” Similarly, participants advised ignoring the artificial boundaries between medicine and dentistry, and exploiting research opportunities related to other areas of healthcare that could be rapidly translated into dental infection control.

Workshop participants recommended against prioritizing individual research agenda components at this time. Concerns were expressed that prioritization or establishment of timelines might limit or constrain research efforts and support. They also deferred discussion regarding research funding sources, choosing to first focus on developing the framework and major topics for the research agenda. These initial steps towards a research agenda were designed to be adaptable and modifiable to emerging infection prevention and control challenges and needs, and will require an on-going process of systematic review and evaluation of the scientific literature.

**Research Agenda Principles and Assumptions**

Through group discussions, workshop participants reached consensus regarding principles integral to advancing the science supporting the prevention and control of HAI in dentistry. They agreed that the research agenda must:

- Fill gaps in the existing science;
- Identify efficient methods for surveillance and data collection;
- Enhance translational and interdisciplinary research;
- Identify and adopt research findings from other fields;
- Integrate cost analyses into evaluation of best practices, technologies and products; and
- Integrate infection prevention and control assessment throughout product and technology life cycle, i.e. during development, use, and during disposal.

Workshop participants also identified two assumptions inherent in topics presented in this research agenda:

- Research topics will encompass all DHCP, including dental laboratory technicians, unless otherwise specified.
- To be included in the research agenda, topics must be relevant to dentistry, important to dental patients or DHCP, and be feasible.

**The Impact of Federal and State Regulatory Policies**

Although workshop participants preferred to exclude research issues related to public policy from the agenda, the current regulatory environment influences dental practice. Similarly, current federal and state regulations and policies influence the research agenda and our knowledge of dental healthcare associated infections. For example, OSHA has determined that dental offices and clinics are not generally required to maintain OSHA injury and illness records, i.e. record bloodborne pathogen exposures, on the OSHA 300 log. This regulatory decision may enhance the perception that there is decreased risk for disease transmission in dental practices. Additionally, the Food
and Drug Administration’s determination that burs and endodontic files are not single use devices has implications for the research agenda. Research regarding the effectiveness of reprocessing procedures for burs and files may influence future regulatory agency activities.

Human Subjects Research Considerations

Ethical considerations in the design of studies evaluating infection control interventions were discussed, including the importance of informed consent for research participants and possibly DHCP. Workshop participants expressed concern regarding the complexities of working with external Institutional Review Boards (IRB). Questions were raised about ensuring that IRBs have properly evaluated research protocols and the need for providing “informed consent” to patients and personnel when studied as controls (untreated) and when using non-investigational products. These issues will need to be addressed and researchers should consider those requirements when designing and conducting their studies. Nonetheless, some participants felt that these issues were outside the scope of the research agenda development process, and were the purview of the institution conducting the research.

International Research

Participants were directed to focus on developing a dental infection control research agenda for the United States (U.S.). However, input from dentists working in developing countries was provided during the workshop deliberations. In addition, a large number of infection control research studies reviewed during the research update session of the workshop were conducted outside the U.S. European regulatory guidelines and other international standards influence the development of dental devices and technologies with concomitant impact on U.S.-based infection control research. The reverse is also true as many countries base their infection control programs on professional guidelines and standards developed in the U.S. Clearly, in today's world, a dental infection control research agenda is likely to have global implications. Therefore, this research agenda should be distributed globally.

PROPOSED RESEARCH AGENDA

Using the research agenda framework, three separate groups were formed to brainstorm and identify specific research topics germane to each of the three research areas, i.e., individual behavior, medical devices and technology, and infrastructure and healthcare systems. Strikingly different processes, ideas and strategies arose from each group. The principal topics relative to each area are summarized here together with examples of research questions. Specific research topics and questions generated during “brainstorming” sessions are outlined in Appendix IV.

During the meeting, there was general agreement among the participants not to prioritize the proposed agenda. Following the workshop, in an effort to assess consensus and to reexplore prioritizing the agenda, each participant was asked to
confirm the relevance, importance and feasibility of the topics below, and to identify each topic as either “critical” or “important”. Responses indicate that there is virtually unanimous agreement concerning relevance and importance. Two participants questioned the feasibility of item 1.3. One individual suggested that topic 3.3 (Healthcare System/Infrastructure) be cross-referenced as a Behavioral topic. This observation is consistent with the interrelationships of the elements depicted by the Dental HAI Prevention Complex model.

The ranking of research topics as critical vs. important (undefined terms), while unscientific, demonstrated that there were two topics that should be singled out. All but one respondent deemed items 1.1 and 3.1 “critical”.

1. **Individual Behavior**

Behavioral research topics include studies designed to:

1.1 Identify and evaluate facilitators and barriers to adherence with infection control guidelines and best practices, including level of knowledge, attitude, and practice (KAP), and potential intervention strategies to improve KAPs.

For example, what is the current level of compliance with the 2003 CDC Dental Infection Control Guidelines, and what are the perceived barriers to greater levels of compliance?

1.2 Measure and assess DHCP’s perception of risk, fear of infection with an emerging disease and attitudes towards patients with infectious diseases.

For example, what are the current perceptions, fears and attitudes about treating patients during an outbreak of influenza or other infectious disease? How would this influence patient care, and possibly disease transmission?

1.3 Examine how the prescribing practices of dentists influence the prevalence and correlates of resistance to antimicrobials e.g., antiseptics, antifungals, antibiotics.

For example, what is the frequency of methicillin-resistant *Staphylococcus aureus* (MRSA) in dental healthcare settings, and is this similar to that of community settings, or to outpatient clinics? How do dentists’ prescribing practices contribute to the growing problem of community-acquired antimicrobial resistance?

1.4 Identify the extent to which DHCP consider infection prevention and control considerations in the selection of products and technology.

For example, what criteria are used by dental professionals to evaluate products for their ability to prevent or control dental HAIs?
Workshop participants emphasized the need to identify the factors involved in adherence (and lack of adherence) to the current dental infection control guidelines. Participants suggested that compliance barriers, worker preferences, perceptions, and cost/benefit issues can influence the implementation of infection control practices.

Research into the efficacy of interventions is also needed. For example, “bundling”, the practice of grouping specific evidenced based practices together to prevent infections –– has been used in healthcare environments to improve infection control outcomes. Whether “bundling” strategies will improve infection control outcomes in dentistry has not been explored.

Post-workshop, the feasibility of studying the influence of dentists’ prescribing practices on antimicrobial resistance was questioned due to the many sources of exposure via agriculture, the environment, and the healthcare delivery system. Concern was expressed that as dentists are responsible for only a small portion of the prescriptions, while answering this question is important, this topic may better be identified as a lower priority for a study limited to dentistry.

2. Medical Devices and Technologies

Medical devices and technology can include equipment, instruments and consumables, such as personal protective equipment (PPE), lasers, computers and digital cameras, water lines, antimicrobials and even vaccines. While some items are strictly “infection control products,” virtually every device used in or around the mouth can serve as a fomite for pathogen transmission and spread infectious disease. Therefore, the design, handling, use, processing and disposal of medical devices and technologies should be evaluated for their effect on preventing and controlling HAIs in dentistry.

2.1 Identify occupational health risks associated with infections and infection control technologies (e.g., skin, respiratory, ocular, etc.).

For example, does occupational contact dermatitis increase the risk of transient or pathogenic organism growth on the skin of dental healthcare professionals? What is a DHCW’s actual occupational risk for specific diseases (e.g., influenza, HCV, multiple drug resistant organisms (MDRO))?  

2.2 Identify the nature and extent of microbial contamination of dental devices and examine the risk of associated disease transmission.

For example, how much and with what microorganisms are dental burs contaminated, and what can we infer about the risk of disease transmission?

2.3 Evaluate products, technologies, materials and techniques to reduce the risk of device-related infections.
For example, do self-sheathing dental anesthetic needle systems reduce the number of percutaneous injuries among DHCP? Are different dental waterline designs less likely to permit pathogen transfer and patient exposure?

2.4 Evaluate the effectiveness of infection prevention and control considerations throughout the product life cycle from development to disposal.

For example, what are effective disinfection methods for digital devices versus conventional dental x-ray armamentarium, and how do these methods influence product lifespan? What are effective methods to dispose of contaminated equipment or products?

The need for objective product research is paramount. Products must balance ease of use in clinical settings with engineering controls designed to prevent disease transmission. Workshop participants agreed that, as much as is feasible, product research should prospectively address infection control before the product is used clinically. Moreover, developers and manufacturers should consider infection control issues throughout the product life cycle.

Participants also suggested that infection control researchers partner with both product manufacturers and business schools to more efficiently implement infection control devices and technologies and to accurately assess cost-benefit issues.

3. Healthcare System and Infrastructure

As noted above, epidemiologic data on dental healthcare-associated infections was viewed by workshop participants as a critical missing element of current infection control research. Without these data, it is very difficult to evaluate the efficacy of engineering controls and work practices or the cost-benefit of interventions.

However, the non-centralized dental healthcare system presents unique challenges to collecting this information. Typically, epidemiological data is gathered by larger institutions such as hospitals or public agencies, with a centralized repository of information derived from and exchanged with multiple clinicians. Therefore, the research topics below focus on understanding and developing an integrated dental infrastructure that could begin to collect epidemiological data, facilitate exchange of information and improve dental infection control programs.

3.1 Identify and evaluate valid, reliable and efficient surveillance methods for dentistry.

For example, can research networks modeled after NIDCR programs effectively monitor and evaluate dental HAIs and interventions? Can dental or medical insurance carriers provide complementary and integrated data about potential disease transmission and improved health?
3.2 Examine infrastructure and systems (e.g. architectural design, staffing, billing, etc.) which facilitate or discourage adoption of guidelines and best practices.

For example, have insurers changed reimbursement practices to reflect changes and potential increased costs associated with the 2003 CDC guidelines?

3.3 Identify and evaluate the effectiveness of communication strategies to disseminate relevant guidelines and information to DCHP?

For example, what are the most effective methods to communicate critical infection control information to the dental professional? How are dental professionals currently getting their information?

Some participants stated that third party payers, state boards of dental examiners, insurers and the military might have collected a body of data related to dental healthcare-associated infections. If this data exists and is accessible to researchers, it may be possible to mine this data to estimate the incidence or prevalence of adverse outcomes associated with infectious diseases in dental practice. The growing popularity of electronic dental records may make it possible in the future to collect data on healthcare associated infections with little risk or effort on the part of clinicians.

RECOMMENDATIONS/NEXT STEPS

Workshop participants identified and described critical elements that must be addressed in tandem with development of a research agenda. To advance the science of dental infection control the participants recommend the following:

- Develop a system for ongoing review and monitoring of the relevant scientific literature;
- Develop a surveillance and reporting system for infections in dentistry;
- Identify entities to conduct and support dental infection control research;
- Develop consensus on the dental infection control research agenda; and
- Conduct research in the areas identified in the research agenda.

The agenda for this meeting was ambitious. The participants, a diverse group of experts, did a remarkable job by both developing a framework for the research agenda and by proposing an agenda. Much more work must be done however to develop a document that can be used by federal agencies, educational and research institutions, professional organizations and industry to stimulate research development and funding. Ongoing participation by dental infection control experts, stakeholders and researchers is crucial to the success of this venture.

Workshop participants identified potential stakeholders who can assist OSAP to further the development of this agenda. The use of small, special interest groups who focus their attention either topically (waterlines, education strategies, clinic design, etc.) or
around the core elements of the framework (Individual Behavior, Healthcare System/Infrastructure and Medical Devices/Technology) may expedite the identification and prioritization of research questions under each topic area.

The agenda must also address global issues. This aspect of dental infection control research may be addressed by inclusion of experts and stakeholders in a global summit on dental infection control research, or through inclusion of experts within small groups focused on agenda topics.

While dentistry shares many commonalities with other areas of healthcare delivery, the predominance of small group or solo practices complicates efforts to develop a cohesive body of epidemiological data upon which to base clinical interventions. This challenges DHCP, professional organizations, educational institutions, investigators, funding agencies and product manufacturers to think outside the existing paradigm to develop and implement a research agenda for the prevention and control of HAIs in dentistry. This research agenda is proposed to stimulate investigations that will develop an evidence-based standard of HAI control and prevention in dentistry.
Appendix I

Workshop Participants

Eugenio D. Beltrán-Aguilar, DMD, MPH, MS
Centers for Disease Control and Prevention,
Division of Oral Health (Observer)
4770 Buford Highway, NE
Mailstop F-10
Chamblee, GA 30341
Phone: 770-488-6068
Fax: 770-488-6080
edb4@cdc.gov

Denise M. Cardo, MD
Centers for Disease Control and Prevention,
Division of Healthcare Quality Promotion,
National Center for Infectious Diseases
(Presenter)
1600 Clifton Road, Mailstop E68
Atlanta, GA 30333
Phone: 404-639-4000
Fax: 404-639-4043
dcardo@cdc.gov

Eve Cuny, RDA, MS
University of the Pacific School of Dentistry
2155 Webster Street
San Francisco, CA 94115
Phone: 415-929-6610
ecuny@pacific.edu

Louis G. DePaola, DDS, MS
(Representing the American Dental Association)
Department of Diagnostic Sciences and Pathology
650 West Baltimore Street
Baltimore, MD 21201-1586
Phone: 410-706-7628
Fax: 410-750-0519
ldepaola@umaryland.edu

Kathy J Eklund, RDH, MHP
The Forsyth Institute
140 Fenway
Boston, MA 02115
Phone: 617-892-8216
Fax: 617-262-4021
keklund@forsyth.org

Sharon Forrence, MSW, ACSW
Independent Consultant (Facilitator)
1619 Monroe Street, NW
Washington, DC 20010
Phone: 202-483-4291
sforrence@yahoo.com

Christopher H. Fox, DMD, DMSc
International Association for Dental Research
1619 Duke Street
Alexandria, VA 22314
Phone: 703-299-8082
Fax: 703-548-1883
cfox@iadr.org

Kathy L. Hayes, DMD, MPH
National Institutes for Dental and Craniofacial Research, National Institutes of Health, Office of Science Policy Analysis
31 Center Drive, MSC 2190
Building 31, Room 5B55
Bethesda, MD 20892-2190
Phone: 301-496-7765
hayesK@mail.nih.gov

Carol Kunzel, PhD
Div. of Community Health
College of Dental Medicine
Columbia University
630 W. 168th Street
New York, NY 10032
Phone: 212-342-3046
Ck60@columbia.edu

Elaine Larson, RN, PhD, FAAN, CIC
Columbia University School of Nursing
241 W. 23rd Street #5B
New York, NY 10011
Phone: 212 305-0723
ELL23@columbia.edu
Gary S. Leff, DDS, MPH  
(Representing the World Dental Development Committee, International Dental Federation)  
3801 N. Fairfax Drive, Suite 40  
Arlington, VA  22203  
Phone: 703-527-6885  
garyleff@erols.com

Therese M. Long, MBA, CAE  
Executive Director  
Organization for Safety and Asepsis Procedures  
P.O. Box 6297  
Annapolis, MD  21401  
Phone:  410-571-0003  
Fax:  410-571-0028  
tlong@osap.org

Donald W. Marianos, DDS, MPH  
(Representing the Association of State and Territorial Dental Directors)  
3141 Lakeview Drive  
Pinetop, AZ  85935  
Phone:  928-369-3001  
dkm78@cableone.net

Chris H. Miller, BA, MS, PhD  
Executive Associate Dean  
Indiana University School of Dentistry  
1121 West Michigan Street  
Indianapolis, IN  46202  
Phone:  317-274-4561  
Fax:  317-278-1071  
chmille@iupui.edu

Shannon E. Mills, DDS  
Associate Professor  
University of Nevada School of Medicine  
1707 W. Charleston Blvd, Ste 290  
Las Vegas, NV  89102  
Phone:  702-671-5046  
Fax:  702-474-9617  
semills@unr.edu

Anne C. Mills, RN, MSN, COHN-S  
7510 Palmyra Ave.  
Las Vegas, NV  89117  
Phone:  702-222-9861  
annecmills@cox.net

Claire Pagliara-Miller, USN, RN, MSN, PhD  
13370 Point Rider Lane  
Herndon, VA  20171-3812  
Phone:  703-318-7979  
CMPagliara@Bethesda.med.navy.mil

Bruce L. Pihlstrom, DDS, MS  
National Institutes for Dental and Craniofacial Research, National Institutes of Health, Center for Clinical Research  
4AS43, 45 Center Drive  
Bethesda, MD  0892-6400  
Phone:  301-594-4830  
Fax:  301-480-8322  
bruce.pihlstrom@nih.gov

David Reznik, DDS  
Grady Health System  
341 Ponce de Leon Avenue  
Atlanta, GA  30308  
Phone:  404-616-9770  
Fax:  404-616-9745  
dreznik@mindspring.com

Pamela A. Rodgers, PhD  
SmartHealth/Smart Practice  
3400 East McDowell Road  
Phoenix, AZ  85008  
Phone:  602-225-0595, ext. 510  
parodger@smarthealth.com
APPENDIX II

“Developing a Research Agenda for Dental Infection Control"
July 31 – August 1, 2006
Hilton Alexandria Mark Center

DAY 1: Monday, July 31

8:30 am  Continental Breakfast

9:30 am  Welcome and Overview
           Therese Long, MBA, CAE                Jennifer Cleveland, DDS, MPH
           Executive Director                  Dental Officer/Epidemiologist
           Organization for Safety             Division of Oral Health
           & Asepsis Procedures                 Centers for Disease Control and
                                                Prevention

           Facilitator: Sharon Forrence
           Review of goals, agenda, expected outcome

9:45 am  Introductions (Name, affiliation, interest and stake in this topic)

10:00 am  Presentations

The Current Status of Dental Infection Control Research:  A Research
Update from 2002 – Today
           Jennifer Cleveland, DDS, MPH           Eve Cuny, RDA, MS
           Kathy Eklund, RDH, MHP                 Shannon Mills, DDS

Practice-based dental research networks:  What are they and what will they
contribute to evidenced-based science?
           Bruce Pihlstrom, DDS, MS

Infection control research:  Where is it headed?  How are we meeting
CDC’s 7 Healthcare Safety Challenges?
           Dr. Denise Cardo via teleconference

12:30 pm  Lunch

1:15 pm  Plenary:  Summary of morning sessions – how do they inform the rest of
           the meeting (CDC recommendations, gaps)?  Review the agenda development
           process and expected outcome.  What will foster collaboration and consensus
           building?  What are the elements to consider in prioritizing research topics?

Key Issues:
1)  Identify and prioritize research topics that are feasible and measurable.
    What is being done?  What needs to be done?
2)  Identify the type of research (e.g., laboratory, educational, applied,) and the
    cost-effectiveness for each topic that could best provide the information we
    need.
3)  Establish a framework to apply evidenced-based information to support new
    or existing practical dental infection control strategies.

2:15 pm  Break
2:30 pm  Small Group Discussions
Considering the 2003 CDC infection control guidelines, the CDC 7 Healthcare Safety Challenges as well as potential new research topics, what needs to be included on the dental infection control research agenda? Using previously established elements, what are the priorities for this agenda under education and promotion? Laboratory based research? Clinical and population based epidemiological research and development?

4:15 pm  Plenary
How will we prioritize results of small group work?
Summary of Day 1, review of Day 2 schedule and announcements

5:00 pm  Adjournment. Dinner on own (see Program Details for options)

DAY 2: Tuesday, August 1

7:00 am  Continental Breakfast

8:00 am  Plenary
Summary of Day 1, review of Day 2 schedule

8:30 am  Small Group Discussions
For each research topic already identified 1) specify the type of research most likely to fill the “gaps” in current research; 2) evaluate the cost-benefit and 3) identify the practical applications for clinicians.

10:00 am  Reconvene for reporting out on small group discussions.

10:15 am  Break

10:30 am  Small Group Discussions
How can we translate scientific research into practical dental infection control? What strategies will improve clinical outcomes, dental healthcare worker safety, and the environment?

11:30 am  Plenary
Reconvene for reporting out on small group discussions

12:00 pm  Lunch

1:15 pm  Plenary
Conclusions – Did we address the key issues? Do we have consensus? What are recommendations for second level review? What are suggestions for report dissemination?

2:30 pm  Wrap-up and next steps
Summary, what next (who, what, when)?

3:30 pm  Adjournment
Appendix III

**Denise M. Cardo, MD**
Centers for Disease Control and Prevention
Division of Healthcare Quality Promotion
National Center for Infectious Diseases

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**Slide 1**

*Infection Prevention Research: Where Is It Headed? How Are We Meeting CDC’s Challenges?*

Denise M. Cardo, MD  
Director  
Division of Healthcare Quality Promotion

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**Slide 2**

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**Slide 3**

*Why should we have challenges?*

- Focus
- Improve collaboration
- Increase partnerships
- Define and establish accountability

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**Slide 4**

*Division of Healthcare Quality Promotion 7 Healthcare Safety Challenges*

In 5 years:
- Reduce catheter-associated adverse events by 50%
- Reduce surgical adverse events by 50%
- Reduce mortality and hospitalizations due to respiratory infections among long-term care patients by 50%
- Reduce antimicrobial-resistant infections by 50%
- Eliminate microbiology laboratory errors
- Eliminate needle injuries among healthcare personnel
- Achieve 100% compliance with immunization of healthcare personnel

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**Slide 5**

*Why these challenges?*

- Protection of patients and healthcare personnel
- Associated morbidity/mortality
- Data on preventability
- Public health impact
- Unique to our Division

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**Slide 6**

*Why 50% decrease?*

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**Slide 7**

*Institute of Medicine Reports*

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**Slide 8**

*Challenges/Goals*

- Measurable
- Have a system to measure them
- Being measured – what is the baseline?
- Evidence-based interventions
DHQP Healthcare Safety Challenges

- Reduce catheter-associated adverse events
- Reduce surgical adverse events
- Reduce mortality and hospitalizations due to respiratory infections among long-term care patients
- Reduce antimicrobial-resistant infections
- Eliminate microbiology laboratory errors
- Eliminate needle injuries among healthcare personnel
- Achieve 100% compliance with immunization of healthcare personnel

M - measurement; I - interventions

Central Line-Associated BSI Rates, By ICU Type, 1990-2004

This slide plots historic data from the National Nosocomial Infections Surveillance (NNIS) system.

Regional Initiatives to Eliminate Infections

- Southwestern Pennsylvania/ Pittsburgh Regional Healthcare Initiative (PRHI):
  - Regional infection control intervention to eliminate central-line associated bloodstream infection (BSI)
  - Voluntary participation (32 hospitals); developed a shared measurement system supported and endorsed by all participants; NNIS as reporting tool
- Michigan Keystone Project:
  - Regional intervention to eliminate BSI and ventilator-associated pneumonia
  - 70 hospitals, 120 ICUs

Prevention of Bloodstream Infections: Southwestern Pennsylvania

Bloodstream Infection Interventions

- Promotion of targeted, evidence-based practices
- Development/promotion of educational module
- Promotion of standardized catheter insertion supply kits
- Regular feedback of rates and adherence to recommended practices
- Process to share information and experience
- Real time problem solving: daily multidisciplinary rounds
- Any person empowered to stop a procedure
- "Bundle" concept
- Cultural change: zero tolerance
DHQP Healthcare Safety Challenges

- Reduce catheter-associated adverse events by 50%
- Reduce surgical adverse events by 50%
- Reduce mortality and hospitalizations due to respiratory infections among long-term care patients by 50%
- Reduce antimicrobial-resistant infections by 50%
- Eliminate microbiology laboratory errors
- Eliminate needle injuries among healthcare personnel
- Achieve 100% compliance with immunization of healthcare personnel

This slide plots historic data from the National Nosocomial Infections Surveillance (NNIS) system.

Compliance with Recommendations to Prevent Surgical Site Infections
Surgical Infection Prevention (SIP) Project*

- Antimicrobial prophylaxis within 1 hour: 56%
- Antimicrobial prophylaxis discontinued within 24 hours: 41%
- Antimicrobial agent consistent with guidelines: 92%

* 34,133 surgical procedures (cardiac, vascular, hip/knee, colon, hysterectomy)

The 100,000 Lives Campaign

- Institute of Healthcare Improvement (IHI) and several organizations
- Six changes that save lives:
  - Prevent central-line infections
  - Prevent surgical site infections
  - Prevent ventilator-associated pneumonia
  - Prevent adverse drug events
  - Deploy rapid response teams
  - Deliver reliable, evidence-based care for acute myocardial infarction

HICPAC Guideline for Public Reporting

- Process measures
  - Central line insertion practices
  - Surgical antimicrobial prophylaxis
  - Influenza vaccination coverage
- Outcome measures
  - Central-line associated laboratory confirmed BSI
  - Surgical site infections

- Deficit Reduction Act, Budget Reconciliation Act of 2005:
  - Oct 08 HAIs in certain patients will not be considered a complication for pay purposes (less reimbursement)
  - HHS Secretary will choose 2 DRGs based on high volume and/or high cost; reasonably preventable with evidence-based guidelines
Slide
23

DHQP Healthcare Safety Challenges

- Reduce catheter-associated adverse events by 50%
- Reduce surgical adverse events by 50%
- Reduce mortality and hospitalizations due to respiratory infections among long-term care patients by 50%
- Reduce antimicrobial-resistant infections by 50%
- Eliminate microbiology laboratory errors
- Eliminate needle injuries among healthcare personnel
- Achieve 100% compliance with immunization of healthcare personnel

Slide
24

C. difficile

Slide
25

MRSA is Increasing in Healthcare Settings

- Percent of Resistance:

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p=0.1, p<0.001

0

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50

60

70


Slide
26

Hospital Transmission of CA-MRSA

- Hospital transmission of CA-MRSA among post-partum women, NY (Saiman L, CID, 2003;37:1313-9)
- CA-MRSA in a NICU, TX (New C, CID, 2004;39:1460-6)
- CA-MRSA in hospital nursery and maternity units, NY (New C, CID, 2005;41:888-93)
- BSI due to MRSA USA 300 containing PVL genes in hospitals, GA (Seybold et al. CID 2006;42:647-56)

Slide
27

National Estimates of U.S. Hospital Discharges with C. difficile Listed as First-listed or Any Diagnosis:

Rates Doubled between 2000 and 2003:

- Discharges per 100,000 population:

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<thead>
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</table>

An y Diagnosis

Primary

Slide
28

MRSA Infection Incidence by Year, Intervention Unit, Hospital A

- Overall Rates
  - Pre-intervention = 1.48 infections/1,000 pt days
  - Post-intervention = 0.68 infections/1,000 pt days
- 54% reduction, p=.04

Slide
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Key Prevention Strategies

- Prevent infection
- Diagnose and treat infection effectively
- Use antimicrobials wisely
- Prevent transmission

Slide
30

Challenges/Goals

- Measurable
- Have a system to measure them
- Being measured
- Evidence-based interventions

- Research on efficacy and effectiveness
- NIH, Epicenters, PRHI, VHA
- Research on use of electronic data sources
DHQP Healthcare Safety Challenges

- Reduce catheter-associated adverse events by 50%
- Reduce surgical adverse events by 50%
- Reduce mortality and hospitalizations due to respiratory infections among long-term care patients by 50%
- Eliminate microbiology laboratory errors
- Eliminate needle injuries among healthcare personnel
- Achieve 100% compliance with immunization of healthcare personnel

Estimated Number of Percutaneous Injuries in US Hospitals

- Estimates derived using data from EpiNet and NaSH
- 1997/98 - 384,325 *
- 1999 - 345,183
- 2000 - 315,388
- Only injuries among hospital personnel
- Adjusted for underreporting

Preventability of Reported Hollow-Bore Needlestick
NaSH, 2000-2003 (n=4,723)

- Preventable 61%
- Non-preventable 19%
- Undetermined 20%

- Unnecessary needle use: 15%
- Unsafe work practice: 13%
- Improper disposal: 9%
- Other: 2%

Influenza Vaccination in Past 12 Months Reported* by Healthcare Personnel by Year

- HCWs
- Other Workers

*Source: National Health Interview Survey
**95% confidence limits indicated by "x" or "-".

HICPAC/ACIP Guideline Feb 2006

- HICPAC and ACIP recommend that all healthcare personnel (HCP) be vaccinated against influenza.
- Facilities that employ HCP are strongly encouraged to provide vaccine to their staff at no cost and by using evidence-based approaches that maximize vaccination rates, including vaccination clinics, mobile carts, vaccination access during work shifts, and modeling/support by institutional leaders (1B)
- Obtain a signed declination from HCP who decline influenza vaccination for reasons other than medical conditions (II)

Challenges/Goals

- Measurable
- Have a system to measure them
- Being measured
- Evidence-based interventions
- OSHA, JCAHO
- Time to act is now

Outbreaks of Healthcare-Related Viral Hepatitis Transmission, United States

- Endoscopy clinic (HCV): NYC, 2001
- Private medical practice (HBV): NYC, 2001
- Pain remediation clinic (HCV): Oklahoma, 2002
- Oncology clinic (HCV): Nebraska, 2002
- Common Theme: Associated with unsafe injections
- "Obvious" violations in standard procedures
- Preventable with basic infection control practices
- HCWs not aware that practices were in error

HAI Prevention Complex
Questions to address: how? and what?

Potential Questions
- Easier ways to identify and measure infections/adherence to recommendations
- Effective strategies to change behavior
- New strategies to
  - decrease device utilization
  - decrease biofilm formation
  - decrease colonization
- Impact of environment (e.g., water)
- Cost, cost-effectiveness, business case

Preventing infections is EVERYONE’s responsibility!

Knowing is not enough; we must apply. Willing is not enough; we must do. Goethe
NIDCR - Sponsored Practice-Based Research Networks (PBRN)

Designed to gather "real-world" evidence for the prevention and treatment of oral diseases

Dr. Bruce Pihlstrom, NIDCR
Director, Center for Clinical Research

Dental Practice-Based Research Networks - Purpose

- Answer questions facing general dental practitioners in the routine care of their patients
- Strengthen knowledge base for making clinical decisions
  - Observational studies
  - Clinical trials
- Establish/use a flexible, adaptable electronic network/platform for connectivity, data sharing, & communication within and between dental and medical networks

Dental Practice-Based Research Networks

- Ideas to be generated by practicing dentists and dental hygienists (i.e., practitioner-investigators)
- Primary objectives:
  - Conduct 16-22 short-term clinical studies over 7 years
  - Emphasis on effectiveness of oral health treatment & disease prevention
  - Clear & clinically meaningful outcomes
- Secondary objective: Provide data on disease and treatment trends and obtain estimates of the prevalence of less common conditions

Dental Practice-Based Research Networks

- Establishes partnership between practitioners and experienced researchers
- PBRN's conduct research in the real world of dental practice
  - Draw on experience & insight of practitioners to help identify and frame questions
  - Findings likely to be immediately relevant to dental practice
  - Results are likely to be accepted and implemented in dental practice
  - Certain types of studies can be conducted more cost-effectively than if supported as stand-alone studies

Dental Practice-Based Research Networks

- Many questions faced by dentistry are most appropriately addressed in practice-based dental settings
- Dental PBRNS may implement protocols developed by one another
- To prevent duplicity of studies in NIDCR portfolio, Dental PBRNs provide NIDCR a summary of prospective protocol prior to development

At least 100 dental practices per Dental PBRN will be recruited to participate during the first year of operations.

Each PBRN will involve large numbers of practitioner-investigators in at least two population centers.

Participating PBRN Dentists (n > 400) by U.S. State (24) & Countries (3) after First Year

- Alabama
- Connecticut
- Delaware
- Florida
- Georgia
- Idaho
- Illinois
- Indiana
- Kentucky
- Louisiana
- Maine
- Maryland
- Massachusetts
- Michigan
- Minnesota
- Mississippi
- Missouri
- Montana
- Nebraska
- Nevada
- New Hampshire
- New Jersey
- New York
- North Carolina
- Ohio
- Oklahoma
- Oregon
- Pennsylvania
- Rhode Island
- South Carolina
- Tennessee
- Texas
- Utah
- Virginia
- Washington
- Wisconsin
- West Virginia
- Wyoming
- Scandinavia

Dental Practice-Based Research Networks – Organization

- Network Chair
- Coordinating Center
- Executive Committee
- NIDCR Staff
- Protocol Review Committee
- IRB
- DSMB (Phase III Trials)
Dental Practice-Based Research Networks – Executive Committee

**Composition**
- Network Chair
- PI of Coordinating Center
- 5-6 elected practitioner-investigators
- NIDCR staff

**Responsibilities**
- Executive and administrative arm of PBRN
- Main governing body of PBRN
- Prioritizes research topics for submission to Protocol Review Committee
- Reviews and approves protocols prior to submission to Protocol Review Committee

Dental Practice-Based Research Networks – Practitioner Investigators

- PBRN trained and certified dentists and dental hygienists engaged in daily practice
- From more than one state and population center
- Representative of gender / racial / ethnic distribution of PBRN region
- Limited number may be from outside U.S. if standard of dental care is comparable to that in U.S

Roles and Responsibilities
- Participate in Annual Meeting
- Elect representatives to Executive Committee
- Suggest studies to Executive Committee
- Contribute to protocol development
- Conduct studies in their practices
- Conform to IRB, DSMB, HIPAA regulations
- Contribute to manuscript preparation

Ideas for individual studies proposed to the PBRN Executive Committee

After review by the PBRN Executive Committee, all protocols must be approved by:
- Protocol Review Committee
- IRB
- DSMB for Phase III Trials

Monitoring Committee (MC) for Dental Practice-Based Research Networks

- Provides NIDCR and PBRNs with feedback regarding research being proposed and conducted
- Includes membership from various stakeholder groups

MC Provides Feedback to PBRNs & NIDCR

- General Organization and Operation of the PBRNS
- Informatics, Data sharing capabilities, and networks’ interoperability
- Clinical Relevance
- Demographic and Ethnic Diversity
- Network Outcomes and Progress
- Knowledge Transfer to Practitioners and Public
PBRN Research Activities – First Year

- PEARL: First studies are focusing on treatment strategies for advanced dental caries
- DPBRN: First studies are focusing on treatment strategies for treating early carious lesions
- PRECEDENT: First study is a survey of oral disease in PBRN practices

PBRN Collaborative Research Activities First year

- Networks are collaborating on a proposal to study risk factors for osteonecrosis of the jaw in relation to a variety of factors including use of bisphosphonate drugs
  - MOSOP is including a patient advocate on the Protocol Review Committee for this study
- Networks are collaborating with the NIH National Cancer Institute’s Center for Bioinformatics in defining common data elements and establishing a common data vocabulary repository

Dental Practice-Based Research Networks - Purpose

- Answer questions facing general dental practitioners in the routine care of their patients
- Strengthen knowledge base for making clinical decisions
  - Observational studies
  - Clinical trials
- Establish/use a flexible, adaptable electronic network/platform for connectivity, data sharing, & communication within and between dental and medical networks
Jennifer Cleveland, DDS, MPH (Presented by Kathy Eklund)
Centers for Disease Control and Prevention
Division of Oral Health

Kathy Eklund, RDH, MHP
The Forsyth Institute

Eve Cuny, RDA, MS
The University of the Pacific School of Dentistry

Shannon E Mills, DDS
University of Nevada School of Medicine

Slide 1

Update on Dental Infection Control Research - 2006

Jennifer Cleveland, DDS, MPH
Kathy Eklund, RDH, MHP
Eve Cuny, RDA, MS
Shannon Mills, DDS

Slide 2

Objectives
✓ For each topic, describe number of articles and research categories
✓ Summarize trends and quality of research
✓ Relate findings to 2003 research considerations
✓ Identify gaps
✓ Identify sources of study funding, if available

Slide 3

Methods
✓ NOT a systematic review of the literature
✓ Divided topics by reviewer expertise
✓ Reviewed Ovid weekly updates since 2002
✓ Conducted Medline searches on specific topics and authors
✓ Reviewed articles randomly collected since 2002

Slide 4

Research Categories
✓ Educational / Policy / Guidelines
✓ Bench / Laboratory
✓ Applied / Clinical
✓ Epidemiological or Population-based
✓ Cost-Benefit / Effectiveness

Slide 5

Topics

<table>
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<th>SHANNON</th>
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Slide 6

Bloodborne Pathogens
✓ Educational/Policy/Guidelines 1
✓ Bench/Laboratory 0
✓ Applied/Clinical 0
✓ Epidemiological or Population-based 2
✓ Cost-Benefit/Effectiveness 0
TOTAL 3
Exposure Control / Transmission Risks
- Educational/Policy/Guidelines: 1
- Bench/Laboratory: 0
- Applied/Clinical: 2
- Epidemiological or Population-based: 4
- Cost-Benefit/Effectiveness: 0
TOTAL: 7

Exposure Controls Considerations
- Educate and train dental health care personnel to screen and evaluate safer dental devices by using tested design and performance criteria
- Continue to characterize the epidemiology of blood contacts, particularly percutaneous injuries
- Develop devices with passive safety features to prevent percutaneous injuries

Postexposure Management / PEP
- Educational/Policy/Guidelines: 1
- Bench/Laboratory: 0
- Applied/Clinical: 0
- Epidemiological or Population-based: 2
- Cost-Benefit/Effectiveness: 0
TOTAL: 3

Postexposure Management / PEP Considerations
- Promote use of protocols for recommend postexposure management and follow-up

Single-Use/Patient Disposable Devices (SUDS)
- Educational/Policy/Guidelines: 2
- Bench/Laboratory: 9
- Applied/Clinical: 0
- Epidemiological or Population-based: 0
- Cost-Benefit/Effectiveness: 0
TOTAL: 11
However, numerous studies evaluated cleaning and sterilization of endo files and burs. However, numerous studies evaluated cleaning and sterilization of endo files and burs.

CJD and vCJD 2003 Research Consideration

- Investigate the infectivity of oral tissues in CJD or variant CJD patients

Knowledge, Practices, and Attitudes (KAPS) DHCP Considerations

- Determine how infection-control guidelines affect the knowledge, attitudes, and practices of DHCP

**Summary of Prion Detection in Patients with vCJD**

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**CJD – Research Trends**

- Laboratory (2002-2006) all outside US
  - Found residual protein on endodontic files regardless of cleaning method
  - Two studies investigated the presence of prions in neurological and dental tissues of patients with variant CJD

**Creutzfeldt-Jacob Disease (CJD or vCJD)**

- Educational/Policy/Guidelines 0
- Bench/Laboratory 3
- Applied/Clinical 0
- Epidemiological or Population-based 0
- Cost-Benefit/Effectiveness 0

**TOTAL 3**

---

**SUDS – Research Trends**

- Laboratory (2004-2006) all outside US
  - 5 articles endodontic files – effects of cleaning and processing methods
  - Removal of debris and sterilization achieved regardless of cleaning method (thermal disinfector v ultrasonic bath) – 2
  - Debris still left regardless of cleaning method

- Clinical
  - Reuse may be cost-effective BUT heat sterilization was not effective in eliminating all bacteria on burs used in oral surgical procedures compared to control burs (never used) 2 articles

**SUDs 2003 Research Consideration**

- Evaluate the effects of repetitive reprocessing cycles on burs and endodontic files
- However, numerous studies evaluated cleaning and sterilization of endo files and burs

---

**SUDS – Research Trends**

- Laboratory (2004-2006)
  - 5 articles endodontic files – effects of cleaning and processing methods
  - Removal of debris and sterilization achieved regardless of cleaning method (thermal disinfector v ultrasonic bath) – 2
  - Debris still left regardless of cleaning method

- Clinical
  - Reuse may be cost-effective BUT heat sterilization was not effective in eliminating all bacteria on burs used in oral surgical procedures compared to control burs (never used) 2 articles
### Slide 23

#### Risk of Transmission of Mtb

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### Slide 24

#### Mycobacterium tuberculosis

- Guidelines for preventing transmission of TB in healthcare settings
- Infection control recommendations similar to 1994 – only 3 risk categories (low, intermediate, high)
- No updates on risk of transmission in dental settings

### Slide 25

#### New Topic - Disasters

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### Slide 26

#### Disasters

- CDC guidelines assessing exposure, clean-up and prevention, personal protective equipment, health effects, and public health strategies and recommendations.
- FDA advice about medical equipment exposed to unusual levels of heat and humidity

### Slide 27

#### New Topic - Hospital Acquired Pneumonias

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### Slide 28

#### Hospital-Acquired Pneumonias

- Research Trends
  - Numerous studies have identified an association between bacterial colonization of oral tissues and pneumonia
  - Recent studies
    - Genetic match between dental plaque pathogens and pathogens in lungs of pts with pneumonia
    - Respiratory pathogens in dental plaque increased over time
    - Equivocal data on whether improving dental hygiene will lower HAPs

### Slide 29

#### New Topic - HIV Testing in Dental Offices

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### Slide 30

#### New Topic - HIV Testing in Dental Offices

- Research Trends
  - CDC guideline recommends screening of entire US population 13-64 years of age
  - Rapid oral HIV test available
  - Survey of dental schools found faculty and students willing to test but not counsel
  - Cost-benefit study of NHANES data that testing in dental clinics could reduce the number of undiagnosed infections
Immunization of Health-Care Personnel

- Educational/Policy/Guidelines: 2
- Bench/Laboratory: 0
- Applied/Clinical: 0
- Epidemiological or Population-based: 1
- Cost-Benefit/Effectiveness: 1
- TOTAL: 4

Influenza – Research Trends

- Policy: 0
  - Immunize all HCP against influenza – should be provided by employer
- Epidemiologic (2002-2006): 0
  - Multiple surveillance reports (influenza, measles, mumps)
- Cost Benefit and Cost Effectiveness: 0
  - Immunizations cost effective in reducing the risk of disease transmission for health-care personnel the public

Immunizations of HCP 2003 Research Consideration

- Design Strategies to communicate to the public and providers, the risk of disease transmission in dentistry
- Yes (in part - influenza immunization recommendations)

Personal Protective Equipment (PPE)

- Educational/Policy/Guidelines: 0
- Bench/Laboratory: 2
- Applied/Clinical: 0
- Epidemiological or Population-based: 4
- Cost-Benefit/Effectiveness: 0
- TOTAL: 6

Personal Protective Equipment (PPE) Research Trends

- Epidemiologic/Clinical: 0
  - N95 respirator more protective than a surgical mask in providing a barrier against viruses
  - Greater puncture resistance of nitrile gloves compared to latex. However, latex had greater ability to re-seal itself on puncture
  - Nonlatex surgical gloves have higher failure rates and lower user satisfaction than latex surgical gloves, however, in clinical use
- No additional data on double gloving

Personal Protective Equipment 2003 Research Considerations

- Conduct studies to determine the effectiveness of gloves (i.e. materials compatibility and duration of use)
- Continue to assess the stress placed on gloves during dental procedures and the potential for developing defects during different procedures

Latex Allergy / Contact Dermatitis

- Educational/Policy/Guidelines: 0
- Bench/Laboratory: 1
- Applied/Clinical: 0
- Epidemiological or Population-based: 1
- Cost-Benefit/Effectiveness: 1
- TOTAL: 3
**Latex Allergy / Contact Dermatitis Research Trends**

- Laboratory research
  - Endotoxin exposure associated with NRL gloves can modulate the development of allergic responses to NRL proteins (used in mouse model)
- Epidemiologically/Clinical
  - Sufficient exposure can lead to an increased risk of IgE sensitization to natural rubber latex among a cohort of dental hygiene students. Dose response difficult to detect
- Cost Benefit/Effectiveness
  - The use of powder-free, low-protein NRL gloves not only reduces health care worker NRL symptoms, but also positively affects the costs of glove purchases and workers’ compensation

**Hand Hygiene 2003 Research Considerations**

- Study the effect of alcohol-based hand-hygiene products on retention of latex proteins and other dental allergens (e.g., methylmethacrylate, glutaraldehyde, thierans) on the hands of DHCP after latex glove use.

**Dental Radiography and Infection Control 2003 Research Consideration**

- Determine the most effective methods for sterilization or disinfection of digital radiology equipment

**Hand Hygiene Research Trends**

- Education/Policy/Guidelines
  - Emphasis on alcohol agents (2)
  - Discussion of methods and rationale (2)
- Applied clinical
  - Comparison of preferences and compliance with methods (1)
- Cost-benefit
  - Soap and water vs. alcohol hand rub (1)

**Hand Hygiene 2003 Research Considerations**

- Educational/Policy/Guidelines 4
- Bench/Laboratory 0
- Applied/Clinical 1
- Epidemiological or Population-based 0
- Cost-Benefit/Effectiveness 1
  - Total: 6

**Sterilization**

- Educational/Policy/Guidelines 9
- Bench/Laboratory 2
- Applied/Clinical 5
- Epidemiological or Population-based 1
- Cost-Benefit/Effectiveness 0
  - Total: 17
Sterilization Research Trends
- Applied clinical
  - Effects of sterilization methods on instruments and devices (3)
  - Effectiveness of sterilization methods (1)
- Epidemiological
  - Removal of proteins from difficult to clean items (1)
- Educational/Policy/Guidelines
  - Survey of dentists’ reuse of matrix bands (1)

Environmental Disinfection
- Educational/Policy/Guidelines 4
- Bench/Laboratory 1
- Applied/Clinical 1
- Epidemiological or Population-based 0
- Cost-Benefit/Effectiveness 0
Total: 6

Environmental Disinfection 2003 Research Considerations
- Determine the most effective methods for sterilization or disinfection of digital radiology equipment.
- Develop methods for evaluating the effectiveness and cost-effectiveness of infection-control interventions.

Dental Laboratory Research Trends
- Education/Policy/Guidelines
  - Procedures (1)
  - Call for research (1)
- Bench/Laboratory
  - Effects of disinfectants on materials (6)
- Applied Clinical
  - Cross-contamination of laboratory (1)
  - Contamination of alginate impressions (1)
**Dental Water Quality (DWQ)**

- Educational/Policy/Guidelines* 10
- Bench/Laboratory 6
- Applied/Clinical 20
- Epidemiological or Population-based 2
- Cost-Benefit/Effectiveness 0

**TOTAL 38**

* Includes 2010 CDC Guideline, literature reviews, and panel reports.

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**DWQ – Research Trends**

**Applied Clinical Studies – Product evaluations and comparisons (12)**
- Majority of studies involved commercial product comparisons (11) or development (1)
- Active ingredients or compounds evaluated included:
  - Chlorhexidine, glutamate, and alcohol
  - Hydrogen peroxide
  - Chlorine dioxide
  - Silver compounds (+hydrogen peroxide or percarbonate)
  - Chelating agents and peracetic acid

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**DWQ – Research Trends**

**Applied Clinical Studies – Other (5)**
- Line drying did not reduce colony counts compared to control
- Distillation and line cleaning system kept colony counts <500 colony (CDC recommendation)
- Flushing DUWL reduced colony counts but failed to meet CDC recommendations
- Iodine did not affect orthodontic bonding

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**DWQ – Research Trends**

**Epidemiological Studies**
- Low prevalence of Legionella bacteria in DUWL and anti-Legionella antibody in UK dentists
- Temporal onset of asthma may be associated with occupational exposure to contaminated DUWL among dentists in London and Northern Ireland

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**DWQ – Research Trends**

**International effort – 19 of 38 articles from outside US**
- UK – 7: 1 review, 3 microbiology, 4 applied clinical
- Poland – 5: 3 reviews, 1 applied clinical, 1 microbiology
- Italy – 3: Applied clinical
- Denmark – 2: Applied clinical
- Germany – 1: Lab study (product development)
- Turkey – 1: Applied clinical (product comparison)

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**DWQ – Research Quality, Consensus and Concerns**

- Quality: Better comparability between studies due to standardization of microbial methods (viable plate counts)
- Efforts underway to develop improved bench-top models
- Move toward international standards for better unit water quality and test methods
- Consensus on ineffectiveness of flushing regimes
- Concerns about reliability of anti-retraction mechanisms
- Ethical concerns about use of negative controls in clinical studies
Dental Water Quality

2003 Research Consideration

- Encourage manufacturers to determine optimal methods and frequency for testing dental-unit waterlines and maintaining dental-unit water-quality standards

Dental Biohazard Waste

- Educational/Policy/Guidelines* 1*
- Bench/Laboratory 0
- Applied/Clinical 7
- Epidemiological or Population-based 0
- Cost-Benefit/Effectiveness 1

TOTAL 9

* 2003 CDC Guideline

Dental Biohazard Waste – Research Trends

- Applied Clinical Studies – All 7 from outside US:
  - Brazil (2005)
  - Italy (2004)
  - Greece (2005)
  - Turkey (2004)
  - Jordan (2005)
  - Saudis (2004)
  - Nigeria (2005)
- Medical and Dental waste issues of greater concern outside US

Environmental Contamination (Airborne and Surfaces)

- Educational/Policy/Guidelines 4*
- Bench/Laboratory 1
- Applied/Clinical 6
- Epidemiological or Population-based 0
- Cost-Benefit/Effectiveness 1

TOTAL 12

* Includes 2003 CDC Guideline and review articles

Environmental Contamination

Research Trends

- Half of studies from outside US:
  - Brazil (2)
  - Italy
  - Iran
  - Lithuania
  - Saudi Arabia

Environmental Contamination

2003 Research Consideration

- Develop animal models to determine the risk of transmitting organisms through inhalation of contaminated aerosols (e.g., influenza) produced from rotary instruments

Dentistry and Bioterrorism

- Educational/Policy/Guidelines* 9*
- Bench/Laboratory 0
- Applied/Clinical 0
- Epidemiological or Population-based 0
- Cost-Benefit/Effectiveness 0

TOTAL 9

* Includes literature review, educational recommendations and panel reports
**Topics with Minimal or No Research**

- Hand Hygiene
- PPE
- Saliva Ejectors
- Antimicrobial mouth rinses
- Dental radiology
- Handpieces
- Frequency of DUWL monitoring
- Laser plumes

**Sterile water**
- M. tuberculosis risks
- Risk communication
- Evaluation of dental safety devices
- Cost effectiveness
- Cost/Benefit/Effectiveness
- Surveillance of DAIs
- Program evaluation

**Total Number of Articles by Research Category**

- Educational/Policy/Guidelines: 47
- Bench/Laboratory: 31
- Applied/Clinical: 44
- Epidemiological or Population-Based: 20
- Cost-Benefit/Effectiveness: 6

**Summary**

- Many (most?) topics lack adequate research (e.g., number of studies, study size, study duration)
- Trends
  - Most research on Applied/Clinical
  - Focus on exposure control, gloves, DUWL maintenance, single-use disposable devices, risks for CJD
  - Few economic analyses
  - Manufacturer sponsored research
  - Much research conducted outside US

**What Next?**

- Define the scope and magnitude of the problem
- Identify and prioritize research needs
- Find interested and funded investigators
- Identify the most efficient methods for conducting research and responding to emergent needs
- Develop best practices for implementation

**Dentistry and Bioterrorism—Research Trends**

- No research articles published
- ADA Consensus Workshop report:
  - Dental personnel and facilities can be of great value in responding to a major bioterrorism attack
  - Dentistry's role in responding to a bioterrorism attack remains poorly defined

**Dentistry and Bioterrorism**

- Educational/Policy/Guidelines*: 9
- Bench/Laboratory: 0
- Applied/Clinical: 0
- Epidemiological or Population-based: 0
- Cost-Benefit/Effectiveness: 0

**TOTAL**: 9
APPENDIX IV
(Research Topics Generated in Small Group Sessions)

Individual Behavior

- General
  - Do DHCP adhere to CDC guidelines and OSHA regulations?
  - What are the factors that affect adherence/compliance?

- Hand Hygiene
  - What are DHCP preferences related to hand hygiene products?
  - What are the cost-benefits of specific hand hygiene options?
  - Do artificial nails and rings pose an infection control risk in the dental environment?

- PPE
  - What is the incidence of injury or exposure associated with the use of PPE (eye splash, mucous membrane exposure, etc.)?
  - Evaluate the potential for transmission of infectious disease from clothing worn beneath PPE
  - What is the incidence and prevalence of “double gloving” or using “extra” PPE and in which clinical situations do the practices occur?

- Radiology
  - What is the nature and the source of contamination of sensors and computer devices such as keyboards and monitors?
  - Which clinical infection control practice is most effective to preserve film positioners' integrity?

- Dental Handpieces
  - How often are oral surgery handpieces autoclaved between patients?

- Dental unit water line monitoring
  - How do DHCP define the term “periodic” as used in the CDC guidelines?
  - How do dentists define “surgery”?
- What are the adverse effects of not using sterile water for oral surgical procedures?

### Safety devices

- Describe the incidence of occupational exposure related to the use of specific safety devices?

### Medical Devices and Technologies

#### General

- How do the design and performance characteristics of dental devices, materials and pharmaceuticals mediate or prevent the transmission of infectious agents in dental settings?
- What are the cost benefits of technology-based interventions to prevent the transmission of infectious agents in dental practice?

#### Antimicrobial resistance

- Do antimicrobials used in dentistry lead to the development of antimicrobial resistance resulting in the development of “superbugs”?
- Does device-mediated transmission of resistant organisms such as methicillin resistant Staphylococcus aureus (MRSA) occur in dental settings?
- Does treatment of dental waterlines with antimicrobial agents lead to the development of resistant organisms?

#### Device associated injuries

- What is the exposure incidence associated with the use of “safer sharps” (e.g. self-sheathing needles)?
- What is the incidence of pathogen exposure associated with burs and sharp dental instruments as compared to those with improved safety features or safer handling methods?

#### Allergy and dermatitis

- Does the device or technology improve or increase the prevalence of allergic reactions in DHCP or patients? For example, what are the effects of glutaraldehyde exposure occurring during instrument sterilization?
- What are the incidence and prevalence of allergies due to latex proteins and rubber-based accelerators in DHCP associated with increased glove use?
What role does bacterial endotoxin play in the development of the latex allergic response in sensitized DHCP?

- Device-mediated contamination/colonization/infection
  - How do various devices, materials and pharmaceuticals employed in dental practice mediate the transmission of infectious disease in dental settings?
  - What are the relative risks of device-mediated exposure to infectious agents between DHCP and patients?
  - What roles do environmental organisms such as those found in dental water systems play in the transmission of infectious disease?
  - Is there a relationship between chronic exposure among DHCP to bacterial by-products such as endotoxin in water used for dental treatment and respiratory diseases such as asthma?
  - Are disinfectant by-products with potential health effects created in dental water systems treated with chemical agents?
  - How frequently are oral microorganisms retracted into waterlines during dental treatment and what measures can be employed to prevent contamination.

- Product comparisons and cost/benefit analyses
  - New technology – What is the cost versus benefit of new devices and technology when infection control issues are factored in?
  - Personal Protective Equipment – What is the cost/benefit of the use of surgical gloves for sterile surgical procedures? Does the risk of infection from exam gloves justify the increased costs to patients and DHCP?
  - Materials – Do newer materials permit improved infection control methods? Do these materials harbor more or fewer microbes throughout their lifecycle?
  - Devices – Which products are most effective, user-friendly and economical for reducing infectious disease transmission risks?
  - Which water treatment systems meet current recommendations for dental water quality at reasonable cost and with minimal user intervention?
  - Dental unit waterlines – Can benchtop dental water system models be developed to evaluate dental water treatment agents and systems under simulated clinical conditions?
  - Syringe and needles – For example, what is the cost/benefit of the use of “safe” needles? Are single use vials more or less cost effective for infection control?
Healthcare System and Infrastructure

- Education and promotion

The three “Education and Promotion” infection control research considerations identified by CDC in the 2003 Guidelines remain as important research topics.

- Design strategies to communicate, to the public and DHCP, the risk of disease transmission in dentistry.
- Promote use of protocols for recommended postexposure management and follow-up.
- Educate and train DHCP to screen and evaluate safer dental devices by using tested design and performance criteria.

- Cost and economic analysis

- What role do reimbursement practices have in infection control and prevention?
- What are efficient, cost-effective ways of evaluating healthcare-associated infections and interventions?

- Communication, integration and learning

- How can dentistry be integrated into healthcare/community research?
- How can general healthcare research be translated for use by the dental community?
- What are the outcomes of training the DHCP in disaster/pandemic response?
- What are the most effective systems and methods to communicate information of importance to the dental community?

- Surveillance

- What are the common healthcare-associated infections in dentistry and how are they acquired?
- What are efficient and effective methods of surveillance?

- Measuring effectiveness of interventions

- What is the critical infrastructure or system necessary to enable adoptions of a new technology or intervention?
- What are effective training methods?
What methods measure the effectiveness of infection control interventions?

What are the “bundles” of infection control practices or information that are effective in infection control and prevention?

How do state-to-state comparisons inform us on the effectiveness of infection control regulations?

What is the effect of documenting immunization status of DHCP?
REFERENCES


