PREVENTION OF ORTHOPAEDIC IMPLANT INFECTION IN PATIENTS UNDERGOING DENTAL PROCEDURES

EVIDENCE-BASED GUIDELINE AND EVIDENCE REPORT

December 7, 2012

Disclaimer
This clinical guideline was developed by a physician and dentist volunteer Work Group and experts in systematic reviews. It is provided as an educational tool based on an assessment of the current scientific and clinical information and accepted approaches to treatment. The recommendations in this guideline are not intended to be a fixed protocol as some patients may require more or less treatment or different means of diagnosis. Patients seen in clinical practice may not be the same as those found in a clinical trial. Patient care and treatment should always be based on a clinician's independent medical judgment given the individual clinical circumstances.

Disclosure Requirement
In accordance with AAOS policy, all individuals whose names appear as authors or contributors to this clinical practice guideline filed a disclosure statement as part of the submission process. All panel members provided full disclosure of potential conflicts of interest prior to beginning work on the recommendations contained within this clinical practice guideline.

Funding Source
No funding from outside commercial sources to support the development of this document.

FDA Clearance
Some drugs or medical devices referenced or described in this clinical practice guideline may not have been cleared by the Food and Drug Administration (FDA) or may have been cleared for a specific use only. The FDA has stated that it is the responsibility of the physician to determine the FDA clearance status of each drug or device he or she wishes to use in clinical practice.

Published 2012 by the American Academy of Orthopaedic Surgeons
6300 North River Road
Rosemont, IL 60018
First Edition

Summary of Recommendations

The following is a summary of the recommendations of the AAOS-ADA clinical practice guideline, Prevention of Orthopaedic Implant Infection in Patients Undergoing Dental Procedures. This summary does not contain rationales that explain how and why these recommendations were developed, nor does it contain the evidence supporting these recommendations. All readers of this summary are strongly urged to consult the full guideline and evidence report for this information. We are confident that those who read the full guideline and evidence report will see that the recommendations were developed using systematic evidence-based processes designed to combat bias, enhance transparency, and promote reproducibility.

This summary of recommendations is not intended to stand alone. Treatment decisions should be made in light of all circumstances presented by the patient. Treatments and procedures applicable to the individual patient rely on mutual communication between patient, physician, dentist and other healthcare practitioners.

1. The practitioner might consider discontinuing the practice of routinely prescribing prophylactic antibiotics for patients with hip and knee prosthetic joint implants undergoing dental procedures.

   Grade of Recommendation: Limited

   Description: Evidence from two or more "Low" strength studies with consistent findings, or evidence from a single Moderate quality study recommending for or against the intervention or diagnostic. A **Limited** recommendation means the quality of the supporting evidence that exists is unconvincing, or that well-conducted studies show little clear advantage to one approach versus another.

   Implications: Practitioners should be cautious in deciding whether to follow a recommendation classified as **Limited**, and should exercise judgment and be alert to emerging publications that report evidence. Patient preference should have a substantial influencing role.

2. We are unable to recommend for or against the use of topical oral antimicrobials in patients with prosthetic joint implants or other orthopaedic implants undergoing dental procedures.

   Grade of Recommendation: Inconclusive

   Description: Evidence from a single low quality study or conflicting findings that do not allow a recommendation for or against the intervention. An **Inconclusive** recommendation means that there is a lack of compelling evidence resulting in an unclear balance between benefits and potential harm.

   Implications: Practitioners should feel little constraint in deciding whether to follow a recommendation labeled as **Inconclusive** and should exercise judgment and be alert to future publications that clarify existing evidence for determining balance of benefits versus potential harm. Patient preference should have a substantial influencing role.

3. In the absence of reliable evidence linking poor oral health to prosthetic joint infection, it is the opinion of the work group that patients with prosthetic joint implants or other orthopaedic implants maintain appropriate oral hygiene.

Grade of Recommendation: Consensus

Description: The supporting evidence is lacking and requires the work group to make a recommendation based on expert opinion by considering the known potential harm and benefits associated with the treatment. A **Consensus** recommendation means that expert opinion supports the guideline recommendation even though there is no available empirical evidence that meets the inclusion criteria.

Implications: Practitioners should be flexible in deciding whether to follow a recommendation classified as **Consensus,** although they may set boundaries on alternatives. Patient preference should have a substantial influencing role.

Terminology Used in This Guideline

Direct evidence – Evidence that demonstrates a relationship between a dental procedure and orthopaedic implant infection.

Indirect evidence – Evidence that demonstrates a relationship between a dental procedure and a surrogate outcome (i.e. bacteremia).

Incidence – New cases of a disease that occur in an at-risk population during a specified time period (i.e. a new bacteremia after a dental procedure)

Prevalence – Existing cases of a disease in a population during a specified time period (i.e. a bacteremia that exists prior to a dental procedure)

Case-control study – Comparison of a diseased group (cases) to a group without disease (controls)

Surrogate Outcome – An outcome (such as a laboratory measurement) that is used as a substitute for a clinically relevant patient centered outcome

High, Moderate, and Low Strength Studies – Derived from quality and applicability analysis; integrating multiple domains composed of questions related to study design and methods (See Appraising Evidence Quality and Applicability)

Prevention of Orthopaedic Implant Infection in Patients Undergoing Dental Procedures
Clinical Practice Guideline Work Group

American Academy of Orthopaedic Surgeons
William Watters, III, MD, Co-Chair
Bone and Joint Clinic of Houston
6624 Fannin Street, #2600
Houston, TX 77030

American Dental Association
Michael P. Rethman, DDS, MS, Co-Chair
47-140 Heno Place
Kaneohe, HI 96744

American Academy of Orthopaedic Surgeons
Richard Parker Evans, MD
Professor and Margaret Sue Neal
Endowed Chair of Orthopaedic Surgery
University of Missouri- Kansas City
School of Medicine
2301 Holmes Street
Kansas City, MO 64108

American Academy of Orthopaedic Surgeons
Calin Moucha, MD
Associate Chief, Joint Replacement Surgery
Mount Sinai Medical Center
Assistant Professor
Leni & Peter W. May Department of Orthopaedic Surgery
Mount Sinai School of Medicine
5 E. 98th Street, Box 1188, 7th Floor
New York, NY 10029

American Academy of Orthopaedic Surgeons
Richard J. O'Donnell, MD
Chief, UCSF Orthopaedic Oncology Service
UCSF Sarcoma Program
UCSF Helen Diller Family Comprehensive Cancer Center
1600 Divisadero Street, 4th Floor
San Francisco, CA 94115

American Academy of Orthopaedic Surgeons & Congress of Neurological Surgeons
Paul A. Anderson, MD
Professor Department of Orthopedics & Rehabilitation
University of Wisconsin
K4/735 600 Highland Avenue
Madison WI 53792

American Dental Association
Elliot Abt, DDS
4709 Golf Road, Suite 1005
Skokie, IL 60076

American Dental Association
Harry C. Futrell, DMD
330 W 23rd Street, Suite J
Panama City, FL 32405

American Dental Association
Stephen O. Glenn, DDS
5319 S Lewis Avenue, Suite 222
Tulsa, OK 74105-6543

American Dental Association
John Hellstein, DDS, MS
The University of Iowa, College of Dentistry
Department of Oral Pathology, Radiology and Medicine
DSB S356
Iowa City, IA 52242

American Association of Hip and Knee Surgeons
David Kolessar, MD
Geisinger Wyoming Valley Medical Center
1000 East Mountain Boulevard
Valley Medical Building
Wilkes-Barre, PA 18711

American Association of Neurological Surgeons/Congress of Neurological Surgeons
John E. O'Toole, MD
Assistant Professor of Neurosurgery
Rush University Medical Center
1725 W. Harrison Street, Suite 970
Chicago, IL 60612

American Association of Oral and Maxillofacial Surgeons
Mark J. Steinberg DDS, MD
1240 Meadow Road, Suite 300
Northbrook, IL 60062

College of American Pathologist
Karen C. Carroll MD, FCAP
Johns Hopkins Hospital
Department of Pathology-Microbiology Division
600 N Wolfe Street
Meyer B1-193
Baltimore, MD 21287

Knee Society
Kevin Garvin, MD
University of Nebraska Medical Center
Creighton/Nebraska Health Fund
Department of Orthopaedic Surgery
981080 Nebraska Medical Center
Omaha, Nebraska 68198-1080

Musculoskeletal Infection Society
Douglas R. Osmon, MD
200 1st Street SW
Rochester, MN 55905

Scoliosis Research Society
Anthony Rinella, MD
Illinois Spine & Scoliosis Center
12701 West 143rd Street, Suite 110
Homer Glen, Illinois 60491

Society for Healthcare Epidemiology of America
Angela Hewlett, MD, MS
Assistant Professor, Section of Infectious Diseases
University of Nebraska Medical Center
985400 Nebraska Medical Center
Omaha, Nebraska 68198

Guidelines Oversight Chair
Michael J. Goldberg, MD
Children's Hospital and Regional Medical Center
1221 1st Avenue, Apt #24E
Seattle, WA 98101

AAOS Staff
Deborah S. Cummins, PhD
Director, Research and Scientific Affairs
6300 N. River Road
Rosemont, IL 60018

Sharon Song, PhD
Manager, Clinical Practice Guidelines

Patrick Sluka, MPH
Former AAOS Lead Research Analyst

Kevin Boyer, MPH
Former Appropriate Use Criteria Unit Manager
Former Interim Clinical Practice Guidelines Manager

Anne Woznica, MLIS
Medical Research Librarian

ADA Staff
Helen Ristic, PhD.
Director, Scientific Information
ADA Division of Science
211 E. Chicago Avenue
Chicago, IL 60611

Nicholas Buck Hanson, MPH
ADA Lead Research Analyst

Special Recognitions
William Robert Martin, III, MD
American Academy of Orthopaedic Surgeons
Medical Director
317 Massachusetts Avenue NE
Washington, D.C. 20002-5769

Additional collaborating organizations involved in this guideline development:
Infectious Disease Society of America (IDSA)

Peer Review Organizations

Participation in the AAOS peer review process does not constitute an endorsement of this guideline by the participating organization.

The following organizations participated in peer review of this clinical practice guideline and gave explicit consent to be listed as peer reviewers:

The Academy of General Dentistry
American Academy of Oral Pathology
American Academy of Orthopaedic Surgeon's Evidence Based Practice Committee
American Academy of Orthopaedic Surgeons' Guidelines Oversight Committee
American Academy of Pediatric Dentistry
American Academy of Periodontology
American Association of Family Physicians
American Association of Hip and Knee Surgeons
American Association of Oral and Maxillofacial Surgeons
American Association of Public Health Dentistry
American College of Prosthodontists
American Dental Association's Council on Scientific Affairs
American Dental Hygienists Association
Canadian Dental Association
Centers for Disease Control and Prevention
College of American Pathologists
Lumbar Spine Research Society
North American Spine Society
Society of Infectious Diseases Pharmacists
The Infectious Diseases Society of America

Participation in the AAOS peer review process does not constitute an endorsement of this guideline by the participating organization.

Table of Contents

List of Tables

List of Figures

INTRODUCTION

OVERVIEW

This clinical practice guideline is based on a systematic review of published studies related to the prevention of orthopaedic implant infection in patients undergoing dental procedures. In addition to providing practice recommendations, this guideline also highlights gaps in the literature and areas that require additional research.

This guideline is intended to be used by all appropriately trained physicians and dentists considering prevention of orthopaedic implant infection in patients undergoing dental procedures.

GOALS AND RATIONALE

The purpose of this clinical practice guideline is to help improve prevention and treatment based on the current best evidence. Current evidence-based practice standards demand that physicians and dentists use the best available evidence in their clinical decision making. To assist them, this clinical practice guideline consists of a systematic review of the available literature related to the prevention of orthopaedic implant infection in patients undergoing dental procedures. The systematic review detailed herein was conducted between October 2010 and July 2011 and demonstrates where there is good evidence, where evidence is lacking, and what topics future research could target to improve the prevention of orthopaedic implant infection in patients undergoing dental procedures. AAOS and ADA staff methodologists and the physician/dentist work group systematically reviewed the available literature and subsequently wrote the following recommendations based on a rigorous, standardized process.

We created this guideline as an educational tool to guide qualified physicians and dentists through a series of treatment decisions in an effort to improve the quality and effectiveness of care. This guideline should not be construed as including all proper methods of care or excluding methods of care reasonably directed to obtaining the same results. The ultimate judgment regarding any specific procedure or treatment must be made in light of all circumstances presented by the patient and the needs and resources particular to the locality or institution.

INTENDED USERS

This guideline is intended to be used by all qualified clinicians considering prevention of orthopaedic implant infection in patients undergoing dental procedures. The guideline is intended to both guide clinical practice and to serve as an information resource for practitioners. An extensive literature base was considered during the development of this guideline. In general, practicing clinicians do not have the resources necessary for such a large project. The AAOS and ADA hope that this guideline will assist practitioners not only in making clinical decisions about their patients, but also in describing, to patients and others, why the chosen treatment represents the best available course of action.

In the interest of collegiality, the ADA elected to follow the rigorous AAOS process for development of this clinical guideline. This guideline is not intended for use as a benefits determination document. Making these determinations involves many factors not considered in the present document, including available resources, business and ethical considerations, and needs.

Evidence for the effectiveness of health-care services is not always present. This is true throughout all areas of medicine and dentistry. Accordingly, all users of this clinical practice guideline are cautioned that an absence of evidence is not evidence of ineffectiveness. An absence means just that; there are no data. It is the AAOS position that rigorously developed clinical practice guidelines should not seek to guide clinical practice when data are absent unless the disease, disorder, or condition in question can result in loss of life or limb. The AAOS incorporates expert opinion into a guideline under these circumstances, and only under these circumstances. Accordingly, when the AAOS states that it cannot recommend for or against a given intervention or service, it is stating that currently available data do not provide clear guidance on which course of action is best, and that it is therefore reluctant to make a recommendation that has potentially national ramifications. The AAOS and ADA believe that when evidence is absent, it is particularly important for treatment decisions to be based on mutual communication between the patient, physician and dentist, with discussion of available treatments and procedures applicable to that patient, and with consideration of the natural history of the disease, costs versus benefits, and current practice patterns. Once the patient has been informed of available therapies and has discussed these options with his/her physician and/or dentist, an informed decision can be made.

PATIENT POPULATION

This document addresses the prevention of orthopaedic implant infection in patients undergoing dental procedures.

BURDEN OF DISEASE AND ETIOLOGY

Approximately 200,000 primary total hip arthroplasties and 400,000 primary total knee arthroplasties were performed in the United States in 2003, with a projected increase to 380,000 hip procedures and over 1,500,000 knee procedures in 2020.[1] Orthopaedic implant infection rates range from 0.3% to 8.3% in the published literature (see Table 26). These infections can be caused by entry of organisms into the wound during surgery, hematogenous spread, recurrence of sepsis in a previously infected joint, or contiguous spread of infection from a local source.[2]

POTENTIAL HARMS, BENEFITS, AND CONTRAINDICATIONS

The goal of prevention of orthopaedic implant infection in patients undergoing dental procedures is avoidance of serious complications resulting from orthopaedic implant infection. Most treatments are associated with some known risks. In addition, contraindications vary widely based on the treatment administered. Therefore, discussion of available treatments applicable to the individual patient rely on mutual communication between the patient, dentist and physician, weighing the potential risks and benefits for that patient.

PREVENTING BIAS IN AN AAOS CLINICAL PRACTICE GUIDELINE

Clinical practice guidelines (CPGs) have come under scrutiny because many of them are not objective. Shaneyfelt and Centor have noted that most current guidelines are not at all like those the Institute of Medicine (IOM) had originally intended, and that they have strayed so far from this original concept that they are mere consensus reports.[3] More recently, the IOM has stated that "the quality of CPG development processes and guideline developer adherence to quality standards have remained unsatisfactory and unreliable for decades."[4] The AAOS understands that only high quality guidelines are credible, and we go to great lengths to ensure the integrity of our guidelines. The purpose of this section is to highlight the processes whereby the AAOS accomplishes this. Additional details about how we combat bias also appear in the Methods section of this guideline.

The AAOS combats bias beginning with the selection of work group members. Applicants for AAOS development work groups who have financial conflicts of interest (COI) related to the guideline topic cannot participate on an AAOS work group if they currently have, or have had a relevant conflict within a year of the start date of guideline development. Applicants also cannot participate if one of their immediate family members has, or has had a relevant conflict of interest.

Financial COI are not the only COI that can influence a guideline. The IOM has noted that income source, long service on government committees or with private insurers, authorship of articles on guideline-related subjects, and biases from personal experience can also cause bias.[5] This suggests that those with the greatest expertise in any given topic area are also those most likely to introduce bias into guideline development. It also suggests that bias can only be counteracted by processes that are in place throughout the entirety of the development, and not just at the beginning.

One manner whereby the AAOS combats bias throughout guideline development is by having a team that is free of all of the above-mentioned COI conduct the literature searches, evaluate the quality of the literature, and sythesize the data (see Appendix I for a list of the work group members and methodologists who participated in the development of this guideline). Hirsh and Guyatt have suggested that using such conflict-free methodologists is critical to developing an unbiased guideline.[6]

Our use of methodologists changes the traditional role of clinicians in guideline development. The clinicians on an AAOS guideline work group serve as content experts. One of the clinicians' tasks is to frame the scope of the guideline by developing preliminary recommendations (these are the questions that will be addressed by the guideline; see below for further information). Another is to develop the article inclusion criteria. After they have done so, the AAOS medical librarian obtains key words from work group members and uses words, the preliminary recommendations, and inclusion criteria to construct literature search strategies. Clinicians are not permitted to suggest specific articles for inclusion at this time inasmuch as those suggestions are often about articles they have authored or that support a particular point of view.

Methodologists then determine which articles should be recalled and whether a recalled article meets the inclusion criteria. After completing this task, the clinician work group is given a list of the recalled articles that are proposed for inclusion and a list of the recalled studies proposed for exclusion. The work group then reviews these lists and suggests modifications. The purpose of this step is to assure the integrity of the guideline's data set. The methodologists are not obligated to take the work group's suggestions, but they are obligated to explain why they did not. Articles included or excluded as a result of this clinician review are handled as all other included articles or excluded studies. The methodologists also appraise the quality and applicability of each included study (we use "quality" as synonymous with "risk of bias." The latter term is preferred by others but, since quality and risk of bias are measured exactly the same way, the difference between the two seems largely semantic. Similarly, we use the terms "applicability" and "generalizability" as synonyms.)

Quality appraisal is a subject worth special mention because it is a necessary step in performing a systematic review and in developing a clinical practice guideline. One evaluates the quality (or risk of bias) of a study to determine how "believable" its results are, the results of high quality studies are more believable than those of low quality studies. This is why, all other things being equal, a recommendation based on high quality evidence will receive a higher grade than recommendations based on lower quality evidence (see Grades of Recommendation for more information). Biases in quality evaluation can cause overestimates of the confidence one should have in available data, and in a guideline recommendation.

Bias in quality evaluation arises when members of a work group view the papers they authored as being more believable than similar research performed by others, view certain studies as more believable simply because they were conducted by thought leaders in a given medical specialty area, and/or view research results that they are "comfortable" with to be more believable than results with which they are uncomfortable.

The problem of biased quality evaluations is aggravated by the fact that no method for quality/risk of bias assessment has been empirically validated. Ultimately, therefore, all methods of quality/risk of bias assessment, are based on expert opinion (including those based on expert consensus obtained through formal methods like the Delphi method), and they all require judgments that are arbitrary. The method we use is no exception.

Given that all currently available quality evaluation systems are imperfect their susceptibility to bias must be a deciding factor about whether to use them in clinical practice guideline development. The AAOS methodology is guided by the thinking that, if guideline developers have the choice between several methodologically imperfect systems, the least biased system is the best. The burden that falls to readers of clinical practice guidelines is to determine which systems are not. Making this determination requires readers to examine two aspects of quality evaluation; the individual criteria used to evaluate a study, and how those criteria are translated into a final determination of a study's believability.

The criteria used to evaluate a study are often framed as one or more questions about a study's design and/or conduct. At the AAOS, independent methodologists answer these questions. This combats bias by virtually eliminating the intellectual conflicts of interest that can arise when others are providing the answers.

Also preventing bias is the way the quality questions are phrased, and the fact that there are specific criteria (described in almost 300 pages of documentation) for answering each question. The simplest example, the AAOS question "Was there >80% follow-up" illustrates the point. The question is answered "Yes,", "No", or "Unclear." To determine whether a "Yes" or "No" answer is unclear, the methodologist merely looks at the number of patients present at the follow-up time of interest, the number of patients present at the start of the study, and expresses the former as a percentage of the latter. If the article does not report the information required to compute this percentage (or does not directly report the percentage) an "Unclear" answer is supplied. In answering this or any other question in the AAOS quality assessment scheme, the methodologist is merely checking to see if the article provides specific data or makes specific statements. If it does, a "Yes" or "No" answer is supplied. If it does not, an "Unclear" answer is given. This lack of ambiguity in the criteria required to answer each question makes answering each question an almost completely objective exercise.

This stands in sharp contrast to the use of Levels of Evidence systems (also called evidence hierarchies), which are probably the most commonly used way of evaluating study quality in clinical practice guideline development. The vagueness of these systems opens the opportunity for bias. For example, these systems often hold that Level I evidence (i.e., the highest quality evidence) is from a well-designed randomized controlled trial, without ever specifying what "well-designed" means. This lack of specific instructions creates the possibility for bias in grading articles because it allows for an *ad hoc* appraisal of study quality. Furthermore, there are over 50 such systems, individuals do not consistently apply any given system in the same way, many are not sensible to methodologists,[7] and Level I studies, those of the highest level of evidence, do not necessarily report that they used adequate safeguards to prevent bias.[8]

Obviously, simply answering a series of questions about a study does not complete the quality evaluation. All clinical practice guideline developers then use that information to arrive at a final characterization of a study's quality. This can be accomplished in two (and only two) ways, by allowing those who are performing this final characterization to use their judgment, or by not letting them do so. Bias is possible when judgment is allowed. Bias is mitigated in the AAOS system because the final rating is accomplished entirely by a computer that uses a pre-determined algorithm.

This aspect of the AAOS system contrasts with the GRADE system,[9] which places the final determination about whether a study has "no", "serious" or "very serious" limitations in the hands of the reviewer. Furthermore, the GRADE system allows the investigator to specify "other sources of bias" (i.e. sources of bias that were not specified *a priori*) and, although this is a theoretically sound way to approach quality evaluation, in practice it too, could allow for *ad hoc* criticisms of a study, and to criticisms that are not evenly applied across all studies. We recognize that we may miss some uncommon study flaws in our evaluation. While this means that our quality evaluation system is not perfectly comprehensive, it does not mean that it is biased. This is yet another example of how the AAOS, faced with a choice among imperfect quality/risk of bias systems, chooses the least biased approach. Given the above mentioned history of guideline development, the AAOS emphasis on elimination of bias seems prudent.

The AAOS system, unlike the GRADE system, also specifically addresses the issue of statistical power (i.e., number of patients enrolled) of a trial. Low statistical power is a common problem in

the medical literature,[10] and low power studies can lead reviewers to incorrectly conclude that a statistically non-significant result means that a given treatment does not work or, perhaps more serious, to reach positive conclusions about an intervention based on the putative "trends" reported in such studies. We regard low power studies as uninformative, and do not consider them when formulating a final recommendation. (We do, however, include low power studies in meta-analyses, inasmuch as one purpose of a meta-analysis is to overcome the low power of individual studies.)

Like the GRADE system, the AAOS guidelines will include observational studies. However, we do not always do so. Rather, we perform "best evidence" syntheses in AAOS guidelines in which we examine the best available (as opposed to the best possible) evidence. We use the best evidence because it is more "believable" than other evidence. The results of studies that are more believable should not be modified by results that are less believable.

When an AAOS guideline includes uncontrolled studies (e.g., case series) it only includes prospective case series that meet a number of other quality-related criteria. We do not include retrospective case series under any circumstances. Such studies do not establish empirically testable comparisons or relationships a priori, are not based on systematic assignment of patients to treatment groups, and are not designed to fully control measurement bias. There is no specific prohibition against using such studies in the GRADE system. We suggest that all guideline developers who are attempting to produce unbiased guidelines employ similar *a priori* criteria to specify the point at which they consider evidence to be too unreliable to consider.

Also unlike the GRADE system, the AAOS guidelines make provisions for making recommendations based on expert opinion. This recognizes the reality of medicine, wherein certain necessary and routine services (e.g., a history and physical) should be provided even though they are backed by little or no experimental evidence, and wherein certain diseases, disorders, or conditions are so grave that issuing a recommendation in the absence of evidence is more beneficial to patients than not issuing one. To prevent the bias that can result when recommendations based on expert opinion proliferate, we have specific rules for when opinion-based recommendations can be issued (further discussed below) and, perhaps more important, for when they cannot be issued. The AAOS will only issue an opinion-based recommendation when the service in question has virtually no associated harms and is of low cost (e.g., a history and physical) or when the consequences of doing (or not doing) something are so catastrophic that they will result in loss of life or limb.

Clinical practice guidelines have not met quality standards for a long time. In recognition of this, the IOM has developed two checklists, one for systematic reviews[11] and another for clinical practice guidelines.[4] Meeting the items on these checklists should assure readers of a guideline that it is unbiased. Table 1 and Table 2 show the performance of the present AAOS guideline on these standards.

Table 1 IOM Clinical Practice Guidelines Standards

IOM Guidelines Standard	AAOS Guideline Meets Standard ?
Establishing transparency	Yes
Management of Conflict of Interest	Yes
Guideline development group composition	No – AAOS does not involve patient representative
Clinical practice guideline – systematic review intersection	Yes
Establishing evidence foundations for and rating strength of recommendations	Yes
Articulation of recommendations	Yes
External review	Yes
Updating	Yes

Table 2 IOM Systematic Review Standards

IOM Systematic Review Standard	AAOS Systematic Reviews Meet Standard ?
Establish a team with appropriate expertise and experience to conduct the systematic review	Yes
Manage bias and conflict of interest (COI) of the team conducting the systematic review	Yes
Ensure user and stakeholder input as the review is designed and conducted	Yes
Manage bias and COI for individuals providing input into the systematic review	Yes
Formulate the topic for the systematic review	Yes
Develop a systematic review protocol	Yes
Submit the protocol for peer review	No – do not have peer review of protocol
Make the final protocol publicly available, and add any amendments to the protocol in a timely fashion	Yes
Conduct a comprehensive systematic search for evidence	Yes
Take action to address potentially biased reporting of research results	No – do not search for unpublished information
Screen and select studies	Yes
Document the search	Yes
Manage data collection	Yes
Critically appraise each study	Yes
Use a prespecified method to evaluate the body of evidence	Yes
Conduct a qualitative synthesis	Yes
Decide if, in addition to a qualitative analysis, the systematic review will include a quantitative analysis (meta-analysis)	Yes
If conducting a meta-analysis, then do the following:	Yes
Prepare final report using a structured format	Partially - no lay public summary
Peer review the draft report	Partially - do not use independent third party to manage peer review process
Publish the final report in a manner that ensures free public access	Yes

METHODS

To develop this guideline, the AAOS-ADA work group held an introductory meeting on November 20 and 21, 2010 to establish the scope of the guideline and the systematic reviews. Upon completing the systematic reviews, the work group participated in a two-day recommendation meeting on October 15 and 16, 2011 at which time the final recommendations and rationales were edited, written, and voted on.

FORMULATING PRELIMINARY RECOMMENDATIONS

The work group determined the scope of the guideline by constructing a set of preliminary recommendations. These recommendations specify [what] should be done in [whom], [when], [where], and [how often or how long]. This is similar to the PICO (patients, interventions, comparisons, and outcomes) format used when the scope of a guideline is framed using key questions instead of preliminary recommendations. The preliminary recommendations function as questions for the systematic reviews that underpin each preliminary recommendation, not as final recommendations or conclusions. To avoid "wordsmithing" discussions at the initial work group meeting, the preliminary recommendations are always worded as recommending for something. Appendix II describes the formulation of preliminary recommendations in further detail.

Once established, these preliminary recommendations cannot be modified until the final work group meeting. At this time, they can only be modified in accordance with the available evidence and only in accordance with the AAOS rules for how the wording of a recommendation depends on the grade of recommendation (see below for information about this wording). No modifications of the preliminary recommendations can require new literature searches and, at the final work group meeting, no recommendations can be added that require the use of expert opinion.

FULL DISCLOSURE INFORMATION

All of the work group's preliminary recommendations are represented in this guideline. This ensures full disclosure of the information that the AAOS-ADA work group examined, and assures readers that they are seeing *all* the information, and not just a selected portion of it.

STUDY SELECTION CRITERIA

We developed *a priori* article inclusion criteria for the systematic reviews for each preliminary recommendation. These criteria are our "rules of evidence." Articles that did not meet them are, for the purposes of this guideline, not evidence.

To be included in our systematic reviews (and hence, in this guideline) an article had to be a report of a study that:

- Study must be of patient population of interest (as described by preliminary recommendations)
- Study must report on >50% of the patient population of interest if results are combined
- Article must be a full article report of a clinical study
- Study must appear in a peer-reviewed publication
- Study must be published in English

- Study must be of humans
- Study must not be an *in vitro* study
- Study must not be a biomechanical study
- Study must not have been performed on cadavers
- Study must be published in or after 1960
- Study results must be quantitatively presented
- Retrospective case series, medical records review, meeting abstracts, historical articles, editorials, letters, and commentaries are excluded
- Registry data is included
- Case series studies that give patients the treatment of interest AND another treatment are excluded
- Case series studies that have non-consecutive enrollment of patients are excluded
- Study should have 10 or more patients per group
- Composite measures or outcomes, even if they are patient-oriented, are excluded

The restriction on English language papers is unlikely to influence the recommendations in the present clinical practice guideline. An umbrella review of systematic reviews on language restriction found that none of the systematic reviews provided empirical evidence that excluding non-English language studies resulted in biased estimates of an intervention's effectiveness.[12]

We did not include systematic reviews or meta-analyses conducted by others, or guidelines developed by others. These documents are developed using different inclusion criteria than those specified by the AAOS-ADA work group. Therefore, they may include studies that do not meet our inclusion criteria. We recalled these documents if their abstract suggested that they might address one of our recommendations, and we searched their bibliographies for additional studies.

LITERATURE SEARCHES

We searched for articles published from January 1966 to July 25, 2011. We searched three electronic databases; PubMed, EMBASE, and The Cochrane Central Register of Controlled Trials. Strategies for searching electronic databases were constructed by the AAOS Medical Librarian using previously published search strategies to identify relevant studies.[13-18]

We supplemented searches of electronic databases with manual screening of the bibliographies of all retrieved publications. We also searched the bibliographies of recent systematic reviews and other review articles for potentially relevant citations. All articles identified were subject to the study selection criteria listed above. As noted above, the guideline work group also examined lists of included and excluded studies for errors and omissions.

We went to these lengths to obtain a complete set of relevant articles. Having a complete set ensures that our guideline is not based on a biased subset of articles. The study attrition diagram in Appendix III provides details about the inclusion and exclusion of the studies considered for this guideline. The search strategies used to identify these studies are provided in Appendix IV.

BEST EVIDENCE SYNTHESIS

We included only the best available evidence for any given outcome addressing a recommendation. Accordingly, we first included the highest quality evidence for any given

outcome if it was available. In the absence of two or more studies that reported an outcome at this quality, we considered studies of the next lowest quality until at least two or more occurrences of an outcome had been acquired. For example, if there were two "Moderate" quality studies that reported an outcome, we did not include "Low" quality studies that also reported this outcome, but if there was only one "Moderate" quality study that reported an outcome, we also included "Low" quality studies.

APPRAISING EVIDENCE QUALITY AND APPLICABILITY

STUDIES OF INTERVENTIONS

QUALITY

As noted earlier, we judged quality using questions specified before this guideline topic was selected, and a computer program determined the final quality rating. Accordingly, it is highly unlikely that bias affected our determinations of quality.

We separately evaluated the quality of evidence for each outcome reported by each study. This follows the suggestion of the GRADE working group and others.[9, 19] We evaluated quality using a domain-based approach. Such an approach is used by the Cochrane Collaboration.[20] Unlike the Cochrane Collaboration's scheme, our scheme allows for evaluation of studies of all designs. The domains we used are whether:

- The study was prospective (with prospective studies, it is possible to have an *a priori* hypothesis to test; this is not possible with retrospective studies.)
- The study was of low statistical power
- The assignment of patients to groups was unbiased
- There was blinding to mitigate against a placebo effect
- The patient groups were comparable at the beginning of the study
- The intervention was delivered in such a way that any observed effects could reasonably be attributed to that intervention
- Whether the instruments used to measure outcomes were valid
- Whether there was evidence of investigator bias

Each quality domain is addressed by one or more questions that are answered "Yes," "No," or "Unclear." These questions and the domains that each address are shown in Appendix V.

To arrive at the quality of the evidence for a given outcome, all domains except the "Statistical Power" domain are termed as "flawed" if one or more questions addressing any given domain are answered "No" for a given outcome, or if there are two or more "Unclear" answers to the questions addressing that domain. The "Statistical Power" domain is considered flawed if a given study did not enroll enough patients to detect a standardized difference between means of 0.2.

Domain flaws lead to corresponding reductions in the quality of the evidence. The manner in which we conducted these reductions is shown in Table 3. For example, the evidence reported in a randomized controlled trial (RCT) for any given outcome is rated as "High" quality if zero or one domain is flawed. If two or three domains are flawed for the evidence addressing this outcome, the quality of evidence is reduced to "Moderate," and if four or five domains are

flawed, the quality of evidence is reduced to "Low." The quality of evidence is reduced to "Very Low" if six or more domains are flawed.

Some flaws are so serious that we automatically term the evidence as being of "Very Low" quality, regardless of a study's domain scores. These serious design flaws are:

- Non-consecutive enrollment of patients in a case series
- Case series that gave patients the treatment of interest AND another treatment
- Measuring the outcome of interest one way in some patients and measuring it in another way in other patients
- Low statistical power

Table 3 Relationship between Quality and Domain Scores for Interventions

Number of Flawed Domains	Quality
0-1	High
2-3	Moderate
4-5	Low
>5	Very Low

Although we mention levels of evidence in this guideline, we do so only to provide some very general information about study quality to those readers familiar with the levels of evidence system of *The Journal of Bone and Joint Surgery - American*. However, for the reasons noted above, we do not use levels of evidence as when we speak of "quality" in this document, and levels of evidence play no role in our determination of the grade of the final recommendations.

APPLICABILITY

We rated the applicability (also called "generalizability" or "external validity") of the evidence for each outcome reported by each study. As with quality, applicability ratings were determined by a computer program that used predetermined questions about specific applicability domains. We rated applicability as either "High", "Moderate", or "Low" depending on how many domains are flawed. As with quality, a domain is "flawed" if one or more questions addressing that domain is answered "No" or if two or more are answered "Unclear." We characterized a domain as "flawed" if one or more questions addressing any given domain are answered "No" for a given outcome, or if there are two or more "Unclear" answers to the questions addressing that domain (see Appendix V for the specific applicability questions we employed and the domains that each question addresses).

Our questions and domains about applicability are those of the PRECIS instrument.[21] The instrument was originally designed to evaluate the applicability of randomized controlled trials, but it can also be used for studies of other design. The questions in this instrument fall into four domains. These domains and their corresponding questions are shown in Appendix V. As shown in Table 4, the applicability of a study is rated as "High" if it has no flawed domains, as "Low" if all domains are flawed, and as "Moderate" in all other cases.

Table 4 Relationship between Applicability and Domain Scores for Interventions

Number of Flawed Domains	Applicability
0	High
1, 2, 3	Moderate
4	Low

STUDIES OF INCIDENCE AND PREVALENCE

QUALITY

As with our appraisal of the quality of studies of intervention, our appraisal of studies of incidence and prevalence is a domain-based approach conducted using *a priori* questions (please see Appendix V for the questions we used and the domains to which they apply), and scored by a computer program. The four domains we employed are listed below:

- Outcome (whether the study is measuring the incidence/prevalence of a clinically meaningful event)
- Measurement (whether the study measured the disease/disorder/condition in a way that would lead to accurate estimates of incidence or prevalence)
- Participants (whether those who were studied were representative of the population of interest)
- Investigator Bias (whether author biases could have prejudiced the results)

We characterized a study that has no flaws in any of its domains as being of "High" quality, a study that has one flawed domain as being of "Moderate" quality, a study with two flawed domains as being of "Low" quality, and a study with three or more flawed domains as being of "Very Low" quality (Table 5).We characterized a domain as "flawed" if one or more questions addressing any given domain are answered "No" for a given screening/diagnostic/test, or if there are two or more "Unclear" answers to the questions addressing that domain.

We considered some design flaws as so serious that their presence automatically guarantees that a study is characterized as being of "Very Low" quality regardless of its domain scores. These flaws are:

- The outcome of interest could have occurred more than once in a person during the course of the study, and more than the first episode of the outcome was counted in the incidence/prevalence estimate
- The study was a study of the proportion (or number) of people who have a disease, and the study was not a study of point prevalence.

Table 5 Relationship between Quality and Domain Scores for Incidence and Prevalence Studies

Number of Flawed Domains	Quality
0	High
1	Moderate
2	Low
≥3	Very Low

APPLICABILITY

We separately evaluated the applicability of prevalence and incidence studies, and did so using a domain-based approach (please see Appendix V for the relevant questions and the domains they address) that involves predetermined questions and computer scoring. The domains we used for the applicability of prognostics are:

- Participants (i.e. whether the participants in the study were like those seen in the population of interest)
- Analysis (i.e., whether participants were appropriately included and excluded from the analysis)
- Outcome (i.e., whether the incidence/prevalence estimates being made were of a clinically meaningful outcome)

We characterized a domain as "flawed" if one or more questions addressing any given domain are answered "No" for a given screening/diagnostic/test, or if there are two or more "Unclear" answers to the questions addressing that domain. We characterized the applicability of a screening/diagnostic test as "High" if none of its domains are flawed, "Low" if all of its domains are flawed, and "Moderate" in all other cases (Table 6).

Table 6 Relationship between Applicability and Domain Scores for Incidence and Prevalence Studies

Number of Flawed Domains	Applicability
0	High
1,2	Moderate
3	Low

STUDIES OF PROGNOSTICS

QUALITY

Our appraisal of studies of prognostics is a domain-based approach conducted using *a priori* questions, and scored by a computer program (please see Appendix V for the questions we used and the domains to which they apply). The six domains we employed are:

- Prospective (A variable is specified as a potential prognostic variable *a priori*. This is not possible with retrospective studies.)
- Power (Whether the study had sufficient statistical power to detect a prognostic variable as statistically significant)
- Analysis (Whether the statistical analyses used to determine that a variable was rigorous to provide sound results)
- Model (Whether the final statistical model used to evaluate a prognostic variable accounted for enough variance to be statistically significant)
- Whether there was evidence of investigator bias

We separately determined a quality score for each prognostic reported by a study. We characterized the evidence relevant to that prognostic variable as being of "High" quality if there are no flaws in any of the relevant domains, as being of "Moderate" quality if one of the relevant

domains is flawed, as "Low" quality if there are two flawed domains, and as "Very Low" quality if three or more relevant domains are flawed (Table 7). We characterized a domain as "flawed" if one or more questions addressing any given domain are answered "No" for a given prognostic variable, or if there are two or more "Unclear" answers to the questions addressing that domain.

Table 7 Relationship between Quality and Domain Scores for Prognostic Studies

Number of Flawed Domains	Quality
0	High
1	Moderate
2	Low
≥3	Very Low

APPLICABILITY

We separately evaluated the applicability of each prognostic variable reported in a study, and did so using a domain-based approach (please see Appendix V for the relevant questions and the domains they address) that involves predetermined questions and computer scoring. The domains we used for the applicability of prognostics are:

- Patients (i.e. whether the patients in the study and in the analysis were like those seen in clinical practice)
- Analysis (i.e., whether the analysis was not conducted in a way that was likely to describe variation among patients that might be unique to the dataset the authors used)
- Outcome (i.e., whether the prognostic was a predictor of a clinically meaningful outcome)

We characterized the evidence relevant to that prognostic as being of "High" applicability if there are no flaws in any of the relevant domains, as being of "Low" applicability if all three domains are flawed, and as of "Moderate" applicability in all other cases (Table 8). We characterized a domain as "flawed" if one or more questions addressing any given domain are answered "No" for a given prognostic variable, or if there are two or more "Unclear" answers to the questions addressing that domain.

Table 8 Relationship between Applicability and Domain Scores for Prognostic Studies

Number of Flawed Domains	Applicability
0	High
1,2	Moderate
3	Low

OTHER BIASES IN THE PUBLISHED LITERATURE

Despite our efforts to rigorously evaluate the quality of the studies we included, there remains the possibility that some of the articles considered in this guideline are biased. A 2007 umbrella review found that 20 of 23 previous systematic reviews found a positive relationship between pharmaceutical industry support and pro-industry findings,[22] leading the author to conclude that "it is unequivocally the case that sponsorship influences published results." The relationship also seems to exist in orthopaedics, where authors of industry-funded studies of hip and knee

arthroplasty come to positive conclusions more often that authors of studies not funded by industry,[23] and where the association between trial outcome and funding source exists across subspecialty societies.[24]

These apparent biases may not be related to the article's quality[22] and, therefore, may not be detected by our evaluations or the quality/risk of bias evaluations performed by others. Accordingly, we follow the suggestion of Montori, et al.[25] and do not use the conclusions of the authors of any article. Rather, we use only the information provided in an article's Methods section and in its Results section. Furthermore, we perform our analysis using network meta-analysis, an analytical technique that considers the full range of alternatives rather than just those comparisons selected by industry.[26]

GRADES OF RECOMMENDATION

A grade of recommendation expresses the degree of confidence one can have in each of the final recommendations. Grades express how likely it is that a recommendation will be overturned by future evidence, and are termed "Strong," "Moderate," or "Limited."

We used the above-discussed quality and applicability ratings in conjunction with consistency, whether the studies reported outcomes that the work group deemed "critical," and the potential for catastrophic harm to determine the final grade of recommendation. More specifically, we began by setting the grade as equal to the quality of the available evidence. In other words, high quality evidence is preliminarily taken as a "Strong" grade, moderate quality as a "Moderate" grade, and low quality as a "Limited" grade. As noted above, very low quality evidence is not included in AAOS guidelines. Accordingly, the final versions of preliminary recommendations that are based on such evidence will either state that the AAOS cannot recommend for or against a given medical service or, assuming that the requirements for a recommendation based on expert opinion are met it will be a consensus-based recommendation. We then adjusted the grade down one step if the evidence is of "Low" applicability, is inconsistent (defined as studies that report qualitatively different effects, a heterogeneous meta-analysis, or a network meta-analysis with statistically significant inconsistency), if there is only one study that addresses a given recommendation, or if a majority of the outcomes deemed "critical" are not reported in the literature. Preliminary grades were adjusted upwards if the evidence is of "High" applicability or if providing the intervention decreases the potential for catastrophic harm (loss of life or limb). Preliminary grades were adjusted downward if the evidence is of "Low" applicability or if the medical service in question is accompanied with catastrophic harm.

For a recommendation of a "Strong" grade, a minimum of two high quality studies are needed. A minimum of two moderate quality studies are required for a "Moderate" grade, and a minimum of two low quality studies are needed for a "Limited" grade. Recommendations addressed by only very low quality studies are consensus-based.

Table 9 Strength of Recommendation Descriptions

Statement Rating	Description of Evidence Strength	Implication for Practice
Strong	Evidence is based on two or more "High" strength studies with consistent findings for recommending for or against the intervention. A **Strong** recommendation means that the benefits of the recommended approach clearly exceed the potential harm (or that the potential harm clearly exceeds the benefits in the case of a strong negative recommendation), and that the strength of the supporting evidence is high.	Practitioners should follow a **Strong** recommendation unless a clear and compelling rationale for an alternative approach is present.
Moderate	Evidence from two or more "Moderate" strength studies with consistent findings, or evidence from a single "High" quality study for recommending for or against the intervention. A **Moderate** recommendation means that the benefits exceed the potential harm (or that the potential harm clearly exceeds the benefits in the case of a negative recommendation), but the strength of the supporting evidence is not as strong.	Practitioners should generally follow a **Moderate** recommendation but remain alert to new information and be sensitive to patient preferences.
Limited	Evidence from two or more "Low" strength studies with consistent findings, or evidence from a single Moderate quality study recommending for or against the intervention or diagnostic. A **Limited** recommendation means the quality of the supporting evidence that exists is unconvincing, or that well-conducted studies show little clear advantage to one approach versus another.	Practitioners should be cautious in deciding whether to follow a recommendation classified as **Limited**, and should exercise judgment and be alert to emerging publications that report evidence. Patient preference should have a substantial influencing role.

Inconclusive	Evidence from a single low quality study or conflicting findings that do not allow a recommendation for or against the intervention. An **Inconclusive** recommendation means that there is a lack of compelling evidence resulting in an unclear balance between benefits and potential harm.	Practitioners should feel little constraint in deciding whether to follow a recommendation labeled as **Inconclusive** and should exercise judgment and be alert to future publications that clarify existing evidence for determining balance of benefits versus potential harm. Patient preference should have a substantial influencing role.
Consensus[1]	The supporting evidence is lacking and requires the work group to make a recommendation based on expert opinion by considering the known potential harm and benefits associated with the treatment. A **Consensus** recommendation means that expert opinion supports the guideline recommendation even though there is no available empirical evidence that meets the inclusion criteria.	Practitioners should be flexible in deciding whether to follow a recommendation classified as **Consensus,** although they may set boundaries on alternatives. Patient preference should have a substantial influencing role.

[1] The AAOS will issue a consensus-based recommendation only when the service in question has virtually no associated harm and is of low cost (e.g. a history and physical) or when not establishing a recommendation could have catastrophic consequences.

WORDING OF THE FINAL RECOMMENDATIONS

To prevent biased nuances in the way recommendations are worded, the AAOS uses predetermined, specific language for its recommendations. The exact wording is governed by the final grade of the recommendation. This wording, and the corresponding grade, is shown in Table 10.

Table 10 AAOS Guideline Language

Guideline Language	Grade of Recommendation
We **recommend**	Strong
We **suggest**	Moderate
The Practitioner ***might***	Limited
We are **unable to recommend for or against**	Inconclusive
In the absence of reliable evidence, the **opinion** of this work group is*	Consensus*

[1] The AAOS will issue a consensus-based recommendation only when the service in question has virtually no associated harm and is of low cost (e.g. a history and physical) or when not establishing a recommendation could have catastrophic consequences.

*Consensus based recommendations are made only if specific criteria are met (see below).

CONSENSUS RECOMMENDATIONS

Consensus recommendations are recommendations based on expert opinion. As noted above, there are times when it is prudent to make such recommendations. However, liberal use of them can allow for bias. Accordingly, we allow consensus-based recommendations using the procedures described by the United States Preventative Services Task Force (USPSTF).[27] In effect, this means that the AAOS will only issue a consensus-based recommendation under two circumstances. The first is for procedures that have virtually no associated harms, are of relatively low cost, and that reflect current, routine clinical practice. The second is when providing (or not providing) a service could result in loss of life or limb. Because they are based on expert opinion, consensus recommendations are the weakest type of recommendation.

In making such recommendations, the AAOS instructs its clinician work group members to address:

- The potential preventable burden of disease (if the burden is low, a consensus-based recommendation cannot be issued)
- Potential harms (if there are serious harms that result from providing a medical service, a consensus-based recommendation cannot be issued)
- Current practice (a consensus-based recommendation cannot be issued if a service is not currently widely used)
- Why, if warranted, a more costly service is being recommended over a less costly one

The AAOS employs additional rules to combat the bias that may affect such recommendations. The rationale for the recommendation cannot contain references to studies that were not included in the systematic reviews that underpin a guideline. Excluded articles are, in effect, not evidence, and they may not be cited. Also, the final recommendation must use the language shown in Table 10. The rationale cannot contain the language "we recommend," "we suggest," or "the practitioner might" inasmuch as this wording could be confused with the evidence-based recommendations in a guideline. In addition, the rationale must address apparent discrepancies in logic with other recommendations in the guideline. For example, if a guideline does not come to a recommendation in some instances but, in the instance in question, the work group has issued a consensus-based recommendation, the rationale must explain the reason for this difference.

One consequence of these restrictions is that the AAOS does not typically recommend new medical devices, drugs, or procedures. These procedures are usually supported by little research, and the AAOS is reluctant to make recommendations that could have a national impact based on small amounts of data.

When it is not possible to issue a recommendation (i.e. when the recommendation reads that "we are unable to recommend for or against") the explanation for why a recommendation cannot be given cannot contain an implied recommendation. For example, in the case of a new device, drug, or procedure, the work group may not write a recommendation similar to "Although the treatment *appears to be promising*, there is currently insufficient evidence to recommend for or against its use." The italicized phrase implies that the treatment is effective, whereas not being

able to recommend "for or against" something implies that effectiveness is currently indeterminate.

More details of our rules for making opinion based recommendation can be found in Appendix VI

VOTING ON THE RECOMMENDATIONS

The recommendations and their strength were voted on using a structured voting technique known as the nominal group technique.[28] We present details of this technique in Appendix VII. Voting on guideline recommendations is conducted using a secret ballot and work group members are blinded to the responses of other members. If disagreement between work group members is significant, there is further discussion to see whether the disagreement(s) can be resolved. Up to three rounds of voting are held to attempt to resolve disagreements. If disagreements are not resolved following three voting rounds, no recommendation is adopted. Lack of agreement is a reason that the grade of some recommendations can be labeled "Inconclusive."

Formal votes on all recommendations that are evidence-based or that read "we are unable to recommend for or against" are only on the recommendations. The rationales require only approval of the work group chair and the methodologists unless the recommendation is consensus-based. Both the recommendation and the rationale of a consensus-based recommendation are the subject of formal votes.

OUTCOMES CONSIDERED

In considering the outcomes discussed in this guideline, it is important to distinguish between patient-oriented and surrogate outcomes. Patient-oriented outcomes measure how a patient feels, functions, or survives.[29] A patient-oriented outcome "tells clinicians, directly and without the need for extrapolation, that a diagnostic, therapeutic or preventive procedure helps patients live longer or live better."[30] Patient-oriented outcomes include pain relief, death, and fractures. Surrogate outcomes are laboratory measurements or physical signs used as substitutes for patient-oriented outcomes. Surrogate outcomes include outcomes like blood cholesterol levels, laboratory and imaging results, and bone mineral densities.

Surrogate outcomes are problematic. An intervention that improves a surrogate outcome does not necessarily improve a patient-oriented outcome. The opposite can be true. Using a surrogate outcome as a study endpoint can make a harmful treatment look beneficial. For example, although the surrogate outcome cardiac sinus rhythm improves when quinidine is given after conversion, mortality is tripled. Similarly, sodium fluoride increases bone mineral density, but it also increases the rate of non-vertebral fractures.[30, 31] This leads to an important (and often overlooked) aspect about surrogate outcomes. To be useful, a surrogate outcome must not only correlate with the patient-oriented outcome of interest, but also the surrogate must predict (capture) the effects of an intervention on that outcome.[29, 31, 32] Additionally, many surrogates may correlate with an outcome, but few predict the effects of an intervention. For these reasons, the AAOS rarely uses surrogate outcomes as endpoints in its clinical practice guidelines. We make an exception, in this guideline, for bacteremia associated with a dental procedure because there is little reliable evidence predicting the effects of bacteremia associated with a dental procedure on orthopaedic implant infections.

STATISTICAL METHODS

When possible, we recalculate the results reported in individual studies and compile them to answer the recommendations. The statistical analysis is conducted using STATA 10.0[33]. STATA was used to determine the magnitude, direction, and/or 95% confidence intervals of the treatment effect. For data reported as means (and associated measures of dispersion) the mean difference between groups and the 95% confidence interval was calculated and a two-tailed t-test of independent groups was used to determine statistical significance. When published studies report measures of dispersion other than the standard deviation the value was estimated to facilitate calculation of the treatment effect. In studies that report standard errors or confidence intervals the standard deviation was back-calculated. In studies that only report the median, range, and/or size of the trial, we estimated the means and variances according to a published method.[34] In some circumstances statistical testing was conducted by the authors and measures of dispersion were not reported. In the absence of measures of dispersion, the results of the statistical analyses conducted by the authors (i.e. the p-value) are considered as evidence. For proportions, we report the ratio of events along with the percentage. P-values < 0.05 were considered statistically significant.

We performed network meta-analyses (also known as a mixed treatment comparisons analyses) to ascertain the comparative effectiveness of strategies for preventing bacteremia among patients undergoing dental extraction. All of the trials entered into our analyses were randomized controlled trials (most, but not all, were of "Moderate" quality; additional details on their quality are presented in the sections of this guideline that present our results of the appraisal of these studies).

Analyses were performed as described by Lu and Ades[35] using Winbugs v 1.4.3. This method preserves the randomization of the original trials. The Markov chains in our model were said to have converged if plots of the Gelman-Rubin statistics indicated that widths of pooled runs and individual runs stabilized around the same value and their ratio was approximately one.[36] In general, we performed 100,000 iterations, the first 50,000 of which were discarded as "burn in" iterations for each of the network models we describe. We specified vague priors for the trial baselines and the basic parameters (normal distribution with mean 0 and variance 10,000) and for the random effects standard deviation (uniform distribution: U(0,2)). We use $p < 0.05$ to define statistical significance.

To assess the adequacy of our models, we checked their overall fit by comparing the posterior mean deviance to the number of data points in any given model. These two figures are approximately equal for models that fit the data well. We also checked the statistical consistency of the models using a "back-calculation" method for networks with direct evidence from multi-arm trials.[37] This method requires point estimates and dispersions of the trial data being entered into the network meta-analysis. When there were two or more trials comparing two of the same treatments, we obtained these latter two quantities from traditional random effects meta-analytic models computed according to the method of DerSimonian and Laird.[38] All traditional meta-analyses were performed using STATA.

We performed separate network meta-analyses for antibiotic prophylaxis and for non-antibiotic prophylaxis (e.g., antiseptic rinses) because the analysis combining both types of prophylaxis resulted in a statistically inconsistent model.

PEER REVIEW

A draft of the present guideline was peer reviewed. Peer review was performed using a structured peer review form (see Appendix VIII). This form requires all peer reviewers to declare their conflicts of interest.

To determine who would serve as peer reviewers, the work group nominated external specialty societies before work on the guideline began. By having work groups specify *organizations* for review (as opposed to individuals), we are attempting to prevent overly favorable reviews that could arise should work group members choose reviewers whom they had personal or professional relationships. We also blind peer reviewers to the identities of the work group members when they peer review the draft.

The outside specialty societies were nominated at the beginning of the process and solicited for names of peer reviewers approximately six weeks before the final recommendation meeting for a guideline. The physician members of the AAOS Guidelines Oversight Committee and the Evidence Based Practice Committee review all draft AAOS clinical practice guidelines. In addition, the ADA Council on Scientific Affairs will review the guideline.

On occasion, some specialty societies (both orthopaedic and non-orthopaedic) ask their evidence-based practice (EBP) committee to provide peer review of our guidelines. The specialty society is responsible for compiling this type of review into one document before it is returned to us. We ask that the Chairpersons of these external EBP committees declare their conflicts of interest and manage the conflicts of interest of their committee members. Some specialty societies ask to post the guideline on their website for review by all of their interested members. Again, the AAOS asks that these reviews be collated into a single response by the specialty society, and that the person responsible for submitting this document to the AAOS disclose his or her financial conflicts of interest. We also ask that this posting be to the "members" only portion of the specialty societies' website because our drafted document represents a "work in progress" and is subject to change as a direct result of the review process. In addition, the draft has not been formally approved by the AAOS Board of Directors or the ADA Board of Trustees. This is not an attempt to restrict input on the draft. Nor do we consider it as a method to imply that outside specialty societies who provide review of the document necessarily agree with the stated recommendations. Hence, the reason all peer review comments and our responses are made publicly available.

AAOS and ADA staff drafted initial responses to comments about methodology. These responses were then reviewed by the work group co-chairs , who also respond to questions concerning clinical practice and techniques. All changes to a recommendation as a result of peer review input were voted on and accepted by a majority of the work group members via teleconference. All changes to any guideline recommendation are based on the evidence in the guideline recommendations. Final changes to the guideline are incorporated, detailed in a summary sheet and forwarded with the document through the rest of the review and approval process.

The AAOS and ADA believe that it is important for guideline developers to demonstrate that they are responsive to peer review. Accordingly, after the AAOS Board of Directors approves a guideline, the AAOS posts all peer reviewer comments on its website (see

http://www.aaos.org/research/guidelines/guide.asp to access these documents) with a point-by-point description of how the AAOS responded to each non-editorial comment made by each reviewer. Reviewers who wish to remain anonymous can notify the AAOS, and their names will be redacted; their comments, our responses and their conflicts of interest will however still be posted for review.

Forty-seven outside organizations were solicited to provide peer reviewers for this document. The draft of this guideline was sent to seventeen review organizations who responded to the solicitation and a total of twenty-three peer reviewers received the document not including the AAOS Evidence-based Practice Committee and Guidelines Oversight Committee members. Eighteen of these reviewers returned comments (see Appendix IX). The disposition of all non-editorial peer review comments was documented and accompanied this guideline through the public commentary and the AAOS guideline approval process.

PUBLIC COMMENTARY

After modifying the draft in response to peer review, the guideline was sent for a thirty day period of "Public Commentary." Public Commentators are blinded to the identities of the work group members. Commentators consist of members of the AAOS Board of Directors (BOD), members of the Council on Research and Quality (CORQ), members of the Board of Councilors (BOC), and members of the Board of Specialty Societies (BOS). AAOS guidelines are automatically forwarded to the AAOS BOD and CORQ for commentary. Members of the BOC and BOS are solicited for interest. If they ask to see the document, it is forwarded to them. In addition, the guideline will be forwarded to the ADA Board of Trustees, Council on Dental Practice, Council on Access, Prevention and Interprofessional Relations, Council on Dental Benefit Programs, and Council on Dental Education and Licensure for commentary.

The draft guideline is, if warranted, modified in response to public commentary by the AAOS Clinical Practice Guidelines Unit, the ADA Division of Science, and the work group members. If changes are made as a result of public comment, these changes are summarized, and those who provided commentary are notified that their input resulted in a change in the guideline. Changes as a result of public commentary are based on evidence in the guideline recommendations. All changes are detailed in a summary sheet that accompanies the document through the approval process.

Over one hundred commentators have had the opportunity to provide input into this guideline. Of these, fifty-eight members received the document and five returned comments (see Appendix IX).

THE AAOS GUIDELINE APPROVAL PROCESS

This final guideline draft was approved by the AAOS Evidence Based Practice Committee, the AAOS Guidelines Oversight Committee, the AAOS Council on Research and Quality, the ADA Council on Scientific Affairs, the AAOS Board of Directors, and the ADA Board of Trustees. Descriptions of these bodies are provided in Appendix X. These reviewing bodies do not have the option to modify the draft guideline during the approval process. They can only vote to approve it or reject it. Accordingly, no changes were made to this guideline during the approval process.

REVISION PLANS

This guideline represents a cross-sectional view of current treatment and may become outdated as new evidence becomes available. This guideline will be revised in accordance with new evidence, changing practice, rapidly emerging treatment options, and new technology. Accordingly, this guideline will be updated or withdrawn in five years in accordance with the standards of the National Guideline Clearinghouse.

GUIDELINE DISSEMINATION PLANS

The primary purpose of the present document is to provide interested readers with full documentation about not only our recommendations, but also about how we arrived at those recommendations. This document is also posted on the AAOS website at http://www.aaos.org/research/guidelines/guide.asp.

Guidelines are first announced by a press release and then published on the AAOS's and the ADA's website. Guideline summaries are published in the Journal of the American Academy of Orthopaedic Surgeons, Journal of the American Dental Association, *AAOS Now* and *ADA News*. In addition, guidelines are disseminated at the AAOS Annual Meeting in various venues such as on Academy Row and at Committee Scientific Exhibits.

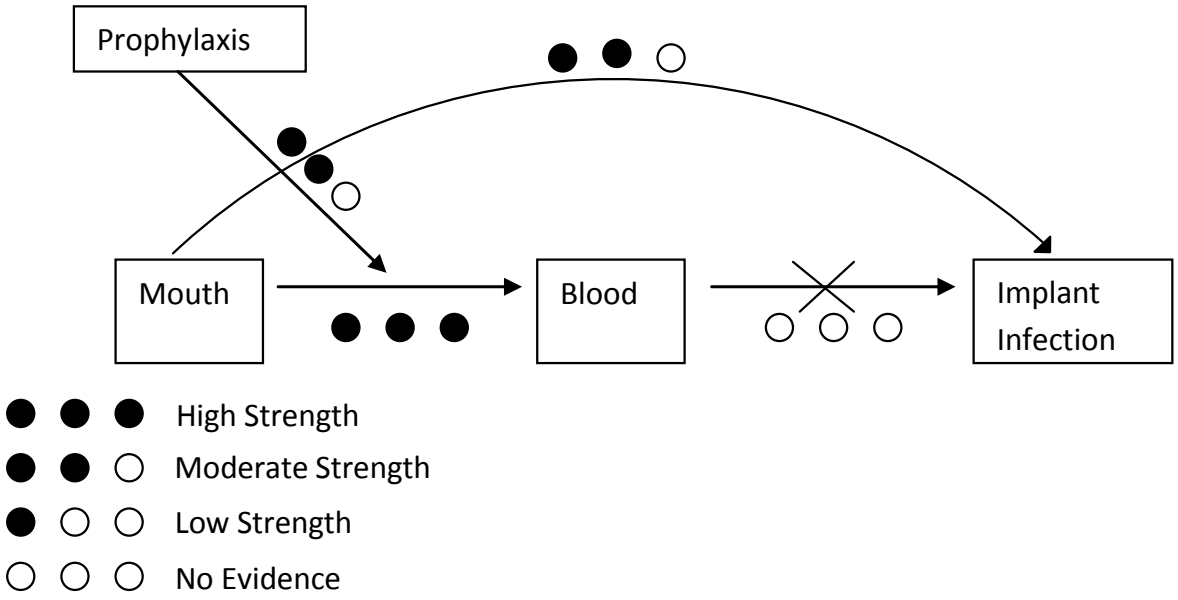
Selected guidelines are disseminated by webinar, an Online Module for the Orthopaedic Knowledge Online website, Radio Media Tours, Media Briefings, and by distributing them at relevant Continuing Medical Education (CME) courses and at the AAOS Resource Center.

Other dissemination efforts outside of the AAOS and ADA include submitting the guideline to the National Guideline Clearinghouse and distributing the guideline at other medical specialty societies' meetings.

OVERVIEW OF THE EVIDENCE

As illustrated in Figure 1, there is varying quality of evidence that explains the proposed association between dental procedures and orthopaedic implant infection. Only one study of direct evidence of moderate strength (represented in Figure 1 below, by the arching arrow) was considered for this guideline. The results of this study show that dental procedures are not risk factors for subsequent implant infection and furthermore that antibiotic prophylaxis does not reduce the risk of subsequent infection.[39] However, multiple high strength studies of indirect evidence link oral procedures to bacteremia, a surrogate measure of risk of orthopaedic implant infection. Furthermore, multiple moderate strength studies of indirect evidence suggest that prophylaxis decreases the incidence of post dental procedure bacteremia. No studies exist that explain the microbiological relationship between bacteremia and orthopaedic implant infection.

Figure 1 Overview of the Evidence



DIRECT EVIDENCE

FINDINGS

The results of one study provide direct evidence for the association between dental procedures and antibiotic prophylaxis on prosthetic hip and knee infection. This single-center, case-control study prospectively enrolled patients between 2001and 2006. 339 case patients were diagnosed with a prosthetic hip or knee infection. 339 control patients were hospitalized on an orthopedic service without a prosthetic hip or knee infection. Characteristics of case and control patients were compared, risk factors for prosthetic hip or knee infection were analyzed and multivariate logistic regression was performed to assess the association between variables and odds of infection. The model included covariates of sex, joint age, dental propensity score, body mass index >40, procedure time >4 h, immunocompromised host, American Society of Anesthesiologists score, wound healing complications, prior arthroplasty or surgery on the index joint, use of surgical antibiotic prophylaxis, postoperative urinary tract infection, and distant organ infection. The results from this model show that low and high-risk dental procedures (see Table 11)

performed within 6 months and 2 years of the hospital admission date were not significantly associated with increased risk of prosthetic hip or knee infection compared with no dental procedure (see Table 12 for a summary of the results of the logistic regression model). The model also assessed the association between antibiotic prophylaxis and prosthetic joint infection. Low and high-risk dental procedures with antibiotic prophylaxis were compared with the same procedures without prophylaxis. No significant associations were found (see

Table 13).

Table 11 High and Low Risk Dental Procedures Defined by Berbari, et al.

High Risk Dental Procedures	Low Risk Dental Procedures
Dental abscess therapy	Dental fillings
Dental extraction	Endodontic treatment
Dental filing	Fluoride treatment
Dental hygiene	Restorative dentistry
Periodontal treatment	
Mouth surgery	

based on the 1997 version of the American Heart Association Guideline on Infective Endocarditis

QUALITY AND APPLICABILITY

Only one study of moderate quality and applicability exists that provides direct evidence for an association between dental procedures and prosthetic hip and knee infection. Details of our appraisal of this study are provided in Table 69 of Appendix XII.

RESULTS

Table 12 Dental procedures performed and risk of prosthetic hip or knee infection at 6 months and 2 years

	Odds Ratio (95% Confidence Interval)			
Variable	**6 months**	**P**	**2 years**	**P**
Low-risk dental procedure				
Low-risk dental procedure without antibiotic prophylaxis	1.1 (0.6-2.1)	0.77	0.6 (0.4-1.1)	0.11
Low-risk dental procedure with antibiotic prophylaxis	0.7 (0.3-1.5)	0.33	0.8 (0.5-1.2)	0.29
High-risk dental procedure				
High-risk dental procedure without antibiotic prophylaxis	0.8 (0.4-1.7)	0.6	0.8 (0.4-1.6)	0.56
High-risk dental procedure with antibiotic prophylaxis	0.5 (0.3-0.9)	0.01	0.7 (0.5-1.1)	0.14

Table 13 Antibiotic prophylaxis and risk of prosthetic hip or knee infection at 6 months and 2 years

	Odds Ratio (95% Confidence Interval)	
Variable	**6 Months**	**2 Years**
Antibiotic Prophylaxis		
Low-risk procedure	0.7 (0.3-1.5)	1.2 (0.7-2.2)
High-risk procedure	0.7 (0.3-1.4)	0.9 (0.5-1.6)

INDIRECT EVIDENCE: DENTAL PROCEDURES AND BACTEREMIA

FINDINGS

Multiple studies of high quality regarding dental procedures with bacteremia as the outcome are considered for this guideline. Rates of bacteremia after dental procedures varied significantly by and within procedure group. Rates are reported as either incidence or prevalence. We focused primarily on the incidence data because these studies reported new cases of bacteremia as a result of the dental procedure. Studies that reported prevalence did not take the necessary measures to ensure that the study population was free of bacteremia before undergoing their respective dental procedures. Due to the heterogeneity of bacteremia rates within procedure group we were unable to calculate an accurate mean value. Therefore the rates of bacteremia are presented in box plots in Figure 2 & Figure 4. Median incidence rates range from approximately 5% for chewing to upwards of 65% for simple tooth extraction and gingivectomy. Prevalence rates are comparable. Rates of bacteremia were represented by a single study in some cases (see Figure 3 & Figure 5 for details). Individual study details can be found in

Table 63 and Table 64 in Appendix XI.

QUALITY AND APPLICABILITY

Refer to Table 97 to Table 113 in Appendix XII.

RESULTS

Figure 2 Incidence of bacteremia by procedure group

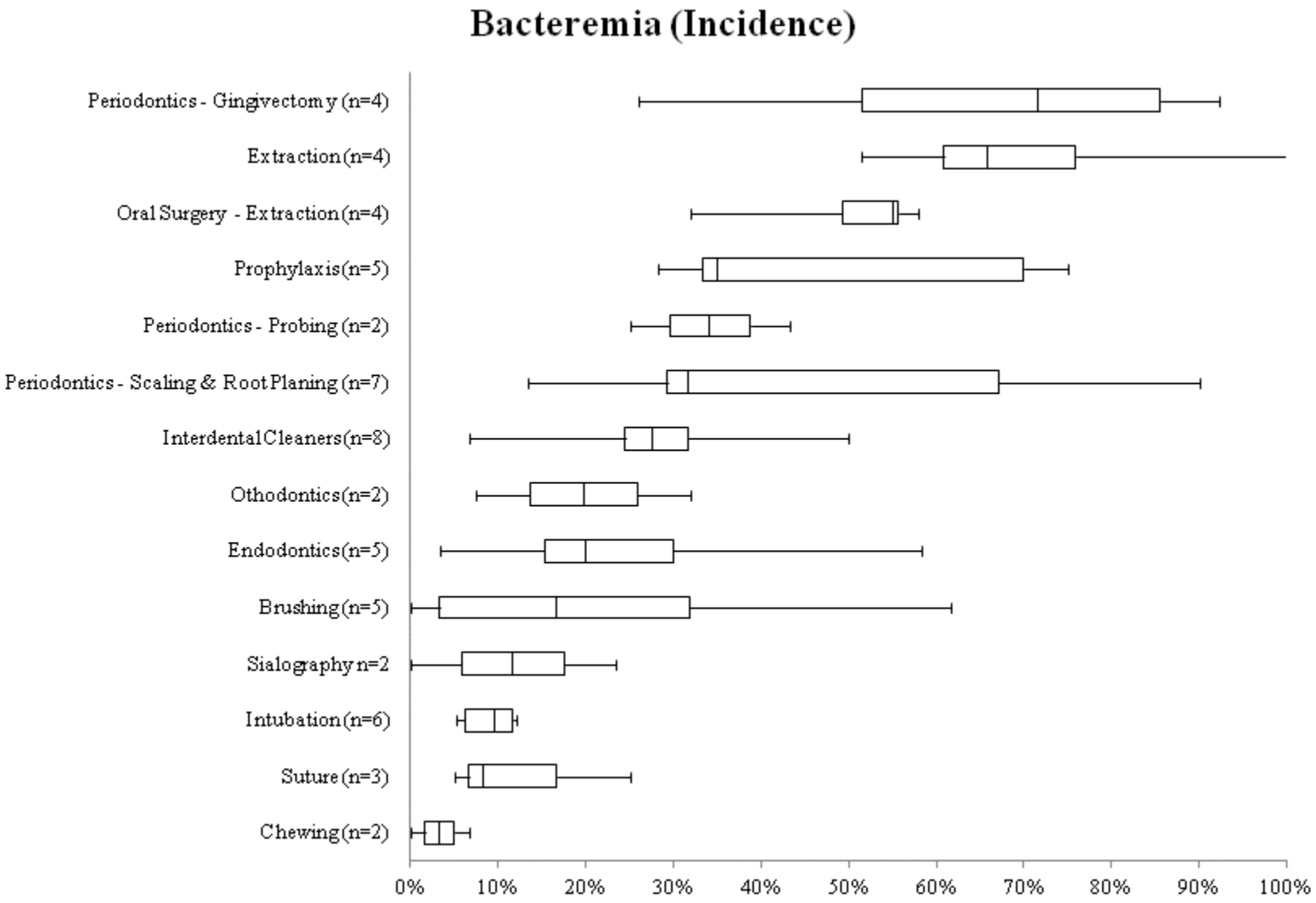


Figure 3 Incidence of bacteremia in single study groups

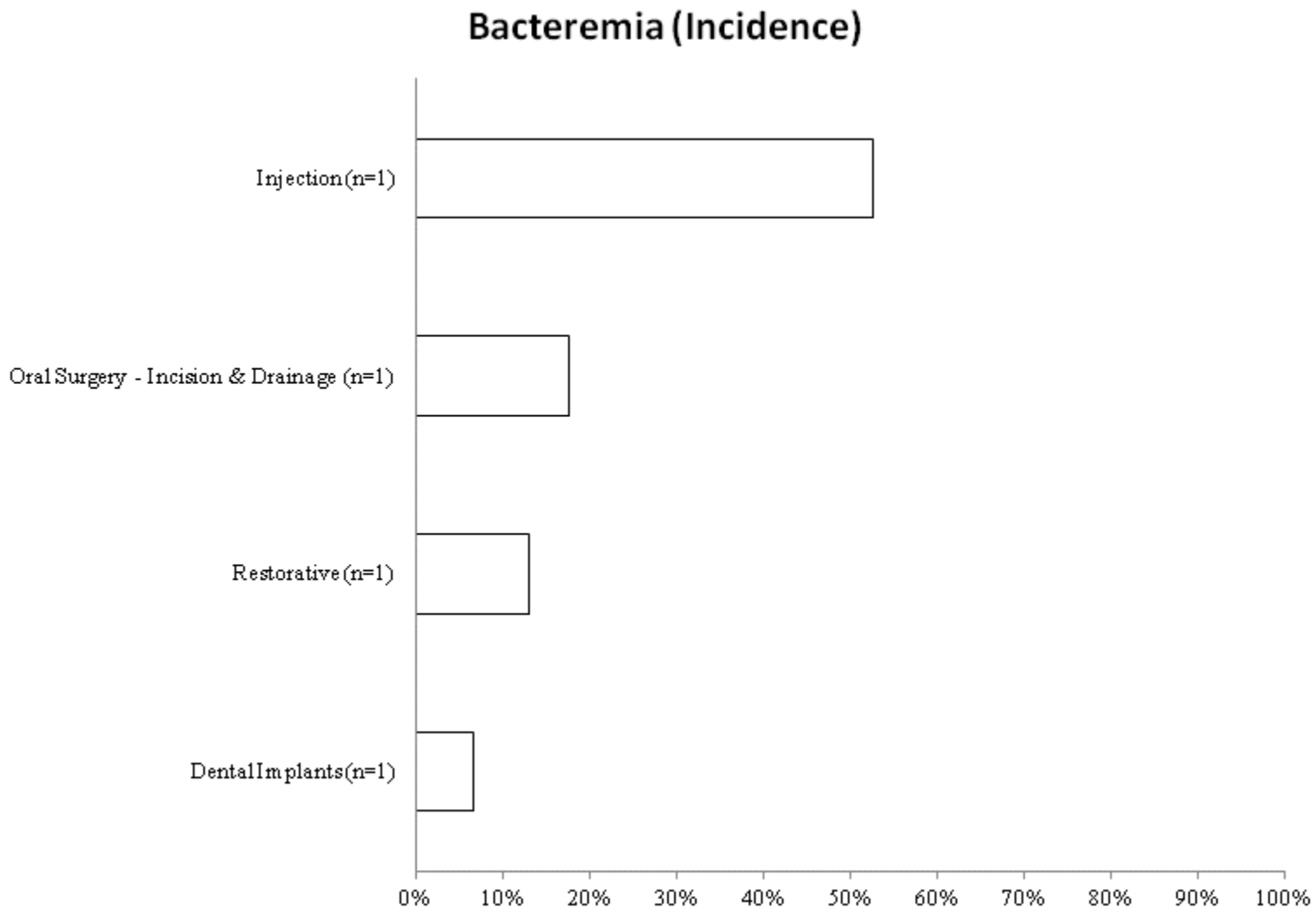


Figure 4 Prevalence of bacteremia by group

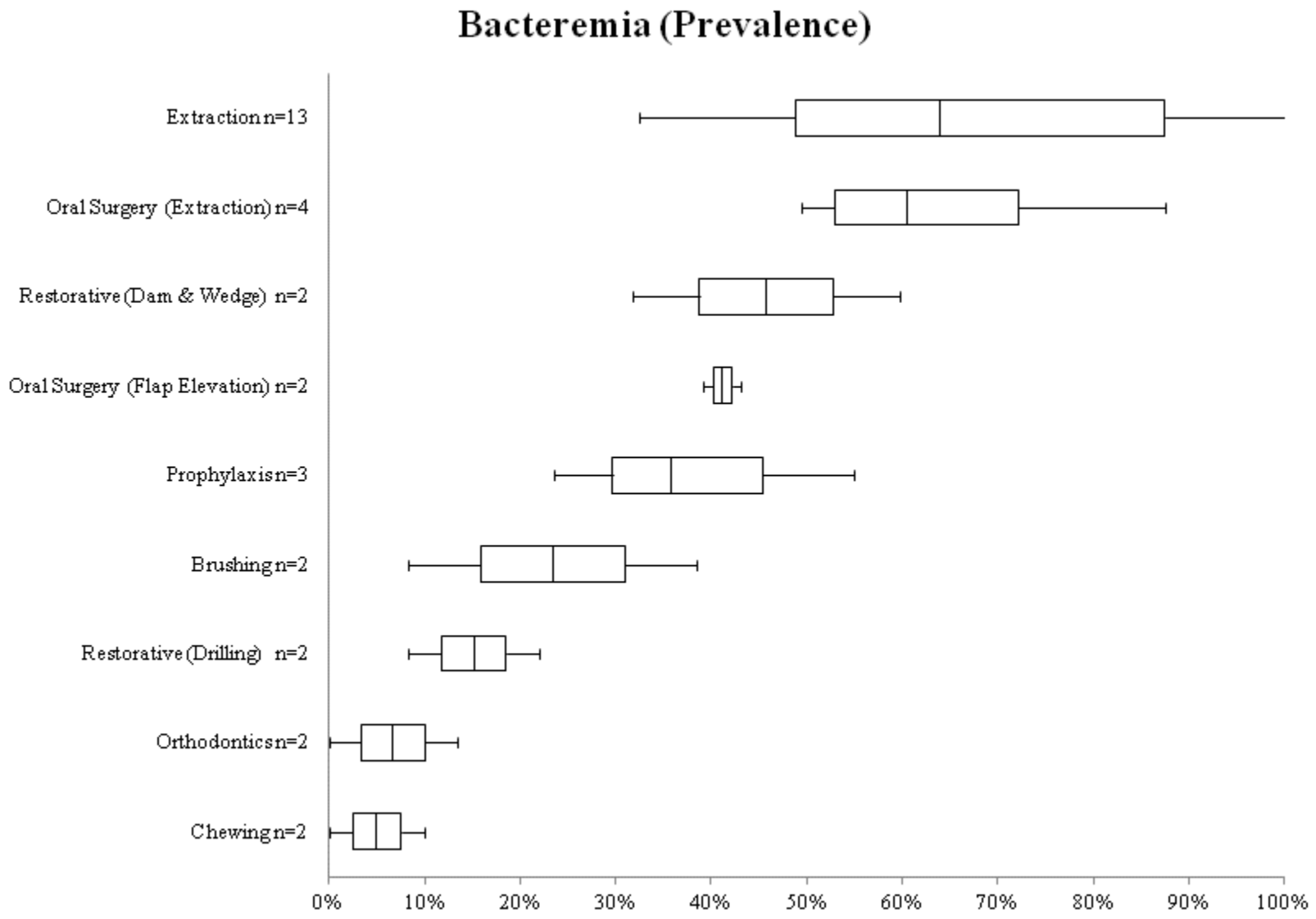
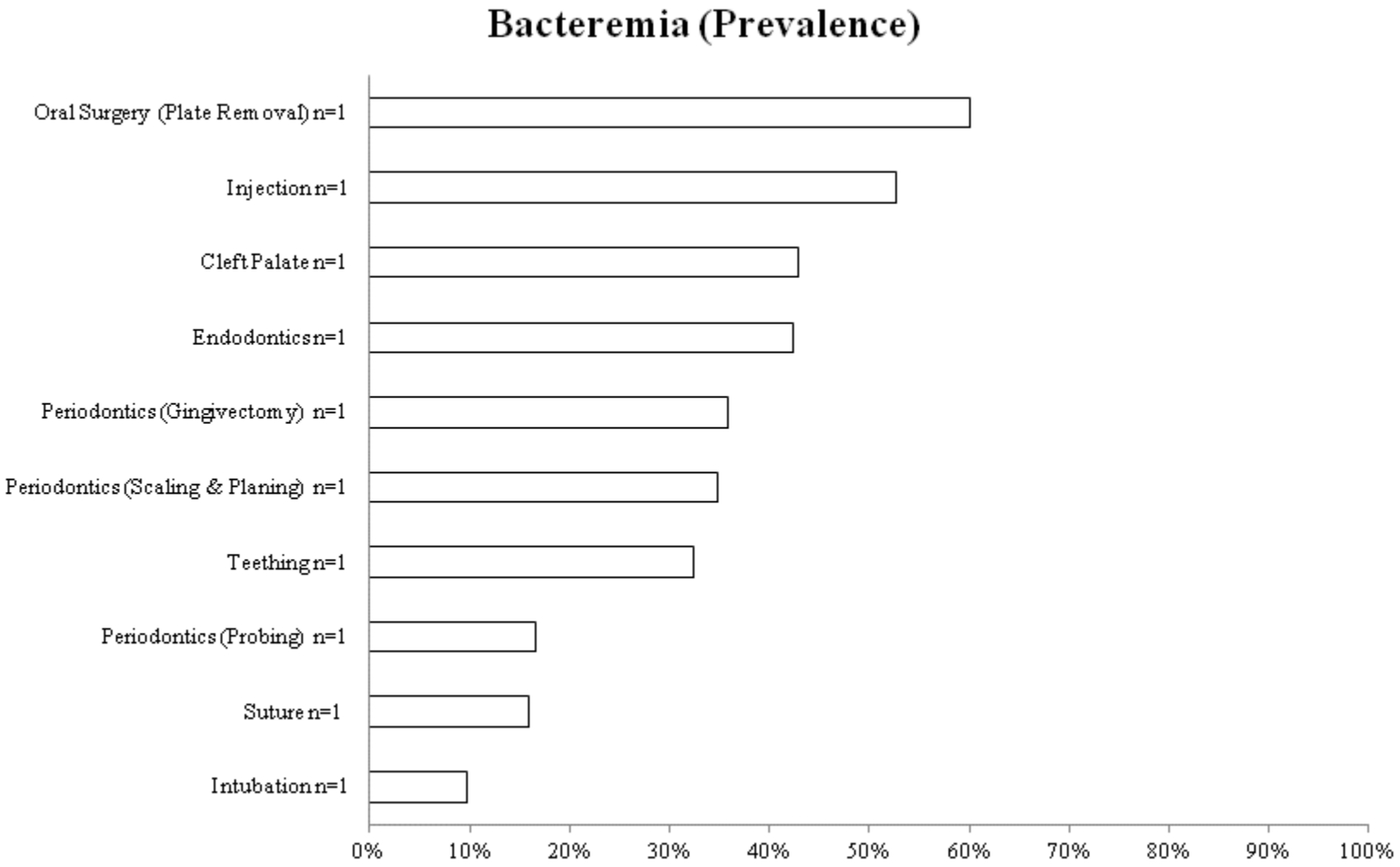


Figure 5 Prevalence of bacteremia in single study groups



INDIRECT EVIDENCE: RISK FACTORS FOR DENTAL PROCEDURE RELATED BACTEREMIA

FINDINGS

While the quality of the evidence is low, several prognostic studies have addressed a multitude of patient characteristics as potential risk factors for developing bacteremia from dental procedures. These low strength studies report on oral health indicators and general patient characteristics such as age, gender, etc. The results vary across and within procedure groups. Evidence is often contradictory. See Table 14 for a summary of significant findings and Table 15 - Table 23 for details.

QUALITY AND APPLICABILITY

Refer to Table 88 - Table 96 in Appendix XII.

RESULTS

Table 14 Summary of Risk Factor Significance (Proportion of studies that reported significant results)

Risk Factor	Brushing	Chewing	Dental Prophylaxis	Inter-dental Cleaning	Intubation	Oral Surgery	Periodontic	Restorative	Tooth Extraction
Patient Characteristics	**Results (% Significant, n/N)**								
Age	50%, 1/2		33%, 1/3	50%, 1/2	0%, 0/1	0%, 0/2	0%, 0/1	0%, 0/1	33%, 1/3
BMI	0%, 0/1								
Cirrhosis	100%, 1/1								
Diabetes			0%, 0/1						
Gender	0%, 0/2		0%, 0/3	0%, 0/2	0%, 0/1	0%, 0/2		0%, 0/1	0%, 0/3
Inflammatory Disease						100%, 1/1			100%, 2/2
Mixed Dentition								0%, 0/1	
Race								0%, 0/1	
Smoking Status			0%, 0/2	0%, 0/1			0%, 0/1		
Procedure									
# Teeth Extracted						0%, 0/1			100%, 4/4
Anaesthesia						0%, 0/1			
Anaesthetic Modality									100%, 1/1
Anaesthetic Technique									0%, 0/1
Bleeding	0%, 0/1		50%, 1/2	0%, 0/1		100%, 1/1	50%, 1/2		50%, 1/2
Bleeding Type	100%, 1/1								0%, 0/1
Blood Loss						0%, 0/1			100%, 1/1

Risk Factor	Brushing	Chewing	Dental Prophylaxis	Inter-dental Cleaning	Intubation	Oral Surgery	Periodontic	Restorative	Tooth Extraction
Procedure Time			0%, 0/1	0%, 0/1		100%, 1/1			
Oral Health									
# Teeth Present						0%, 0/1	0%, 0/1		
Abscess						0%, 0/1			0%, 0/2
Apical Lucency	0%, 0/1								0%, 0/1
Calculus Index/Score	100%, 1/1								0%, 1/1
Caries	0%, 0/1							0%, 0/1	0%, 0/1
Caries Depth	0%, 0/1							0%, 0/1	0%, 0/1
Clinical Attachment Loss				0%, 0/1					
Gingival Index/Score	25%, 1/4		100%, 1/1	0%, 0/1		50%, 1/2		100%, 1/1	67%, 2/3
Gingival Size								0%, 0/1	
Gingivitis	0%, 0/1	0%, 0/1	0%, 0/1						
Infected Tooth						100%, 1/1			
Odontogenic Disease									0%, 0/1
Oral Health Status					0%, 0/1	0%, 0/1			50%, 1/2
Periodontal Diagnosis			0%, 0/1						0%, 0/1
Periodontitis	0%, 0/1	0%, 0/1	100%, 1/1	0%, 0/1			50%, 1/2	0%, 0/1	
Plaque Index/Score	67%, 2/3		50%, 1/2	0%, 0/1		0%, 0/1			0%, 0/3

Risk Factor	Brushing	Chewing	Dental Prophylaxis	Inter-dental Cleaning	Intubation	Oral Surgery	Periodontic	Restorative	Tooth Extraction
Probing Depth			0%, 0/2	0%, 0/1			0%, 0/1		33%, 1/3
Probing Depth Mean	0%, 0/1						100%, 1/1		0%, 0/1
Radiolucency								0%, 0/1	
Recession			0%, 0/1						
Suppuration								0%, 0/1	
Swelling								0%, 0/1	
Tooth Mobility	0%, 0/1								0%, 0/1

Table 15 Risk Factors for Brushing Bacteremia

Author	Strength	N	Statistical Test	Outcome	Risk Factor	Results
Ashare 2009	Low	48	ANOVA followed by Bonferroni	Bacteremia (Bacterial Load @ 30s, 5m, 15m)	Cirrhosis	p<0.01 for all time points
Ashare 2009	Low	48	unknown	Bacteremia (Bacterial Load @ 30s, 5m, 15m)	Age	NS for all time points
Lockhart 2009	Low	98	logistic regression	Bacteremia (Infective Endocarditis related bacteria)	Age	OR 1.06 p=.017
Lockhart 2009	Low	98	logistic regression	Bacteremia (Infective Endocarditis related bacteria)	BMI	OR 0.99 p=.749
Ashare 2009	Low	48	unknown	Bacteremia (Bacterial Load @ 30s, 5m, 15m)	Gender	NS for all time points
Lockhart 2009	Low	98	logistic regression	Bacteremia (Infective Endocarditis related bacteria)	Sex (risk level=female)	OR 1.09 p=.866
Ashare 2009	Low	48	Linear regression	Bacteremia (Bacterial Load @ 30s, 5m, 15m)	Plaque Index	p<0.01 @ 30s & 5m, NS @ 15m
Bhanji 2002	Low	50	logistic regression	Bacteremia	Plaque Score	OR 1.05, p=0.44
Lockhart 2009	Low	98	logistic regression	Bacteremia (Infective Endocarditis related bacteria)	Mean plaque score	OR 2.53 p=.010
Lockhart 2009	Low	98	logistic regression	Bacteremia (Infective Endocarditis related bacteria)	Plaque score ≥ 2	OR 3.78 p=.008
Ashare 2009	Low	48	Linear regression	Bacteremia (Bacterial Load @ 30s, 5m, 15m)	Gingival Index	NS for all time points
Bhanji 2002	Low	50	chi square	Bacteremia	Gingival Score	p=0.96
Lockhart 2009	Low	98	logistic regression	Bacteremia (Infective Endocarditis related bacteria)	Mean gingival score	OR 1.62 p=.203
Lockhart 2009	Low	98	logistic regression	Bacteremia (Infective Endocarditis related bacteria)	Gingival score ≥ 2	OR 1.61 p=.335

Author	Strength	N	Statistical Test	Outcome	Risk Factor	Results
Silver 1977	Low	96	Critical ratio test	Bacteremia	Gingival Index	p<.01
Forner 2006	Low	20	Fishers exact test	Bacteremia	Gingivitis	NS
Forner 2006	Low	20	Fishers exact test	Bacteremia	Periodontitis	NS
Lockhart 2009	Low	98	logistic regression	Bacteremia (Infective Endocarditis related bacteria)	Mean calculus score	OR 1.77 p=.048
Lockhart 2009	Low	98	logistic regression	Bacteremia (Infective Endocarditis related bacteria)	Calculus score ≥ 2	OR 4.43 p=.004
Lockhart 2009	Low	98	logistic regression	Bacteremia (Infective Endocarditis related bacteria)	Bleeding with toothbrushing	OR 0.89 p=.810
Lockhart 2009	Low	98	logistic regression	Bacteremia (Infective Endocarditis related bacteria)	Bleeding type with toothbrushing	OR 7.96 p=.015
Lockhart 2009	Low	98	logistic regression	Bacteremia (Infective Endocarditis related bacteria)	Mean probing depth	OR 1.02 p=.918
Lockhart 2009	Low	98	logistic regression	Bacteremia (Infective Endocarditis related bacteria)	Tooth mobility score	OR 1.93 p=.200
Lockhart 2009	Low	98	logistic regression	Bacteremia (Infective Endocarditis related bacteria)	Dental caries	OR 4.40 p=.165
Lockhart 2009	Low	98	logistic regression	Bacteremia (Infective Endocarditis related bacteria)	Depth of dental caries	OR 0.43 p=.155
Lockhart 2009	Low	98	logistic regression	Bacteremia (Infective Endocarditis related bacteria)	Apical lucency	OR 2.37 p=.086
Lockhart 2009	Low	98	logistic regression	Bacteremia (Infective Endocarditis related bacteria)	Apical lucency size (mm)	OR 0.87 p=.647

Table 16 Risk Factors for Chewing Bacteremia

Author	Strength	N	Statistical Test	Outcome	Risk Factor	Results
Forner 2006	Very Low	20	Fisher's exact test	Bacteremia	Periodontitis	NS
Forner 2006	Very Low	20	Fisher's exact test	Bacteremia	Gingivitis	NS

Table 17 Risk Factors for Dental Prophylaxis Bacteremia

Author	Strength	N	Statistical Test	Outcome	Risk Factor	Results
Cherry 2007	Low	60	Logistic regression	Bacteremia	Age	OR 1.4 p=.05
De Leo 1974	Low	39	Chi square	Bacteremia	Age	6.31, NS
Forner 2006	Low	20	Spearman's correlation coefficients	Bacteremia (magnitude)	Age	NS
Cherry 2007	Low	60	Logistic regression	Bacteremia	Gender	NS
De Leo 1974	Low	39	Chi square	Bacteremia	Sex	NS
Forner 2006	Low	20	Spearman's correlation coefficients	Bacteremia (magnitude)	Gender	NS
Cherry 2007	Low	60	Logistic regression	Bacteremia	Smoking status	NS
Forner 2006	Low	20	Spearman's correlation coefficients	Bacteremia (magnitude)	Smoking	NS
Cherry 2007	Low	60	Logistic regression	Bacteremia	Plaque Index	NS
Forner 2006	Low	20	Spearman's correlation coefficients	Bacteremia (magnitude)	Plaque Index	0.41 p=.0117
Cherry 2007	Low	60	Logistic regression	Bacteremia	Modified papilla, margin, attached gingiva index	NS
Cherry 2007	Low	60	Logistic regression	Bacteremia	Probing depth	NS
Cherry 2007	Low	60	Logistic regression	Bacteremia	Recession	NS
Cherry 2007	Low	60	Logistic regression	Bacteremia	Bleeding on scaling	NS
Forner 2006	Low	20	Fishers exact test	Bacteremia	Periodontitis	p<.001

Author	Strength	N	Statistical Test	Outcome	Risk Factor	Results
Forner 2006	Low	20	Spearman's correlation coefficients	Bacteremia (magnitude)	Periodontal diagnosis	NS
Forner 2006	Low	20	Fishers exact test	Bacteremia	Gingivitis	NS
Forner 2006	Low	20	Spearman's correlation coefficients	Bacteremia (magnitude)	Gingival Index	0.53 p<.0001
Forner 2006	Low	20	Spearman's correlation coefficients	Bacteremia (magnitude)	Bleeding on probing	0.45 p=.0089
Forner 2006	Low	20	Spearman's correlation coefficients	Bacteremia (magnitude)	Probing pocket depth >5	NS
Forner 2006	Low	20	Spearman's correlation coefficients	Bacteremia (magnitude)	Pocket sum score	NS
Forner 2006	Low	20	Spearman's correlation coefficients	Bacteremia (magnitude)	Scaling time*	NS
Trivedi 1984	Low	40	Chi square	Bacteremia	Diabetes	4.5 p>0.5

*Procedure related risk factor

Table 18 Risk Factors for Inter-dental Cleaning Bacteremia

Author	Strength	N	Statistical Test	Outcome	Risk Factor	Results
Crasta 2009	Low	60	Spearman's correlation coefficients	Bacteremia	Periodontitis	0.17 p=.2
Crasta 2009	Low	60	Spearman's correlation coefficients	Bacteremia	Age	0.18 p=.2
Linberger 1973	Low	21	Chi square	Bacteremia	Age	0.81 p<.04
Crasta 2009	Low	60	Spearman's correlation coefficients	Bacteremia	Gender	−0.08 p=.5
Linberger 1973	Low	21	Exact method of binomial dist.	Bacteremia	Sex	1.97, NS
Crasta 2009	Low	60	Spearman's correlation coefficients	Bacteremia	Smoking status	−0.04 p=.7
Crasta 2009	Low	60	Spearman's correlation coefficients	Bacteremia	Time spent flossing*	−0.04 p=.8
Crasta 2009	Low	60	Spearman's correlation coefficients	Bacteremia	Gingival Index	0.22 p=.09

Author	Strength	N	Statistical Test	Outcome	Risk Factor	Results
Crasta 2009	Low	60	Spearman's correlation coefficients	Bacteremia	Plaque Index	0.07 p=.6
Crasta 2009	Low	60	Spearman's correlation coefficients	Bacteremia	% of sites bleeding on flossing	0.17 p=.2
Crasta 2009	Low	60	Spearman's correlation coefficients	Bacteremia	# sites bleeding on flossing	0.17 p=.2
Crasta 2009	Low	60	Spearman's correlation coefficients	Bacteremia	% of sites bleeding on probing	0.16 p=.2
Crasta 2009	Low	60	Spearman's correlation coefficients	Bacteremia	Pocket depth	0.09 p=.5
Crasta 2009	Low	60	Spearman's correlation coefficients	Bacteremia	Clinical attachment loss	0.06 p=.6
Crasta 2009	Low	60	Spearman's correlation coefficients	Bacteremia	Self-reported daily flossing	−0.12 p=.4

*Procedure related risk factor

Table 19 Risk Factors for Intubation Bacteremia

Author	Strength	N	Statistical Test	Outcome	Risk Factor	Results
Valdes 2008	Low	110	Logistic regression	Bacteremia	Age	NS
Valdes 2008	Low	110	Logistic regression	Bacteremia	Sex	NS
Valdes 2008	Low	110	Logistic regression	Bacteremia	Oral health status	NS

Table 20 Risk Factors for Oral Surgery Bacteremia

Author	Strength	N	Statistical Test	Outcome	Risk Factor	Results
Enabulele 2008	Low	170	chi-square	Bacteremia	Inflammatory disease	0.004 p=.05
Enabulele 2008	Low	170	chi-square	Bacteremia	Sex	NS
Tomas 2008	Low	100	not reported	Bacteremia	Gender	NS
Roberts 1998	Low	154	chi-square	Bacteremia	Abscess	1.878 p=.1706
Roberts 1998	Low	154	Pearson correlation coefficient	Bacteremia	Age	0.29
Tomas 2008	Low	100	not reported	Bacteremia	Age	NS

Author	Strength	N	Statistical Test	Outcome	Risk Factor	Results
Roberts 1998	Low	154	Scheffe's multiple comparison	Bacteremia	Plaque Index	p=.47
Roberts 1998	Low	154	Scheffe's multiple comparison	Bacteremia	Gingival Index	p<.03
Takai 2005	Low	237	chi-square	Bacteremia	Gingival Index	NS
Roberts 1998	Low	154	Scheffe's multiple comparison	Bacteremia	Bleeding Index	p<.04
Takai 2005	Low	237	chi-square	Bacteremia	Oral hygiene index simplified	NS
Takai 2005	Low	237	chi-square	Bacteremia	# teeth present	NS
Takai 2005	Low	237	chi-square	Bacteremia	Blood loss	NS
Takai 2005	Low	237	chi-square	Bacteremia	Duration of procedure*	p<.05
Takai 2005	Low	237	chi-square	Bacteremia	# teeth extracted*	NS
Takai 2005	Low	237	chi-square	Bacteremia	Method of procedure*	NS
Takai 2005	Low	237	chi-square	Bacteremia	Infection in extracted tooth (periodontitis, periapical infection, and pericoronitis)	p<.01
Takai 2005	Low	237	chi-square	Bacteremia	Anaesthesia for procedure*	NS

*Procedure related risk factor

Table 21 Risk Factors for Periodontic Bacteremia

Author	Strength	N	Statistical Test	Outcome	Risk Factor	Results
Daly 1997	Low	30	chi-square	Bacteremia	Periodontitis severity	p=.9
Daly 2001	Low	40	logistic regression	Bacteremia	Periodontitis	OR 5.993 CI=1.081-33.215
Daly 1997	Low	30	t-test	Bacteremia	Bleeding on probing	p=.3
Daly 2001	Low	40	logistic regression	Bacteremia	Bleeding on probing	OR 1.025 CI=1.004-1.047

Author	Strength	N	Statistical Test	Outcome	Risk Factor	Results
Daly 2001	Low	40	logistic regression	Bacteremia	Age	OR 1.008 CI=.960-1.058
Daly 2001	Low	40	logistic regression	Bacteremia	Sex	NS
Daly 2001	Low	40	logistic regression	Bacteremia	Smoking status	NS
Daly 2001	Low	40	logistic regression	Bacteremia	# of teeth	OR 1.0 CI=.845-1.185
Daly 2001	Low	40	logistic regression	Bacteremia	Total probing depth	OR 1.006 CI=.999-1.013
Daly 2001	Low	40	logistic regression	Bacteremia	Plaque index	OR 3.154 CI=.603-16.514
Daly 2001	Low	40	logistic regression	Bacteremia	Mean probing depth per tooth	OR 1.444 CI=.1.055-1.977

Table 22 Risk Factors for Restorative Bacteremia

Author	Strength	N	Statistical Test	Outcome	Risk Factor	Results
Brennan 2007	Very Low	51	chi-square or fisher's exact	Bacteremia	Age	p=.06
Brennan 2007	Very Low	51	chi-square or fisher's exact	Bacteremia	Sex	NS
Brennan 2007	Very Low	51	chi-square or fisher's exact	Bacteremia	Race	NS
Brennan 2007	Very Low	51	chi-square or fisher's exact	Bacteremia	Gingival Score (0-3)	p=.01
Brennan 2007	Very Low	51	chi-square or fisher's exact	Bacteremia	Gingival Size (0-3)	NS
Brennan 2007	Very Low	51	chi-square or fisher's exact	Bacteremia	Periodontal disease with probing >3mm	NS
Brennan 2007	Very Low	51	chi-square or fisher's exact	Bacteremia	Mixed Dentition	p=.08
Brennan 2007	Very Low	51	chi-square or fisher's exact	Bacteremia	Caries Present	NS
Brennan 2007	Very Low	51	chi-square or fisher's exact	Bacteremia	Depth of caries (0-3)	NS
Brennan 2007	Very Low	51	chi-square or fisher's exact	Bacteremia	Periapical radiolucency	NS
Brennan 2007	Very Low	51	chi-square or fisher's exact	Bacteremia	Size radiolucency (mm)	NS

Author	Strength	N	Statistical Test	Outcome	Risk Factor	Results
Brennan 2007	Very Low	51	chi-square or fisher's exact	Bacteremia	Swelling	NS
Brennan 2007	Very Low	51	chi-square or fisher's exact	Bacteremia	Suppuration	NS

Table 23 Risk Factors for Extraction Bacteremia

Author	Strength	N	Statistical Test	Outcome	Risk Factor	Results
Barbosa 2010	Low	210	logistic regression (univariate)	Bacteremia 30s	Oral health status	OR 3.704 (1.929-7.109)
Barbosa 2010	Low	210	logistic regression (univariate)	Bacteremia 15m	Oral health status	OR 2.047 (1.138-3.683)
Wahlmann 1999	Low	59	logistic regression	Bacteremia	Oral Hygiene	NS
Wahlmann 1999	Low	59	logistic regression	Bacteremia	Periodontal status	NS
Barbosa 2010	Low	210	logistic regression (univariate)	Bacteremia 30s	Local anesthetic technique*	OR 0.143 (0.063-0.323), OR 0.119 (0.046-0.309)
Barbosa 2010	Low	210	logistic regression (univariate)	Bacteremia 15m	Local anesthetic technique*	OR 0.179 (0.090-0.356), OR 0.186 (0.076-0.455)
Barbosa 2010	Low	210	logistic regression (univariate)	Bacteremia 60m	Local anesthetic technique*	OR 0.118 (0.027-0.520), OR 0.251 (0.055-1.135)
Barbosa 2010	Low	210	logistic regression (univariate)	Bacteremia 30s	Anesthetic modality*	OR 7.431 (3.453-15.990)
Barbosa 2010	Low	210	logistic regression (univariate)	Bacteremia 15m	Anesthetic modality*	OR 5.518 (3.004-10.133)
Barbosa 2010	Low	210	logistic regression (univariate)	Bacteremia 60m	Anesthetic modality*	OR 6.247 (2.058-18.961)
Barbosa 2010	Low	210	logistic regression (multivariate)	Bacteremia 30s	Anesthetic modality*	OR 5.040 (2.068-12.283)

Author	Strength	N	Statistical Test	Outcome	Risk Factor	Results
Barbosa 2010	Low	210	logistic regression (multivariate)	Bacteremia 15m	Anesthetic modality*	OR 5.368 (2.361-12.211)
Barbosa 2010	Low	210	logistic regression (multivariate)	Bacteremia 60m	Anesthetic modality*	OR 6.464 (1.333-31.346)
Barbosa 2010	Low	210	logistic regression (univariate)	Bacteremia 15m	# of extractions*	OR 1.126 (1.046-1.212)
Barbosa 2010	Low	210	logistic regression (univariate)	Bacteremia 60m	# of extractions*	OR 1.128 (1.042-1.222)
Coulter 1990	Low	58	Spearman's correlation coefficient	Bacteremia	# of teeth extracted*	r=0.08
Okabe 1995	Low	183	Mann-Whitney	Bacteremia	# of extractions*	4367.5 p<.0001
Wahlmann 1999	Low	59	logistic regression	Bacteremia	# of extractions*	Significant for Control grp
Coulter 1990	Low	58	chi-square	Bacteremia	Plaque Index	NS
Lockhart 2009	Low	96	logistic regression	Bacteremia	Mean plaque score	OR 0.74 p=.236
Lockhart 2009	Low	96	logistic regression	Bacteremia	Plaque score ≥ 2	OR 0.90 p=.811
Roberts 1998	Low	154	Scheffe's multiple comparison	Bacteremia	Plaque Index	p=.47
Coulter 1990	Low	58	chi-square	Bacteremia	Gingival Index	NS
Lockhart 2009	Low	96	logistic regression	Bacteremia	Mean gingival score	OR 0.71 p=.217
Lockhart 2009	Low	96	logistic regression	Bacteremia	Gingival score ≥ 2	OR 0.76 p=.518
Roberts 1998	Low	154	Scheffe's multiple comparison	Bacteremia	Gingival Index	p<.03
Coulter 1990	Low	58	Fisher's	Bacteremia	Abscess	p=0.2088
Roberts 1998	Low	154	chi-square	Bacteremia	Abscess	1.878 p=.1706
Enabulele 2008	Low	170	chi-square	Bacteremia	Inflammatory disease	0.004 p=.05
Okabe 1995	Low	183	Fisher's	Bacteremia	Inflammatory disease	p<.0005
Enabulele 2008	Low	170	chi-square	Bacteremia	Sex	NS

Author	Strength	N	Statistical Test	Outcome	Risk Factor	Results
Lockhart 2009	Low	96	logistic regression	Bacteremia	Sex (risk level=female)	OR 1.64 p=.241
Okabe 1995	Low	183	Fisher's	Bacteremia	Sex	0.624, NS
Lockhart 1996	Low	70	chi-square or Fisher's exact	Bacteremia	Surgery Time < 3m*	p=.04
Lockhart 1996	Low	70	chi-square or Fisher's exact	Bacteremia	Surgery Time > 6m*	p=.04
Okabe 1995	Low	183	Mann-Whitney	Bacteremia	Duration of procedure*	4050 p<.05
Wahlmann 1999	Low	59	logistic regression	Bacteremia	Duration of procedure*	NS
Lockhart 1996	Low	70	chi-square or Fisher's exact	Bacteremia	Odontogenic disease severity	NS
Lockhart 2009	Low	96	logistic regression	Bacteremia	Age	OR 1.03 p=.211
Okabe 1995	Low	183	Mann-Whitney	Bacteremia	Age	4517.5 p<.0005
Roberts 1998	Low	154	Pearson correlation coefficient	Bacteremia	Age	0.29
Lockhart 2009	Low	96	logistic regression	Bacteremia	BMI	OR 0.99 p=.630
Lockhart 2009	Low	96	logistic regression	Bacteremia	Mean calculus score	OR 0.93 p=.724
Lockhart 2009	Low	96	logistic regression	Bacteremia	Calculus score ≥ 2	OR 0.82 p=.715
Lockhart 2009	Low	96	logistic regression	Bacteremia	Bleeding with toothbrushing	NA
Lockhart 2009	Low	96	logistic regression	Bacteremia	Bleeding type with toothbrushing	NA
Okabe 1995	Low	183	Mann-Whitney	Bacteremia	Blood loss (ml)	3997.5 p<.05
Roberts 1998	Low	154	Scheffe's multiple comparison	Bacteremia	Bleeding Index	p<.04
Lockhart 2009	Low	96	logistic regression	Bacteremia	Mean probing depth	OR 0.95 p=.735
Lockhart 2009	Low	96	logistic regression	Bacteremia	Tooth mobility score	OR 1.01 p=.978
Lockhart 2009	Low	96	logistic regression	Bacteremia	Dental caries	OR 1.66 p=.452
Lockhart 2009	Low	96	logistic regression	Bacteremia	Depth of dental caries	OR 0.21 p=.156
Lockhart 2009	Low	96	logistic regression	Bacteremia	Apical lucency	OR 0.86 p=.724
Lockhart 2009	Low	96	logistic regression	Bacteremia	Apical lucency size (mm)	OR 1.00 p=.995

*Procedure related risk factor

INDIRECT EVIDENCE: PROPHYLAXIS FOR DENTAL PROCEDURE RELATED BACTEREMIA

FINDINGS

We recognize the diversity of opinion concerning the clinical importance of bacteremia as a surrogate outcome for orthopaedic implant infection and understand the clinician's concern and rationale for wanting to prevent bacteremia. Multiple studies of moderate quality regarding prophylaxis for the prevention of bacteremia post dental procedure suggest that antibiotic and topical antimicrobial prophylaxis are effective in reducing the rate of bacteremia after simple tooth extraction. There was insufficient data to investigate the effects of prophylaxis in regard to other dental procedure groups via a meta-analysis. However, simple tooth extraction resulted in the second highest median incidence of bacteremia and the highest median prevalence of bacteremia for all procedure groups (see Figure 2 & Figure 4). Table 24 describes the included studies related to antibiotic prophylaxis for the prevention of bacteremia upon tooth extraction. Table 25 describes the included studies related to topical antimicrobials for the prevention of bacteremia upon tooth extraction.

We performed network meta-analyses in order to determine which prophylactic treatments are most effective. An initial attempt was made to combine both antibiotics and topical antimicrobials into a single network meta-analysis. The exact cause of the inconsistency could not be determined and therefore all results of antibiotic and topical antimicrobial prophylaxis are presented independent of one another. The implication of this inconsistency is that formal (as well as casual) indirect comparisons of treatment effects can be misleading and are thus avoided in this clinical practice guideline. See Table 62 in the Appendix XI for results of the consistency check. Further details on the results of these independent network meta-analyses are presented in Recommendation 1 and Recommendation 2.

QUALITY AND APPLICABILITY

Refer to Table 70 - Table 87 in Appendix XII.

RESULTS

Table 24 Antibiotic prophylaxis and tooth extraction bacteremia

Study	N	Strength	Outcome (specific type)	Active Antibiotic (%, n/N)	Control (%, n/N)	Route of Administration	Time of Administration	Results
Lockhart 2008	179	High	Bacteremia	Amoxicillin (56%, 50/90)	Placebo (80%, 71/89)	Oral	1 hour before procedure	Favors Amoxicillin
Lockhart 2004	100	High	Bacteremia	Amoxicillin (33%, 16/49)	Placebo (84%, 43/51)	Oral elixir	1 hour before intubation	Favors Amoxicillin
Aitken 1995	40	Moderate	Bacteremia	Erythromycin (60%, 12/20) Clindamycin (40%, 8/20)	N/A	Oral	1-1.5 hours before procedure	Favors Clindamycin over Erythromycin
Cannell 1991	60	Moderate	Bacteremia	Erythromycin (60%, 13/20) Josamycin (70%, 14/20)	Placebo (65%, 13/20)	Oral	1-1.5 hours before procedure	Erythromycin and Josamycin marginally more effective than placebo
Casolari 1989	106	Moderate	Bacteremia	Penicillin (48%, 12/25) Antiseptic rinse (44%, 11/25)	No Treatment (67.9%, 38/56)	Oral	1 hour before procedure	Favors Penicillin and Antiseptic over control
Coulter 1990	58	Moderate	Bacteremia	Penicillin or Amoxicillin or Amoxicillin or Erythromycin (35%, 9/26)	No Treatment (63%, 20/32)	Intramuscular (Penicillin), Oral (Amoxicillin), Intravenous (Amoxicillin), Intravenous (Erythromycin)	Unclear	Favors Antibiotics over control

Study	N	Strength	Outcome (specific type)	Active Antibiotic (%, n/N)	Control (%, n/N)	Route of Administration	Time of Administration	Results
Diz 2006	221	Moderate	Bacteremia	Amoxicillin (46.4%, 26/56) Clindamycin (85.1%, 46/54) Moxifloxacin (56.9%, 33/58)	No Treatment (96.2%, 51/53)	Oral	1-2 hours before procedure	Favors Amoxicillin over control and Clindamycin, Favors Moxifloxacin over control and Clindamycin
Hall 1996	39	Moderate	Bacteremia	Cefaclor (79%, 16/20)	Placebo (85%, 16/19)	Oral	1 hour before procedure	No difference
			Bacteremia (viridans streptococci)	Cefaclor (79%, 16/20)	Placebo (50%, 10/19)	Oral	1 hour before procedure	No difference
			Bacteremia (anaerobic)	Cefaclor (74%, 15/20)	Placebo (75%, 14/19)	Oral	1 hour before procedure	No difference
Hall 1996	38	Moderate	Bacteremia	Erythromycin (79%, 15/19) Clindamycin (84%, 16/19)	N/A	Oral	1.5 hours before procedure	No difference
	38		Bacteremia (viridans streptococci)	Erythromycin (79%, 15/19) Clindamycin (74%, 14/19)	N/A	Oral	1.5 hours before procedure	No difference
Hall 1993	60	Moderate	Bacteremia	Penicillin (90%, 18/20) Amoxicillin (85%, 17/20)	Placebo (95%, 19/20)	Oral	1 hour before procedure	No difference
	60		Bacteremia (viridans streptococci)	Penicillin (70% 14/20) Amoxicillin (55%, 11/20)	Placebo (70%, 14/20)	Oral	1 hour before procedure	No difference

Study	N	Strength	Outcome (specific type)	Active Antibiotic (%, n/N)	Control (%, n/N)	Route of Administration	Time of Administration	Results
	60		Bacteremia (anaerobic)	Penicillin (85%, 17/20) Amoxicillin (75%, 15/20)	Placebo (85%, 17/20)	Oral	1 hour before procedure	No difference
Head 1984	65	Moderate	Bacteremia (anaerobic)	Penicillin V (20%) Metronidazole (52%)	Placebo (84%)	Oral	1 hour before procedure	Favors Penicillin over Metronidazole
Jokinen 1970	152	Moderate	Bacteremia	Penicillin (40%, 15/38) Penicillin with local prophylaxis (5%, 2/38)	No Treatment (87%, 66/76)	Oral (Penicillin), topical (local prophylaxis)	45-90 minutes before procedure PLUS daily doses prior to operation day (penicillin)	Favors prophylaxis
Khairat 1966	242	Moderate	Bacteremia	Erythromycin 250mg (37.5%, 6.16) Erythromycin 500mg (41%, 7/17) Erythromycin 1000mg (33%, 3/9) Tetracycline (3%, 3/100)	No Treatment (64%, 64/100)	Oral (Erythromycin), Intravenous (Tetracycline)	1.5-4 hours before procedure (Erythromycin), 3 minutes before procedure (Tetracycline)	Favors prophylaxis
Maskell 1986	30	Moderate	Bacteremia	Teicoplanin (60%, 6/10) Amoxicillin (40%, 4/10)	No Treatment (100%, 10/10)	Intramuscular (Teicoplanin), Oral (Amoxicillin)	1 hour before procedure	Favors Amoxicillin over Teicoplanin over control
Roberts 1987	94	Moderate	Bacteremia	Amoxicillin (2%, 1/47)	No Treatment (38%, 18/47)	Oral	2 hours before procedure	Favors Amoxicillin

Study	N	Strength	Outcome (specific type)	Active Antibiotic (%, n/N)	Control (%, n/N)	Route of Administration	Time of Administration	Results
Shanson 1987	120	Moderate	Bacteremia (viridans streptococci)	Amoxicillin (25%, 10/40) Teicoplanin (2.5%, 1/40)	No Treatment (32.5%, 13/40)	Intramuscular (Amoxicillin), Intravenous bolus (Teicoplanin)	25-40 minutes before procedure (Amoxicillin), 5-10 minutes before procedure (Teicoplanin)	Favors Teicoplanin over Amoxicillin over control
Shanson 1985	82	Moderate	Bacteremia (streptococcal)	Erythromycin (15%, 6/40)	Placebo (43%, 18/42)	Oral	1 hour before procedure	Favors Erythromycin
Shanson 1978	120	Moderate	Bacteremia (streptococcal)	Penicillin V (12%, 5/40) Amoxicillin (5%, 2/40)	No Treatment (40%, 16/40)	Oral	1 hour before procedure	Favors Penicillin and Amoxicillin over control
	60		Bacteremia (anaerobic)	Penicillin V (20%, 4/20) Amoxicillin (15%, 3/20)	No Treatment (50%, 10/20)	Oral	1 hour before procedure	Favors Penicillin and Amoxicillin over control
	60		Bacteremia	Penicillin (20%, 4/20) Amoxicillin (25%, 5/20)	No Treatment (70%, 14/20)	Oral	1 hour before procedure	Favors Penicillin and Amoxicillin over control
Vergis 2001	29	Moderate	Bacteremia	Oral Amoxicillin (10%, 1/10) Topical Amoxicillin (60%, 6/10)	No Treatment (89%, 8/9)	Oral, Rinse	1 hour before procedure (Oral), 1 and 2 hours before procedure (Rinse)	Favors oral Amoxicillin over topical and control
	36		Bacteremia (intent-to-treat)	Oral Amoxicillin (9%, 1/11) Topical Amoxicillin (53%, 8/15)	No Treatment (90%, 9/10)	Oral, Rinse	1 hour before procedure (Oral), 1 and 2 hours before procedure (Rinse)	Favors oral Amoxicillin over topical and control

Study	N	Strength	Outcome (specific type)	Active Antibiotic (%, n/N)	Control (%, n/N)	Route of Administration	Time of Administration	Results
DeVries 1972	200	Low	Bacteremia	Lincomycin (8%, 2/25) Clindamycin Prolonged (0%, 0/25) Clindamycin Short (8%, 4/50)	No Treatment (49%, 49/100)	Oral	Daily for 3 days AND 1 hour before procedure (lincomycin), Daily for 3 days AND 2 hours before procedure (prolonged Clindamycin), 2 hours before procedure (short Clindamycin)	Favors Lincomycin and Clindamycin over control
Wahlmann 1999	60	Low	Bacteremia	Cefuroxime (33%, 10/30)	Placebo (86%, 25/30)	Intravenous	10 minutes before procedure	Favors Cefuroxime

Table 25 Topical antimicrobials and tooth extraction bacteremia

Study	N	Strength	Outcome	Active Treatment (n/N, %)	Control (n/N, %)	Application	Results
Lockhart 1996	70	High	Bacteremia	Chlorhexidine (31/37, 84%)	Placebo (31/33, 94%)	Mouth rinse	No difference
Casolari 1989	106	Moderate	Bacteremia	Chlorhexidine OR Povidone-iodine (11/25, 44%) Penicillin antibiotic (12/25, 48%)	No treatment (38/56, 68%)	Irrigation of gingival crevice and retention of solution in mouth for a few minutes	Favors Chlorhexidine and Povidone-Iodine over control

Study	N	Strength	Outcome	Active Treatment (n/N, %)	Control (n/N, %)	Application	Results
Jokinen 1978	152	Moderate	Bacteremia	Organic Iodine (21/38, 55%) Operative Field Isolation (13/38, 34%) Isolation+Iodine (12/38, 32%) Isolation+Chlorhex (5/38, 13%)	N/A	Mouth rinse	No difference
Macfarlane 1984	60	Moderate	Bacteremia	Chlorhexidine (5/20, 25%) Povidone-Iodine (8/20, 40%)	Saline (16/20, 80%)	Irrigation of gingival crevice and retention of solution in mouth for a few minutes	Favors Povidone-Iodine over saline, Favors Chlorhexidine over saline
Rahn 1995	120	Moderate	Bacteremia	Chlorhexidine (18/40, 45%) Povidone-Iodine (11/40, 27.5%)	Water (21/40, 52.5%)	Irrigation of gingival crevice and retention of solution in mouth for a few minutes	Favors Povidone-Iodine
Scopp 1971	64	Moderate	Bacteremia	Povidone-Iodine (9/32, 28%)	Placebo (18/32, 56%)	Mouth rinse and irrigation of gingiva	Favors Povidone-Iodine rinse over placebo
Sweet 1978	100	Moderate	Bacteremia	Chloramine-T rinse (12/25, 48%) Chloramine-T brush (12/25, 48%) Lugol's solution (20/25, 80%)	No Treatment (21/25, 84%)	Chloramine-T rinse and brushing, Irrigation with Lugol's solution	Favors Chloramine-T (brush or rinse) over control and Lugol's solution
Tomas 2007	106	Moderate	Bacteremia	Chlorhexidine (42/53, 79%)	No Treatment (51/53, 96%)	Mouth filled	Favors Chlorhexidine
Cutcher 1971	100	Low	Bacteremia	Phenolated (27/50, 54%)	No Treatment (39/50, 78%)	Mouth rinse	Favors Phenolated rinse

Study	N	Strength	Outcome	Active Treatment (n/N, %)	Control (n/N, %)	Application	Results
Francis 1973	175	Low	Bacteremia	Sodium perborate-ascorbic acid (9/50, 18%)	No Treatment (51/100, 51%) Saline (15/25, 60%)	Mouth rinse and irrigation of gingival sulcus	Favors Sodium perborate-ascorbic acid over saline and no treatment
Jones 1970	201	Low	Bacteremia	Phenolated (12/67, 18%)	No Treatment (44/67, 66%) Saline (31/67, 46%)	Mouth rinse and irrigation of gingival sulcus	Favors Phenolated rinse over control, Favors saline rinse over control
Nasif 1977	120	Low	Bacteremia	Hydrogen Peroxide (13/60, 22%)	No Treatment (26/60, 43%)	Irrigation of gingival sulcus	Favors Hydrogen Peroxide
Yamalik 1992 (941)	80	Low	Bacteremia	Povidone-Iodine (7/20, 35%) Hydrogen peroxide (10/20, 50%) Chlorhexidine (8/20, 40%)	No Treatment (14/20, 70%)	Irrigation of gingival sulcus	Favors Povidone-Iodine over control

INDIRECT EVIDENCE: BACKGROUND MICROBIOLOGY

FINDINGS

There was no direct evidence to explain the proposed association between bacteremia and orthopaedic implant infection, therefore we summarized the microbiological information pertaining to cases and rates of bacteremia and implant infection when available. Thirteen orthopaedic implant cohort studies were included that followed up on almost 13,000 implants, twelve of which provided detailed information on any infections that resulted over the course of the study. Approximately 53% of organisms responsible for the infections were *Staphylococcus* species. Overall rate of infection was approximately 1.5%. Of the studies that distinguished early from late infections we were able to calculate rates of 0.4% and 0.9% respectively. The definition of late infection varied greatly. In some cases it was not defined and in others it ranged from >3months to >18months. See Table 26 and 26 for details.

Eighteen studies addressing only infected orthopaedic implants were included and totaled approximately 1090 cases of implant infections. All eighteen studies provided detailed information on the infection. Approximately 64% of the infections were *Staphylococcus* species. Of the studies that distinguished early from late infections, 36.7% were early and 63.3% were late. The definition of late infection varied greatly. It ranged from >4 weeks to >1 year. See Table 27 and Figure 7 for details.

Incidence and prevalence of bacteremia varied greatly by procedure and study, as did the organism responsible for the bacteremia. Data is presented by procedure group. For studies that provided the necessary information, data were pooled and represent the proportion of bacteremic study participants that were found positive for the respective infecting organism. Microbiology data that was available from patients who received a form of prophylaxis was not included. No clear association between the organisms found in the prosthetic implant infections and bacteremia exists. However, the majority of the organisms found in implant infections are *Staphylococcus* and the majority of the organisms found as the cause of bacteremias are *Streptococcus.* See Figure 8 - Figure 34 for microbiological details on bacteremia.

RESULTS

Table 26 Orthopaedic implant cohort studies

Author	Year	Implant	Study N	Infected N	% Population Infected	Early Infection	Late Infection	% Late infection	Late Infection Criteria
Ainscow	1984	Hip & Knee	1112	22	2.0%	11	11	1.0%	≥3 months
Choong	2007	Hip	819	14	1.7%	NA	NA	NA	NA
Goodman	2006	Hip	17	1	5.9%	NA	NA	NA	NA
Hamilton	2008	Hip & Knee	1993	29	1.5%	11	18	0.9%	≥3 months
Klenerman	1991	Hip & Knee	174	2	1.1%	0	2	1.1%	≥3 months
Mont	1999	Hip	109	1	0.9%	NA	NA	NA	NA
Petrie	1998	Knee	1837	40	2.2%	NA	NA	NA	NA
Sancheti	2009	Knee	297	1	0.3%	0	1	0.3%	≥7 months
Smith	1997	Hip	66	2	3.0%	0	2	3.0%	≥18 months
Soultanis	2003	Spine	60	5	8.3%	NA	5	8.3%	≥1 year
Uckay	2009	Hip & Knee	6101	71	1.2%	21	50	0.8%	≥3 months
Wagner	2000	Hip	78	1	1.3%	0	1	1.3%	NA
Wimmer	1998	Spine	110	1	0.9%	0	1	0.9%	≥17 months

Figure 6 Organisms cultured from cohort studies

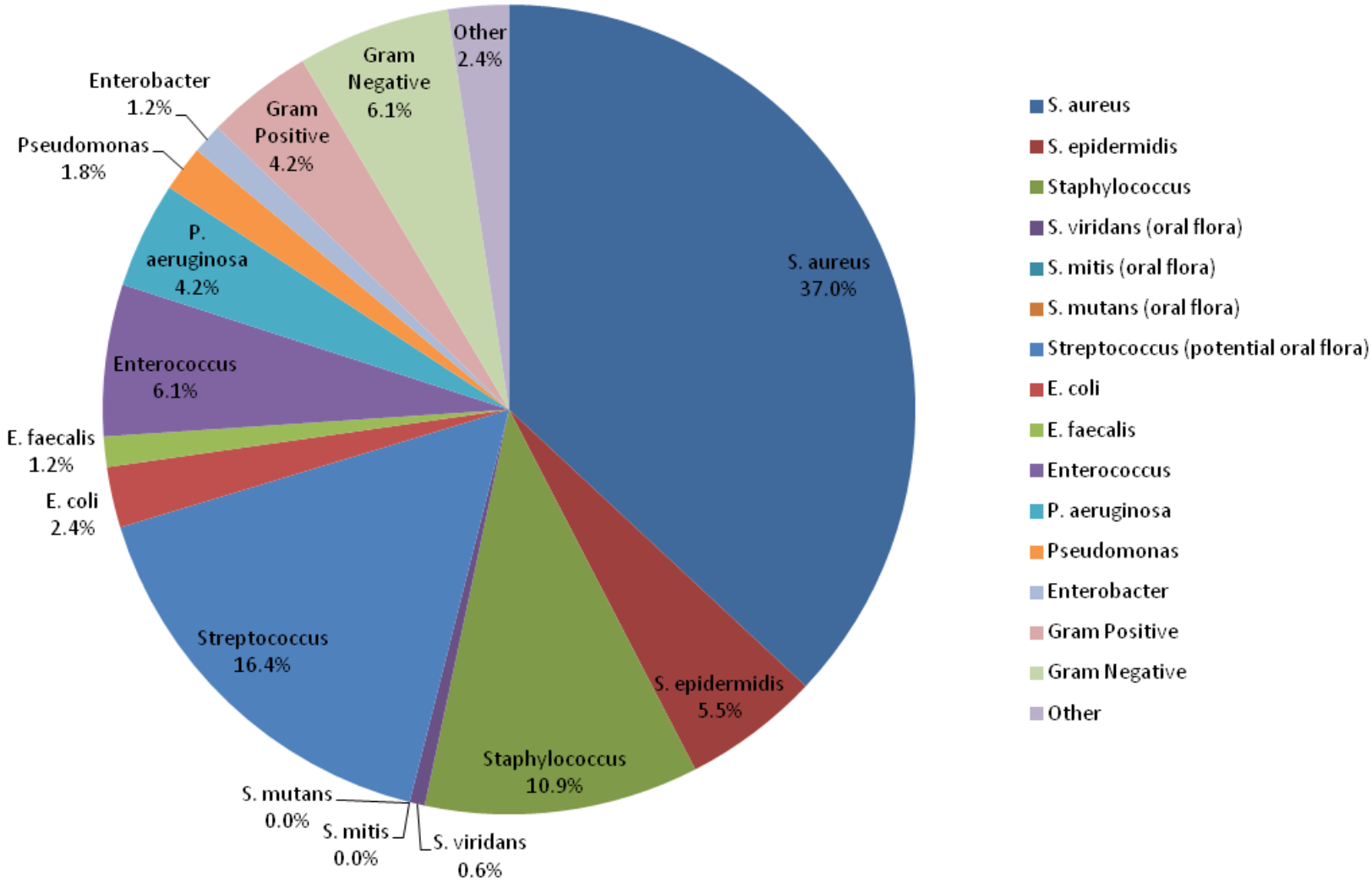


Table 27 Orthopaedic implant case series studies

Author	Year	Site	Study N	Infected N	Early Infection	Late Infection	% Late Infection	Late Infection Criteria
Berbari	2009	Hip & Knee	339	339	151	188	55.5%	≥12 months
Chiu	2007	Knee	40	40	10	30	75.0%	≥4 weeks
Cordero-Ampuero	2009	Hip	36	36	0	36	100.0%	≥3 months
Cordero-Ampuero	2007	Hip & Knee	40	40	0	40	100.0%	≥3 months
Crockarell	1998	Hip	42	42	19	23	54.8%	≥1 month
Fink	2008	Knee	40	40	0	40	100.0%	≥2 months
Hoad-Reddick	2005	Knee	59	59	NA	NA	NA	NA
Insall	1983	Knee	11	11	3	8	72.7%	≥3 months
Jerosch	2003	Shoulder	12	12	2	10	83.3%	4 weeks
Mont	1997	Knee	24	24	10	14	58.3%	≥29 days
Munoz-Mahamud	2011	Hip, Knee, Other	79	79	69	10	12.7%	≥3 months
Rao	2003	Hip, Knee, Elbow	36	36	13	23	63.9%	≥1 year
Rodriguez	2009	Hip , Knee, Shoulder	50	50	0	50	100.0%	≥5 years
Soriano	2007	Knee, Hip, Shoulder, other	85	85	NA	NA	NA	NA
Soriano	2006	Hip & Knee	47	47	NA	NA	NA	NA
Waldman	2000	Knee	16	16	4	12	75.0%	≥6 months
Windsor	1990	Knee	29	29	NA	NA	NA	NA
Wroblewski	1986	Hip	102	102	NA	NA	NA	NA

Figure 7 Organisms cultured from case series studies

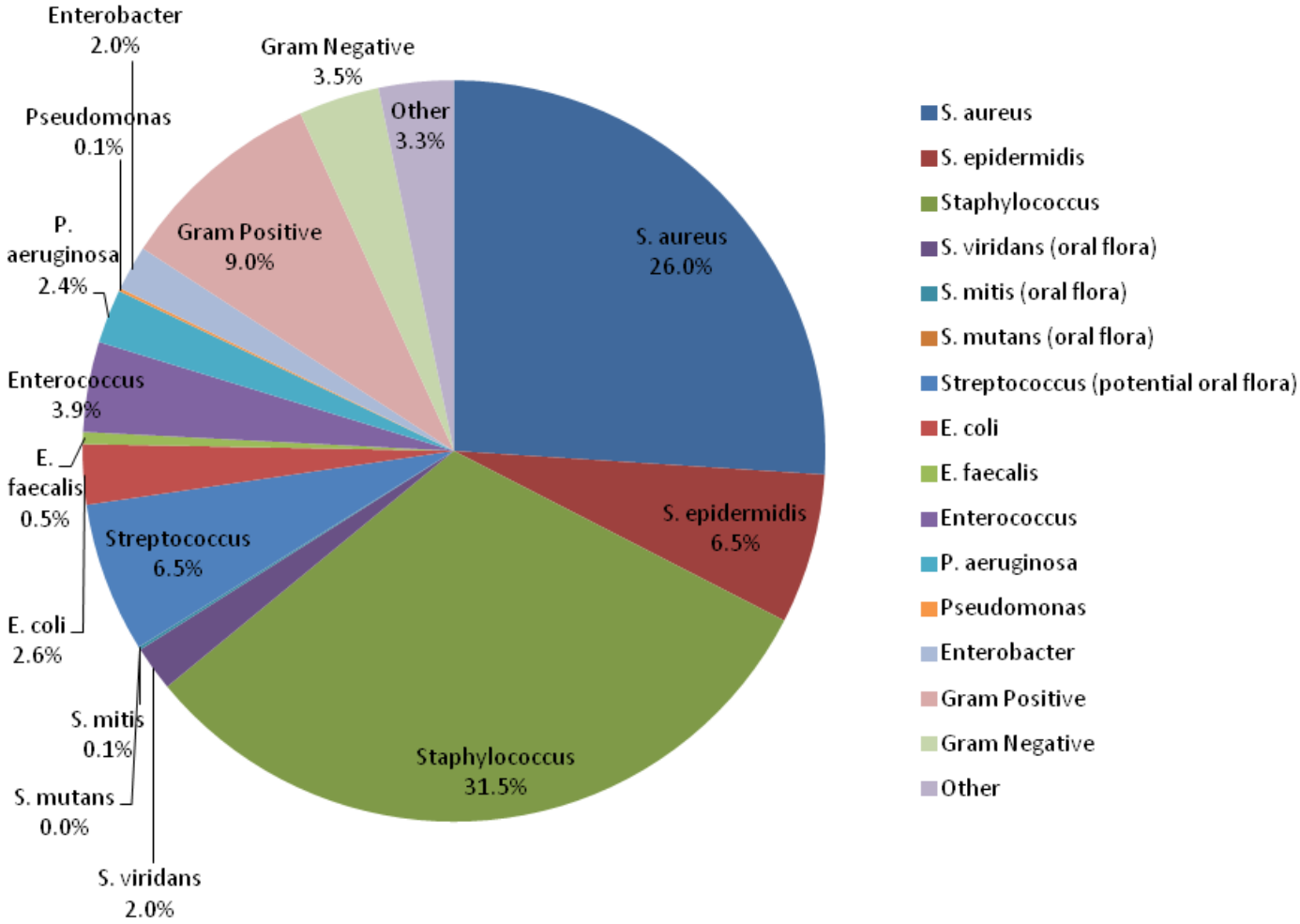
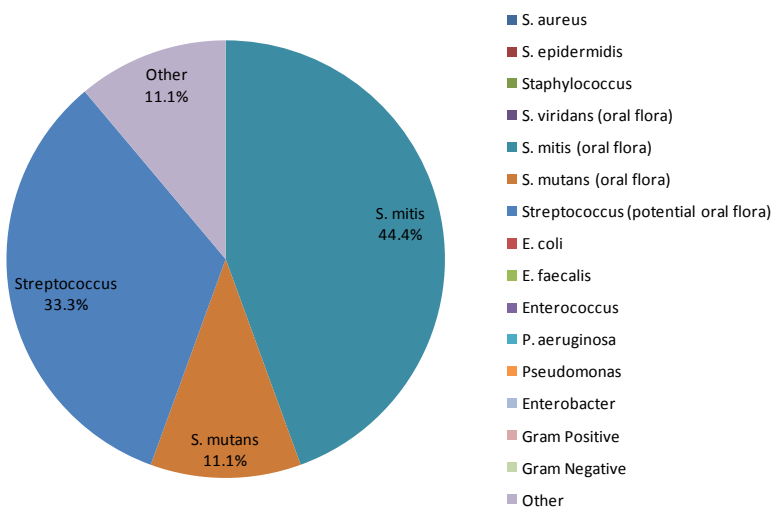
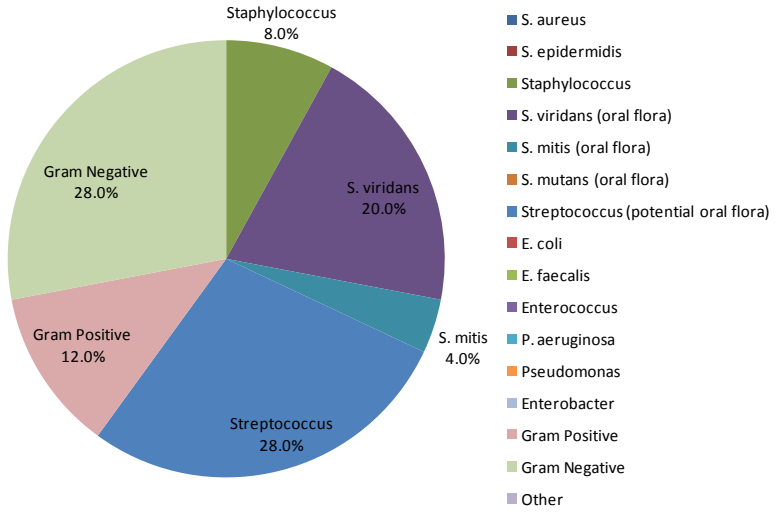


Figure 8 Brushing Bacteria (Incidence)



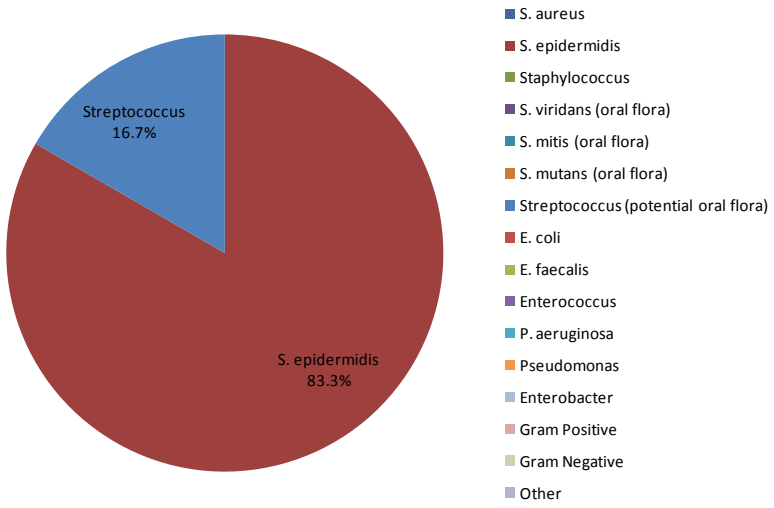
Study	Total N	Infected N	Rate
Forner 2006	60	2	3.3%
Sconyers 1973	30	5	16.7%

Figure 9 Brushing Bacteria (Prevalence)



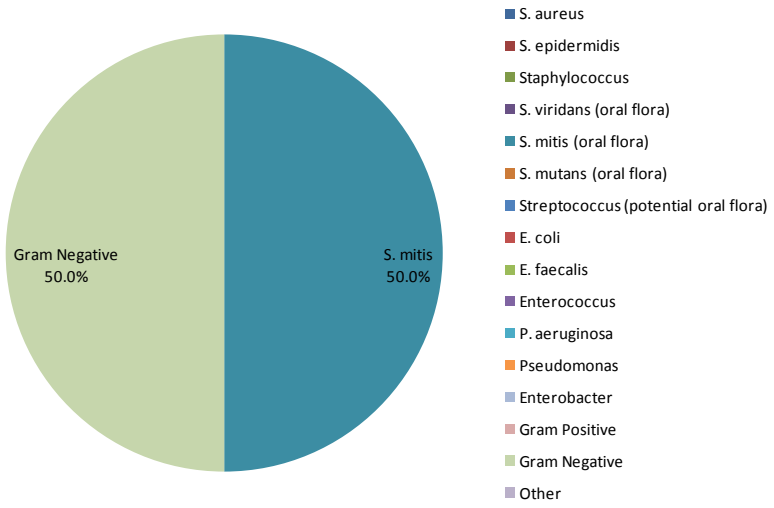
Study	Total N	Infected N	Rate
Lucas 2000	52	20	38.5%
Silver 1979	36	3	8.3%

Figure 10 Cleft Palate Bacteria (Prevalence)



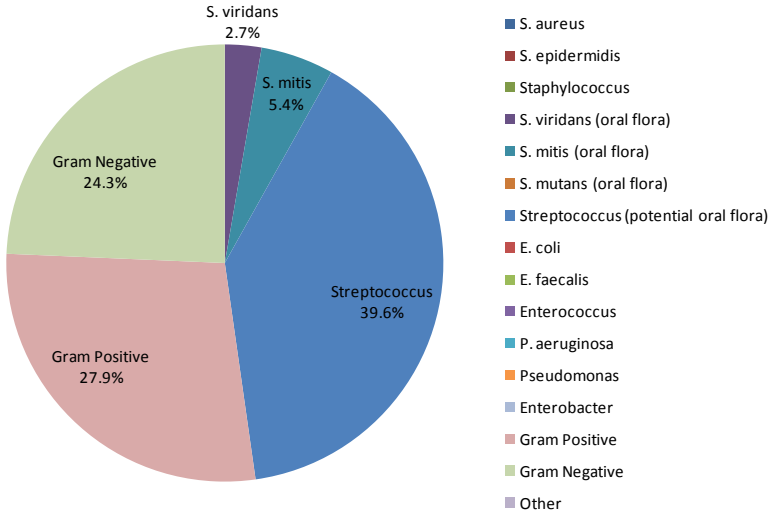
Study	Total N	Infected N	Rate
Marzoni 1983	14	6	42.9%

Figure 11 Dental Implant Bacteria (Incidence)



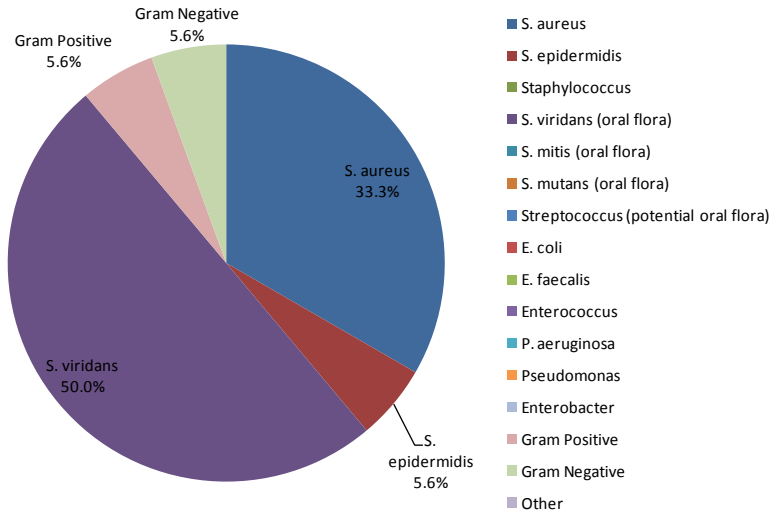
Study	Total N	Infected N	Rate
Pineiro 2010	30	2	6.7%

Figure 12 Dental Prophylaxis Bacteria (Incidence)



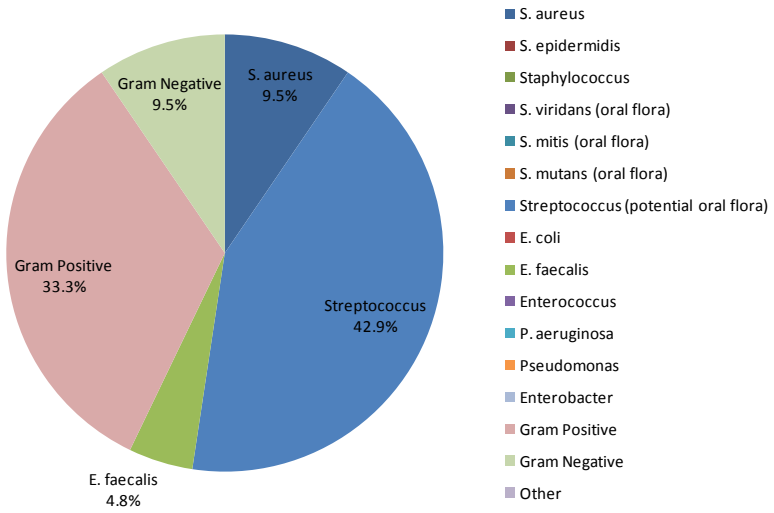
Study	Total N	Infected N	Rate
Cherry 2007	60	11	28.2%
Forner 2006	20	15	75.0%
Heimdahl 1990	20	14	70.0%

Figure 13 Dental Prophylaxis Bacteria (Prevalence)



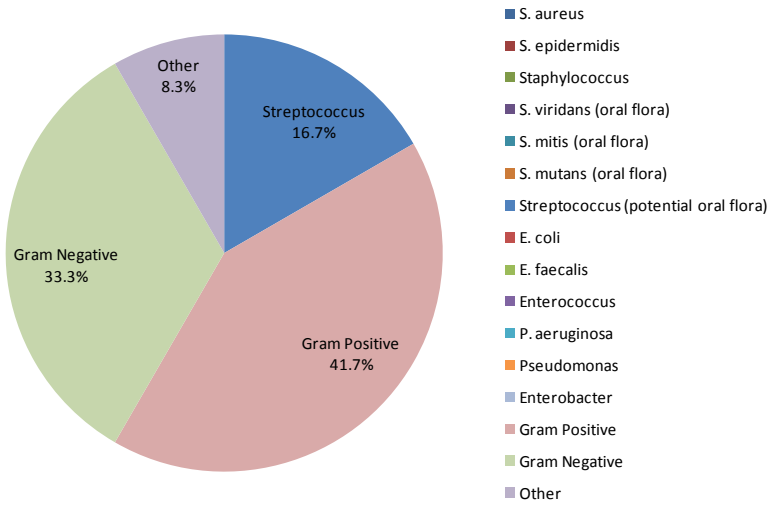
Study	Total N	Infected N	Rate
Windslow 1960	72	17	23.6%

Figure 14 Endodontic Bacteria (Incidence)



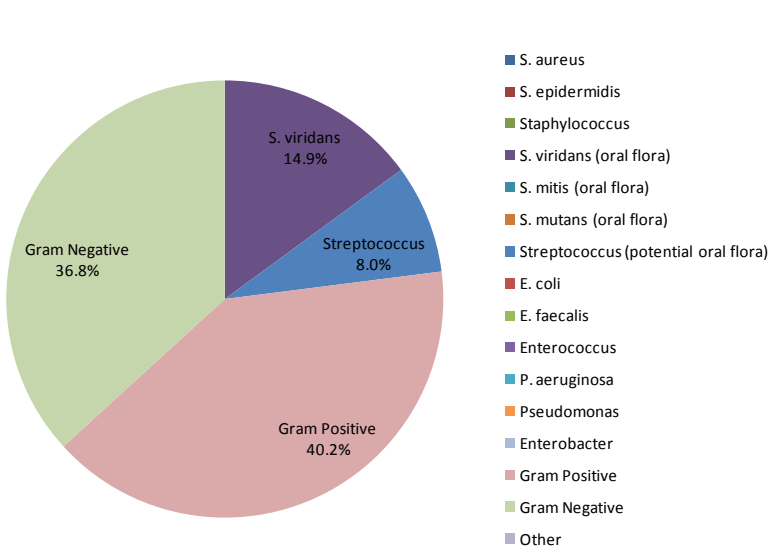
Study	Total N	Infected N	Rate
Baumgartner 1976	30	1	3.3%
Baumgartner 1977	12	7	58.3%
Heimdahl 1990	20	4	20.0%

Figure 15 Endodontic Bacteria (Prevalence)



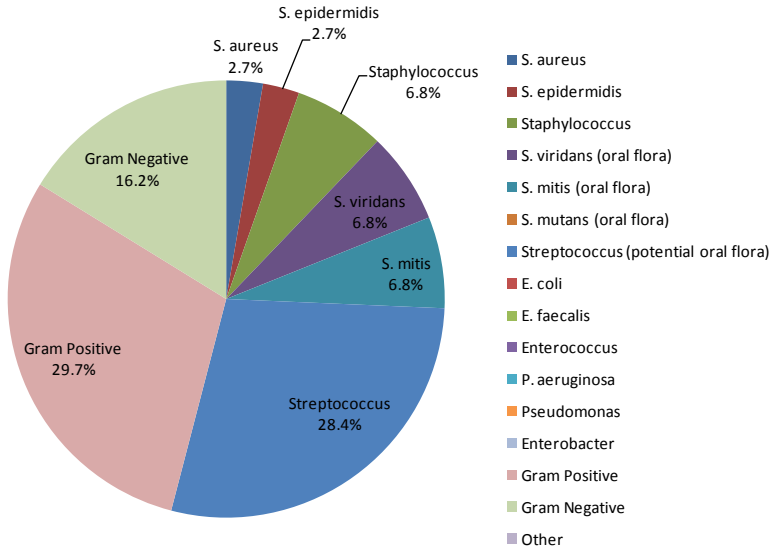
Study	Total N	Infected N	Rate
Debelian 1995	26	11	42.3%

Figure 16 Injection Bacteria (Incidence)



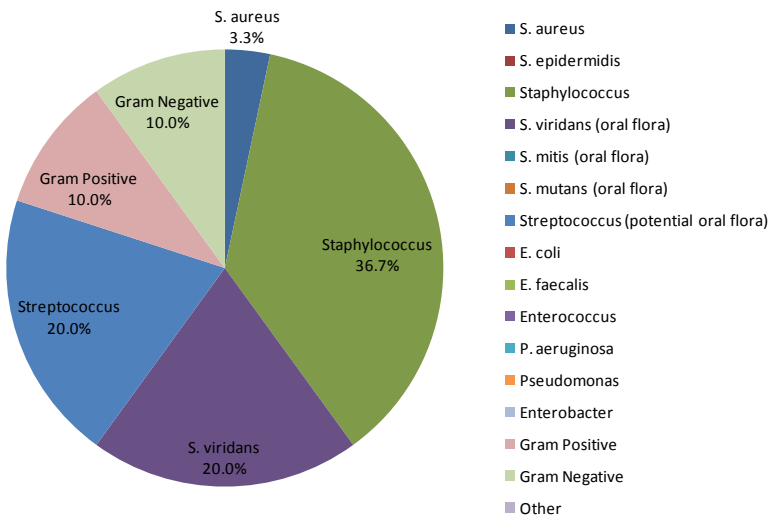
Study	Total N	Infected N	Rate
Rahn 1994	40	21	52.5%

Figure 17 Inter-dental Cleaning Bacteria (Incidence)



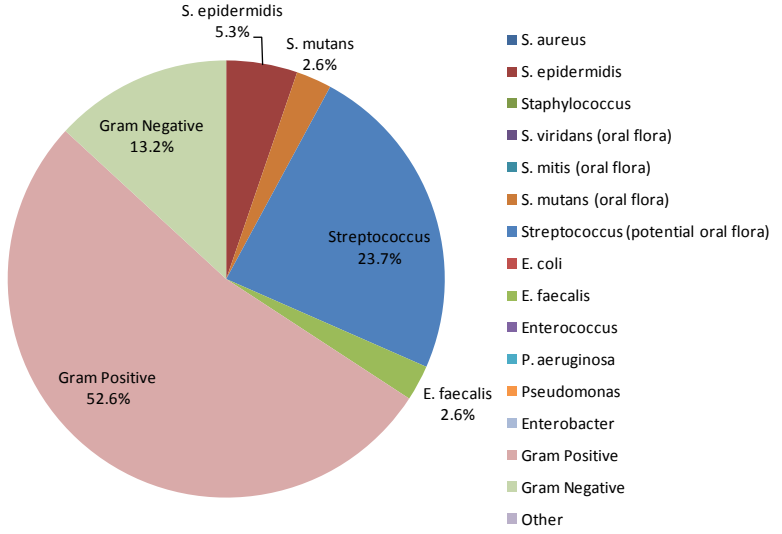
Study	Total N	Infected N	Rate
Berger 1974	30	9	18.0%
Crasta 2009	59	24	40.7%
Felix 1971	30	15	50.0%
Ramadan 1975	50	9	18.8%
Romans 1971	30	1	6.7%
Wank 1976	21	6	28.6%

Figure 18 Intubation Bacteria (Incidence)



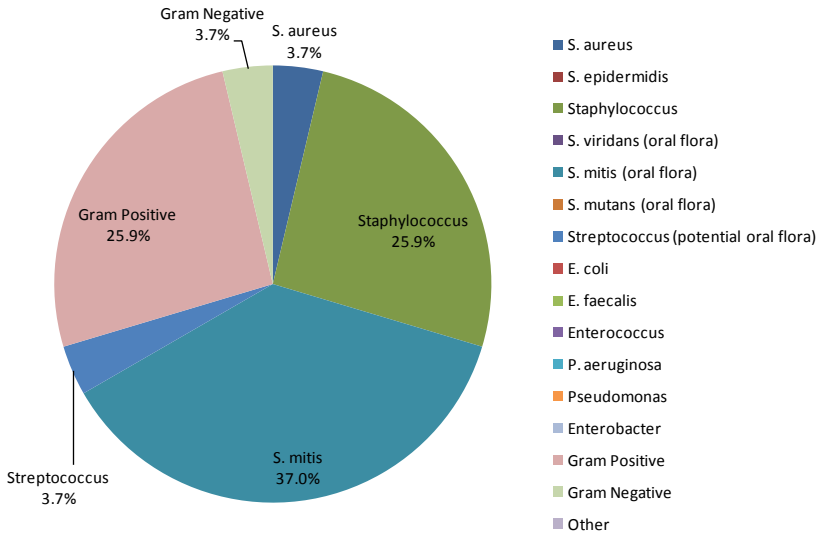
Study	Total N	Infected N	Rate
Berry 1973	50	4	8.0%
Dinner 1987	54	3	5.6%
Hansen 1989	19	1	5.3%
Oncag 2005	74	9	12.2%
Valdes 2008	110	13	11.8%

Figure 19 Oral Surgery Bacteria (Incidence)



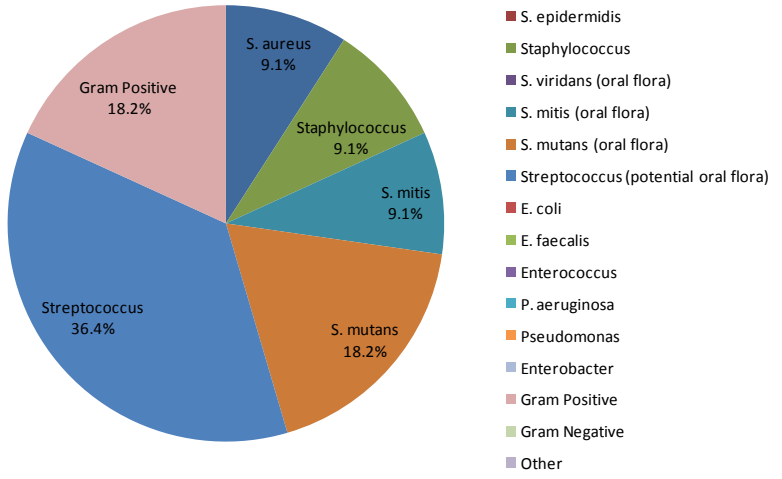
Study	Total N	Infected N	Rate
Flood 1990	17	3	17.6%
Heimdahl 1990	20	11	55.0%

Figure 20 Oral Surgery Bacteria (Prevalence)



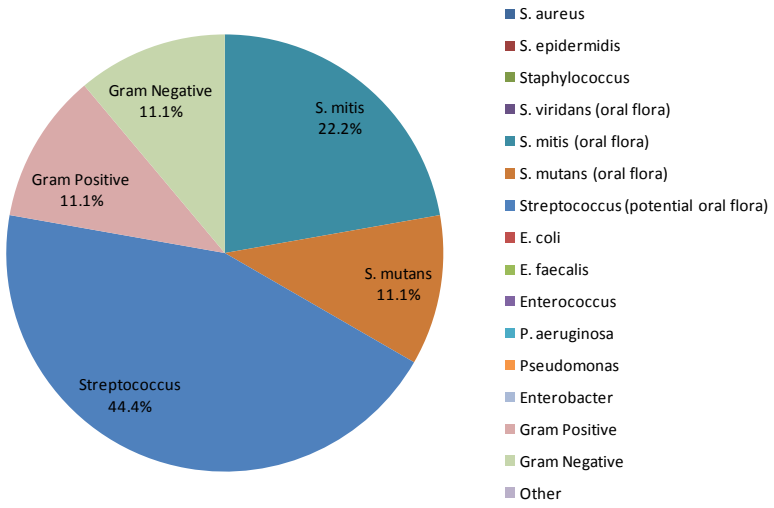
Study	Total N	Infected N	Rate
Martin 1964	50	27	54.0%

Figure 21 Orthodontic Bacteria (Incidence)



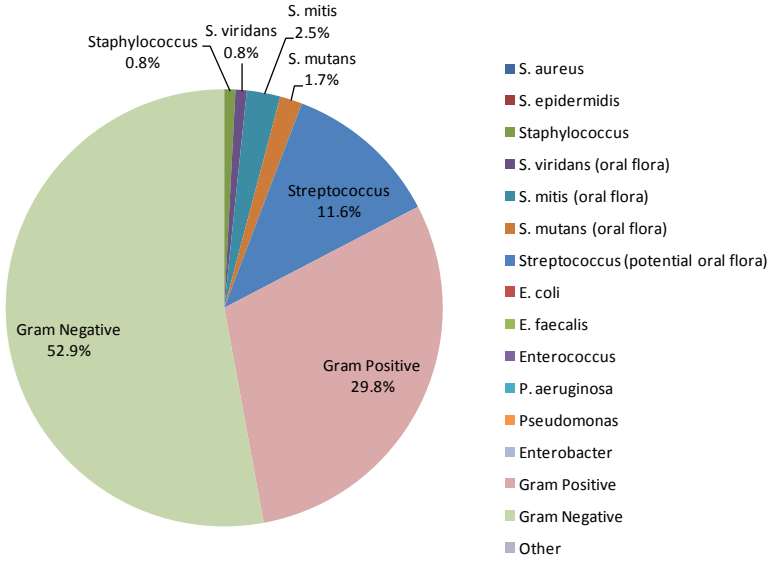
Study	Total N	Infected N	Rate
Erverdi 1999	40	3	7.5%
Gurel 2009	25	8	32.0%

Figure 22 Orthodontic Bacteria (Prevalence)



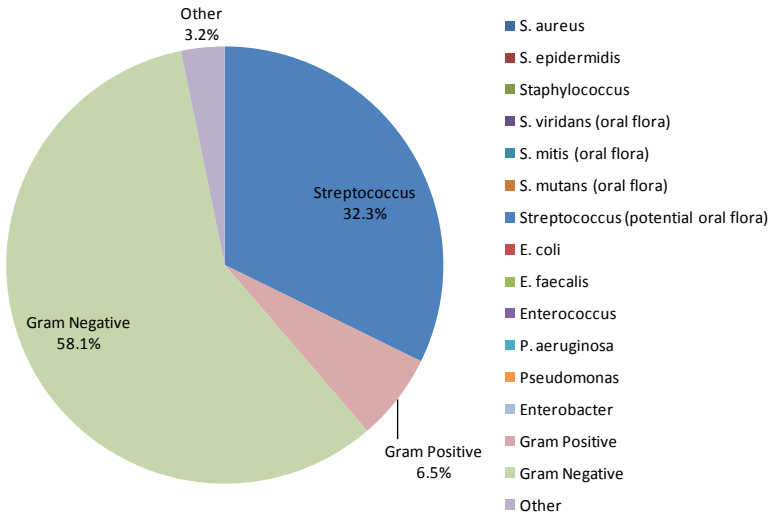
Study	Total N	Infected N	Rate
Burden 2004	30	4	13.3%

Figure 23 Periodontic [Scaling & Planing] Bacteria (Incidence)



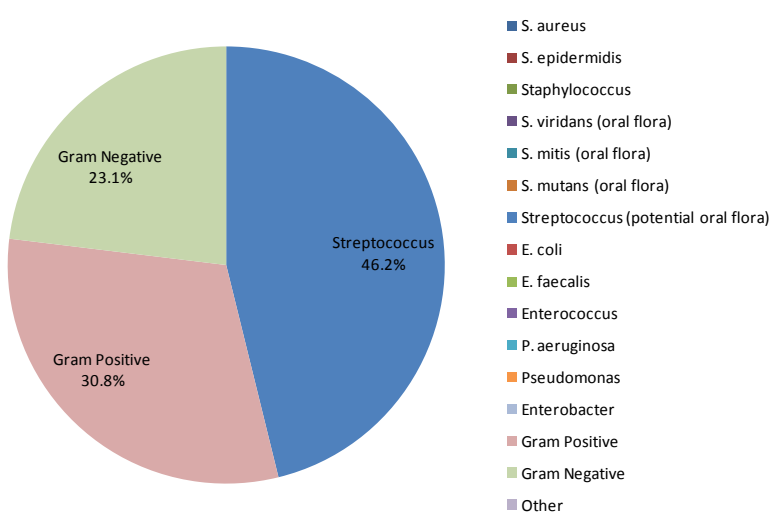
Study	Total N	Infected N	Rate
Casolari 1989	42	12	28.6%
Lafaurie 2007	42	34	81.0%
Lucartorto 1992	41	13	31.7%
Morozumi 2010	10	9	90.0%
Waki 1990	15	2	13.3%

Figure 24 Periodontic [Gingivectomy] Bacteria (Incidence)



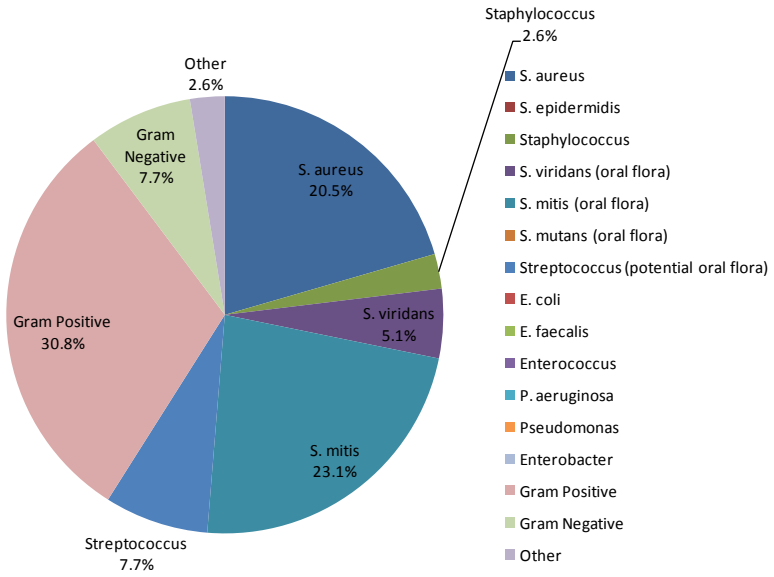
Study	Total N	Infected N	Rate
Rogosa 1960	13	12	92.3%

Figure 25 Periodontic [Probing] Bacteria (Incidence)



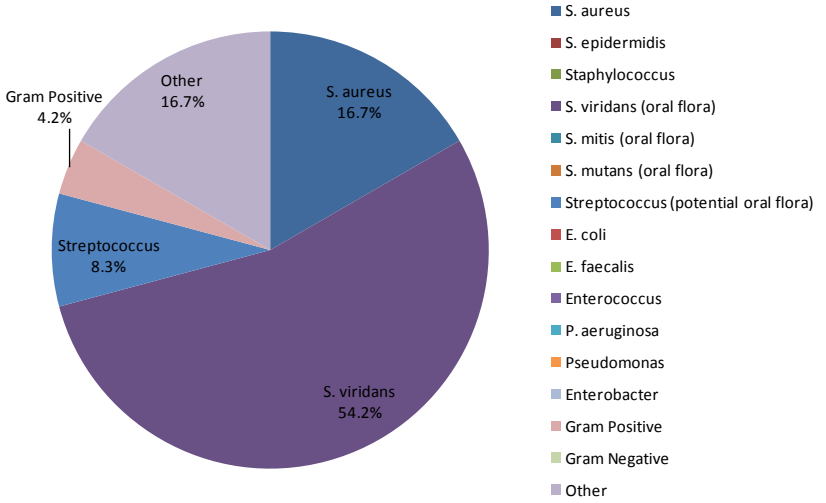
Study	Total N	Infected N	Rate
Daly 2001	40	10	25.0%

Figure 26 Periodontic [Scaling & Planing] Bacteria (Prevalence)



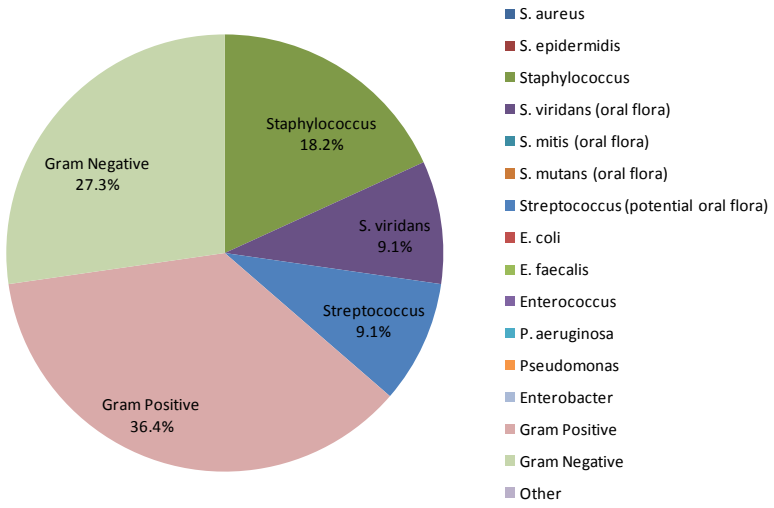
Study	Total N	Infected N	Rate
Conner 1967	109	38	34.9%

Figure 27 Periodontic [Gingivectomy] Bacteria (Prevalence)



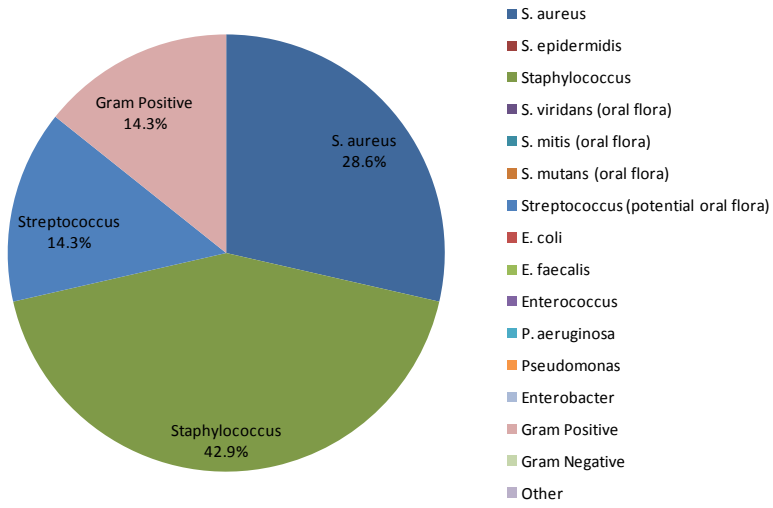
Study	Total N	Infected N	Rate
Gutverg 1962	67	24	35.8%

Figure 28 Periodontic [Probing] Bacteria (Prevalence)



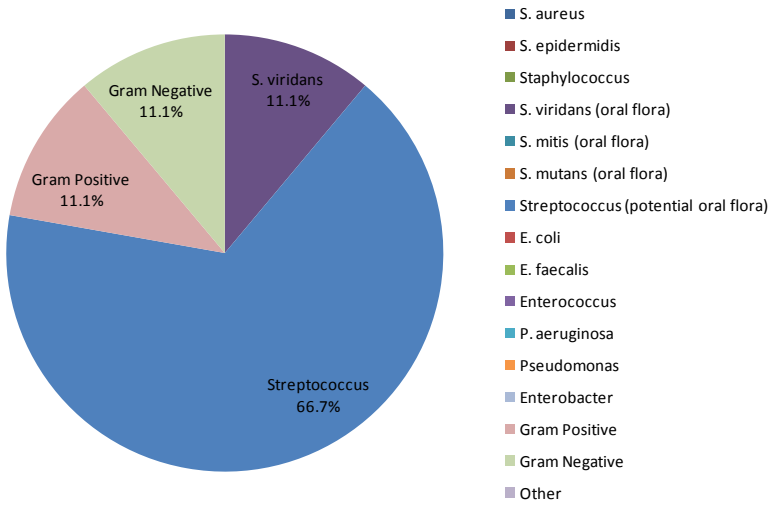
Study	Total N	Infected N	Rate
Kinane 2005	30	5	16.7%

Figure 29 Sialography Bacteria (Prevalence)



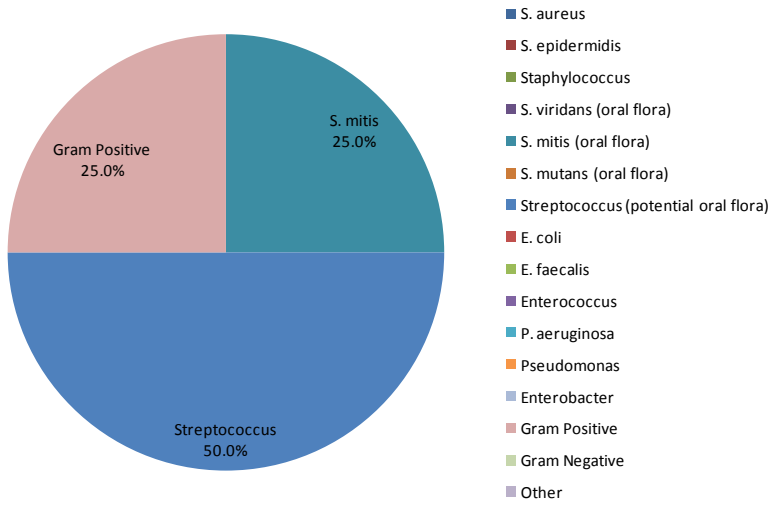
Study	Total N	Infected N	Rate
Lamey 1985	30	7	23.3%

Figure 30 Suture Bacteria (Incidence)



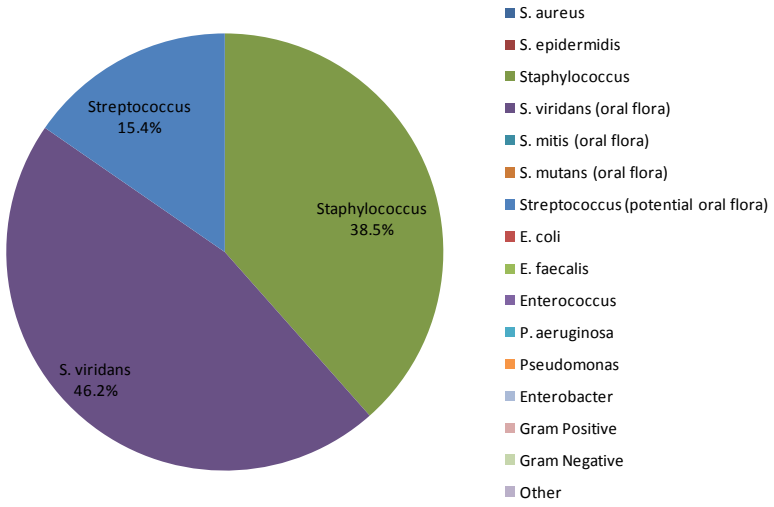
Study	Total N	Infected N	Rate
Brown 1998	24	2	8.3%
King 1988	20	1	5.0%
Wampole 1978	20	5	25.0%

Figure 31 Suture Bacteria (Prevalence)



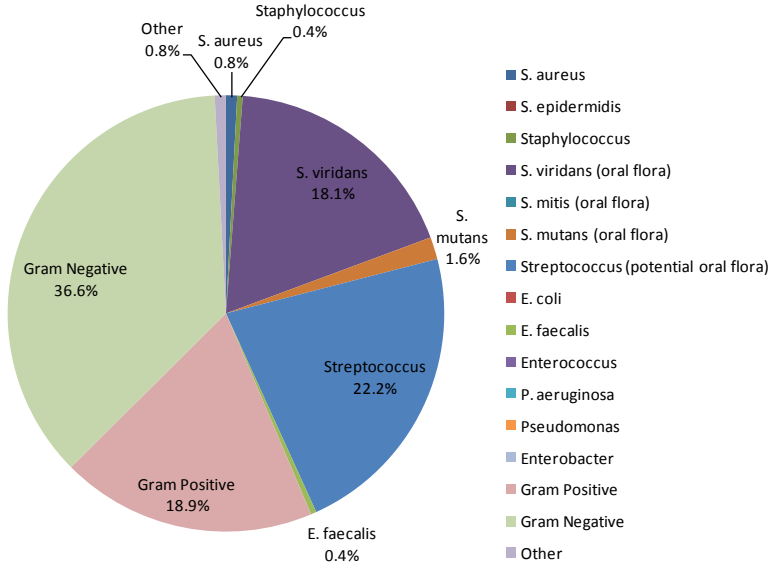
Study	Total N	Infected N	Rate
Giglio 1992	25	4	16.0%

Figure 32 Teething Bacteria (Prevalence)



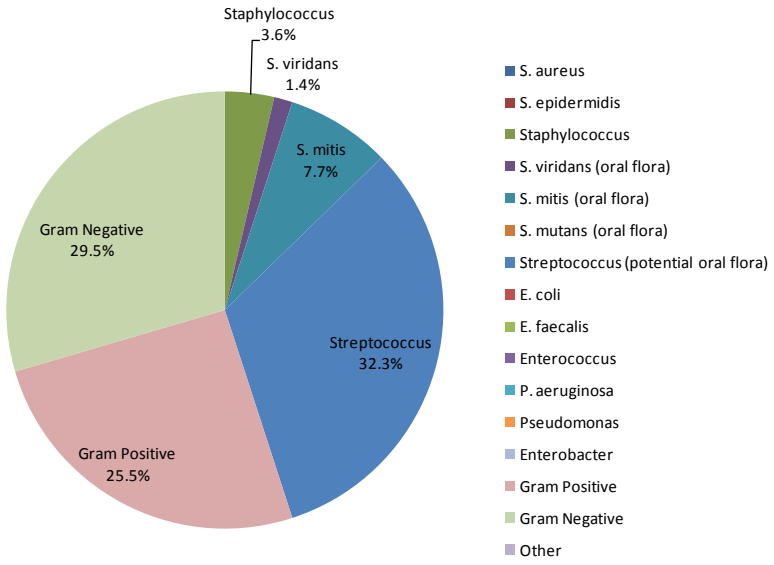
Study	Total N	Infected N	Rate
Soliman 1977	40	13	32.5%

Figure 33 Tooth Extraction Bacteria (Incidence)



Study	Total N	Infected N	Rate
Heimdahl 1990	20	20	100.0%
Khairat 1966	100	64	64.0%

Figure 34 Tooth Extraction Bacteria (Prevalence)



Study	Total N	Infected N	Rate
Crawford 1973	25	23	92.0%
Maskell 1986	10	10	100.0%
Peterson 1976	80	39	48.8%
Shanson 1978	40	16	40.0%
Shanson 1987	40	13	32.5%

RECOMMENDATIONS

The following recommendations are not intended to stand alone. Treatment decisions should be made in light of all circumstances presented by the patient. Treatments and procedures applicable to the individual patient rely on mutual communication between patient, physician, dentist and other healthcare practitioners.

RECOMMENDATION 1

The practitioner might consider discontinuing the practice of routinely prescribing prophylactic antibiotics for patients with hip and knee prosthetic joint implants undergoing dental procedures.

Grade of Recommendation: Limited

Description: Evidence from two or more "Low" strength studies with consistent findings, or evidence from a single Moderate quality study recommending for or against the intervention or diagnostic. A **Limited** recommendation means the quality of the supporting evidence that exists is unconvincing, or that well-conducted studies show little clear advantage to one approach versus another.

Implications: Practitioners should be cautious in deciding whether to follow a recommendation classified as **Limited**, and should exercise judgment and be alert to emerging publications that report evidence. Patient preference should have a substantial influencing role.

RATIONALE

Moderate strength evidence finds that dental procedures are unrelated to implant infection and that antibiotic prophylaxis prior to dental procedures does not reduce the risk of subsequent implant infection. There is no direct evidence to support otherwise. High strength evidence suggests that antibiotic prophylaxis reduces the incidence of post-dental procedure related bacteremia, but there is no evidence that these bacteremias are related to prosthetic joint infections.

A single well-conducted case-control study provides direct evidence for this recommendation.[39] Case-control studies are appropriate to answer questions regarding risk factors or etiology. Study enrollment consisted of 339 patients with prosthetic hip or knee infections (cases) and 339 patients with hip or knee arthroplasties without infection (controls) hospitalized on an orthopaedic service during the same time period. The comparison between these groups was for differences in dental visits (exposure) in terms of high and low-risk dental procedures, with and without antibiotic prophylaxis. Results reported as odds ratios with 95% confidence interval, demonstrate no statistically significant differences between groups. Neither dental procedures nor antibiotic prophylaxis prior to dental procedures were associated with risk of prosthetic hip or knee infections. The authors performed a sample size calculation and withdrawals were low, minimizing attrition bias. The prospective nature of this study minimized recall bias. Additionally, blinding of the treatment group to those assessing outcomes limits detection bias.

Although this one study of direct evidence was of moderate quality, it did have limitations. The authors conducted covariate analysis on some subgroups of higher risk patients. The number of patients in these subgroups, however, was relatively small, and there is insufficient data to suggest that these patients are at higher risk of experiencing hematogenous infections.

There is high quality evidence that demonstrates the occurrence of bacteremia with dental procedures. Historically, there has been a suggestion that bacteremias can cause hematogenous seeding of total joint implants, both in the early postoperative period and for many years following implantation. It was felt that the most critical period was up to two years after joint

placement. In addition, bacteremias may occur during normal daily activities such as chewing and tooth brushing. It is likely that these daily activities induce many more bacteremias than dental procedure associated bacteremias. While evidence supports a strong association between certain dental procedures and bacteremia, there is no evidence to demonstrate a direct link between dental procedure associated bacteremia and infection of prosthetic joints or other orthopaedic implants. Multiple studies of moderate and high quality evidence suggest that antibiotic prophylaxis decreases the risk of dental procedure associated bacteremias. However, dental procedure associated bacteremia is a surrogate outcome for prosthetic joint infection. Surrogate outcomes may or may not relate to a clinically relevant patient outcome. Of additional concern is a positive surrogate outcome (e.g. reduced bacteremias) that could mask a negative patient-centered outcome (e.g. implant infection).

This recommendation is limited to patients with hip and knee prostheses because the single study of direct evidence included only patients with these types of orthopaedic implants. There is no direct evidence that met our inclusion criteria for patients with other types of orthopaedic implants.

FINDINGS

As illustrated in Figure 1 there is varying quality of evidence that explains the purported association between dental procedures and orthopaedic implant infection. Only one moderate quality study of direct evidence was considered for this recommendation. The results of this study conclude that dental procedures are not risk factors for subsequent orthopaedic implant infection and furthermore that antibiotic prophylaxis prior to dental procedures does not reduce the risk of implant infection. However, multiple high quality studies of indirect evidence link oral procedures to bacteremia (see Figure 2 - Figure 5). Furthermore, multiple moderate quality studies of indirect evidence suggest that antibiotic prophylaxis prevents post-dental procedure bacteremia. Details of our analysis on antibiotic prophylaxis are presented in the results section below.

QUALITY AND APPLICABILITY

NETWORK META-ANALYSIS

Of the 21 studies included for this recommendation, 2 were of high quality and moderate applicability, 17 were of moderate quality and moderate applicability, and 2 were of low quality and moderate applicability. For details see Table 69 and Table 75 of Appendix XII.

RESULTS

NETWORK META-ANALYSIS

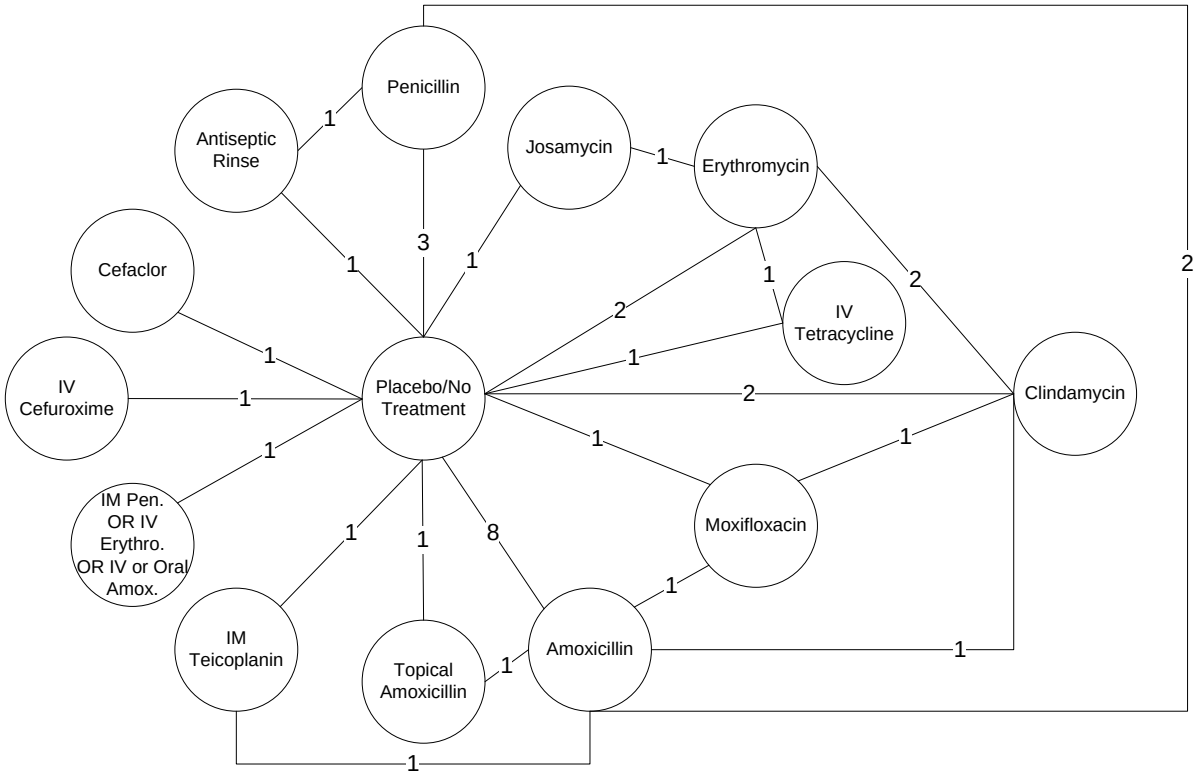
Twenty one studies that investigated the efficacy of antibiotic prophylaxis for prevention of dental procedure related bacteremia were included that compared antibiotics to controls or other antibiotics. Direct and indirect comparisons were drawn from network meta-analysis as diagramed in Figure 35. The network meta-analysis allowed us to compare treatments that were not in the same study. More detailed information on this method can be found in the "Statistical Methods" section of this guideline. Table 28, Table 29, and Table 30 summarize the results of these comparisons. Figure 36 and Figure 37 graphically depict the direct and indirect antibiotic comparisons vs. placebo/no treatment. Odds ratios were converted to number needed to treat

(NNT) for a more clinically meaningful interpretation (see Table 31). Rankings of the antibiotics are presented in Table 32. These rankings do not indicate statistical significance.

The overall network model was consistent. See Table 59 in Appendix XI. Goodness-of-fit statistics are also presented in Appendix XI (see

Table 61). These results suggest that our model fits the available data. Individual study results can be found in Table 24. Individual study results that could not be meta-analyzed can be found in Table 67 in Appendix XI.

Figure 35 Network Diagram of Antibiotic Prophylaxis for the Prevention of Dental-related Bacteremia



Circles denote the treatments studied. Lines between circles denote treatment comparisons that are addressed by direct evidence. The numbers on these lines show the number of trials that compared the two treatments denoted in the circles.

Table 28 Direct Comparisons of Antibiotic Prophylaxes for the Prevention of Dental-related Bacteremia

Comparison	Studies	Odds Ratio (95% CI)
Amoxicillin vs. Placebo/No Treatment	8	0.093* (0.041, 0.212)
Penicillin vs. Placebo/No Treatment	3	0.282 (0.109, 0.731)
Erythromycin vs. Placebo/No Treatment	2	0.512 (0.188, 1.396)
Clindamycin vs. Placebo/No Treatment	2	0.121 (0.049, 0.299)
Josamycin vs. Placebo/No Treatment	1	1.256 (0.334, 4.733)
Moxifloxacin vs. Placebo/No Treatment	1	0.052 (0.011, 0.233)
Cefaclor vs. Placebo/No Treatment	1	0.75 (0.144, 3.903)
IV Tetracycline vs. Placebo/No Treatment	1	0.017 (0.005, 0.059)
IV Cefuroxime vs. Placebo/No Treatment	1	0.1 (0.029, 0.34)
IM Teicoplanin vs. Placebo/No Treatment	1	0.069 (0.003, 1.498)
Topical Amoxicillin vs. Placebo/No Treatment	1	0.127 (0.013, 1.269)
Antiseptic Rinse vs. Placebo/No Treatment	1	0.372 (0.141, 0.98)
IM Pen. OR IV Erythro. OR Oral OR IV Amox. vs. Placebo/No Treatment	1	0.318 (0.108, 0.935)
Penicillin vs. Amoxicillin	2	0.997 (0.308, 3.229)
Clindamycin vs. Amoxicillin	1	6.635 (2.654, 16.586)
Moxifloxacin vs. Amoxicillin	1	1.523 (0.728, 3.189)
IM Teicoplanin vs. Amoxicillin	1	2.25 (0.376, 13.465)
Topical Amoxicillin vs. Amoxicillin	1	11.429 (1.155, 113.115)
Antiseptic Rinse vs. Penicillin	1	0.851 (0.28, 2.591)
Clindamycin vs. Erythromycin	2	0.7 (0.23, 2.129)
Josamycin vs. Erythromycin	1	1.256 (0.334, 4.733)
IV Tetracycline vs. Erythromycin	1	0.05 (0.014, 0.186)
Moxifloxacin vs. Clindamycin	1	0.23 (0.092, 0.572)

*Heterogeneity (I^2 >50%)

Figure 36 Forest Plot of Direct Comparisons of Antibiotics vs. Placebo/No Treatment for the Prevention of Dental-related Bacteremia

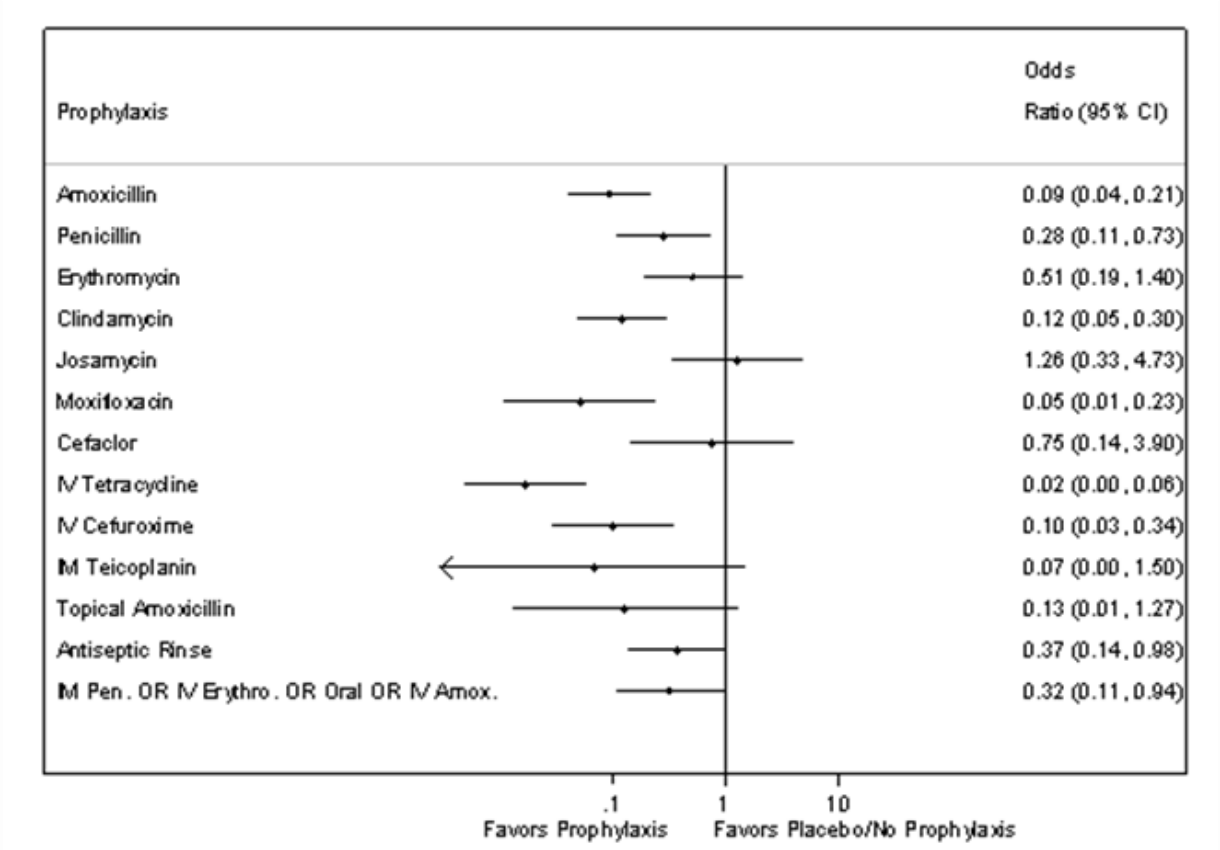


Table 29 Indirect (Network) Comparisons of Antibiotic Prophylaxes for the Prevention of Dental-related Bacteremia

Comparison	Odds Ratio
Amoxicillin vs. Placebo/No Treatment	0.071 (0.026, 0.167)
Penicillin vs. Placebo/No Treatment	0.176 (0.042, 0.685)
Erythromycin vs. Placebo/No Treatment	0.426 (0.111, 1.593)
Clindamycin vs. Placebo/No Treatment	0.235 (0.063, 0.842)
Josamycin vs. Placebo/No Treatment	0.838 (0.093, 7.636)
Moxifloxacin vs. Placebo/No Treatment	0.068 (0.009, 0.447)
Cefaclor vs. Placebo/No Treatment	0.719 (0.047, 10.31)
IV Tetracycline vs. Placebo/No Treatment	0.016 (0.001, 0.146)
IV Cefuroxime vs. Placebo/No Treatment	0.089 (0.007, 0.952)
IM Teicoplanin vs. Placebo/No Treatment	0.099 (0.006, 1.266)
Topical Amoxicillin vs. Placebo/No Treatment	0.326 (0.028, 3.479)
Antiseptic Rinse vs. Placebo/No Treatment	0.239 (0.028, 1.899)
IM Pen. OR IV Erythro. OR Oral OR IV Amox. vs. Placebo/No Treatment	0.301 (0.029, 3.064)
Penicillin vs. Amoxicillin	2.478 (0.594, 11.06)
Erythromycin vs. Amoxicillin	5.983 (1.345, 30.20)
Clindamycin vs. Amoxicillin	3.303 (0.816, 14.87)
Josamycin vs. Amoxicillin	11.77 (1.161, 134.5)
Moxifloxacin vs. Amoxicillin	0.968 (0.143, 6.753)
Cefaclor vs. Amoxicillin	10.10 (0.608, 180.9)
IV Tetracycline vs. Amoxicillin	0.226 (0.019, 2.615)
IV Cefuroxime vs. Amoxicillin	1.254 (0.099, 17.20)
IM Teicoplanin vs. Amoxicillin	1.393 (0.101, 17.27)
Topical Amoxicillin vs. Amoxicillin	4.585 (0.422, 52.35)
Antiseptic Rinse vs. Amoxicillin	3.363 (0.375, 32.49)
IM Pen. OR IV Erythro. OR Oral OR IV Amox. vs. Amoxicillin	4.229 (0.372, 54.81)
Erythromycin vs. Penicillin	2.413 (0.370, 16.34)
Clindamycin vs. Penicillin	1.333 (0.214, 8.542)
Josamycin vs. Penicillin	4.749 (0.368, 64.07)
Moxifloxacin vs. Penicillin	0.390 (0.038, 3.811)
Cefaclor vs. Penicillin	4.075 (0.198, 83.42)
IV Tetracycline vs. Penicillin	0.091 (0.006, 1.290)
IV Cefuroxime vs. Penicillin	0.506 (0.031, 8.068)
IM Teicoplanin vs. Penicillin	0.562 (0.028, 9.679)
Topical Amoxicillin vs. Penicillin	1.850 (0.119, 28.41)
Antiseptic Rinse vs. Penicillin	1.357 (0.163, 11.47)
IM Pen. OR IV Erythro. OR Oral OR IV Amox. vs. Penicillin	1.706 (0.118, 26.84)
Clindamycin vs. Erythromycin	0.552 (0.137, 2.181)
Josamycin vs. Erythromycin	1.968 (0.222, 17.81)
Moxifloxacin vs. Erythromycin	0.161 (0.016, 1.389)
Cefaclor vs. Erythromycin	1.688 (0.082, 33.61)
IV Tetracycline vs. Erythromycin	0.037 (0.003, 0.353)
IV Cefuroxime vs. Erythromycin	0.209 (0.013, 3.158)
IM Teicoplanin vs. Erythromycin	0.232 (0.010, 4.034)
Topical Amoxicillin vs. Erythromycin	0.766 (0.048, 11.33)
Antiseptic Rinse vs. Erythromycin	0.562 (0.045, 6.494)
IM Pen. OR IV Erythro. OR Oral OR IV Amox. vs. Erythromycin	0.707 (0.050, 10.30)

Comparison	Odds Ratio
Josamycin vs. Clindamycin	3.564 (0.329, 39.80)
Moxifloxacin vs. Clindamycin	0.293 (0.037, 2.090)
Cefaclor vs. Clindamycin	3.055 (0.150, 60.82)
IV Tetracycline vs. Clindamycin	0.068 (0.005, 0.779)
IV Cefuroxime vs. Clindamycin	0.379 (0.024, 5.691)
IM Teicoplanin vs. Clindamycin	0.421 (0.021, 6.972)
Topical Amoxicillin vs. Clindamycin	1.388 (0.091, 19.96)
Antiseptic Rinse vs. Clindamycin	1.018 (0.085, 11.63)
IM Pen. OR IV Erythro. OR Oral OR IV Amox. vs. Clindamycin	1.280 (0.091, 18.65)
Moxifloxacin vs. Josamycin	0.082 (0.004, 1.368)
Cefaclor vs. Josamycin	0.857 (0.025, 27.41)
IV Tetracycline vs. Josamycin	0.019 (0.000, 0.373)
IV Cefuroxime vs. Josamycin	0.106 (0.004, 2.789)
IM Teicoplanin vs. Josamycin	0.118 (0.003, 3.333)
Topical Amoxicillin vs. Josamycin	0.389 (0.014, 9.954)
Antiseptic Rinse vs. Josamycin	0.285 (0.013, 5.870)
IM Pen. OR IV Erythro. OR Oral OR IV Amox. vs. Josamycin	0.359 (0.014, 8.688)
Cefaclor vs. Moxifloxacin	10.43 (0.386, 301.8)
IV Tetracycline vs. Moxifloxacin	0.233 (0.012, 4.379)
IV Cefuroxime vs. Moxifloxacin	1.295 (0.061, 28.38)
IM Teicoplanin vs. Moxifloxacin	1.438 (0.056, 31.72)
Topical Amoxicillin vs. Moxifloxacin	4.735 (0.237, 100.0)
Antiseptic Rinse vs. Moxifloxacin	3.472 (0.211, 60.64)
IM Pen. OR IV Erythro. OR Oral OR IV Amox. vs. Moxifloxacin	4.366 (0.230, 95.01)
IV Tetracycline vs. Cefaclor	0.022 (0.000, 0.756)
IV Cefuroxime vs. Cefaclor	0.124 (0.003, 4.517)
IM Teicoplanin vs. Cefaclor	0.137 (0.002, 5.562)
Topical Amoxicillin vs. Cefaclor	0.454 (0.012, 16.46)
Antiseptic Rinse vs. Cefaclor	0.333 (0.011, 10.07)
IM Pen. OR IV Erythro. OR Oral OR IV Amox. vs. Cefaclor	0.418 (0.012, 14.52)
IV Cefuroxime vs. IV Tetracycline	5.551 (0.208, 150.8)
IM Teicoplanin vs. IV Tetracycline	6.165 (0.174, 189.2)
Topical Amoxicillin vs. IV Tetracycline	20.28 (0.735, 561.7)
Antiseptic Rinse vs. IV Tetracycline	14.87 (0.686, 330.9)
IM Pen. OR IV Erythro. OR Oral OR IV Amox. vs. IV Tetracycline	18.70 (0.769, 484.9)
IM Teicoplanin vs. IV Cefuroxime	1.110 (0.028, 35.26)
Topical Amoxicillin vs. IV Cefuroxime	3.658 (0.116, 107.7)
Antiseptic Rinse vs. IV Cefuroxime	2.682 (0.109, 62.67)
IM Pen. OR IV Erythro. OR Oral OR IV Amox. vs. IV Cefuroxime	3.370 (0.120, 96.44)
Topical Amoxicillin vs. IM Teicoplanin	3.293 (0.108, 117.0)
Antiseptic Rinse vs. IM Teicoplanin	2.415 (0.093, 75.71)
IM Pen. OR IV Erythro. OR Oral OR IV Amox. vs. IM Teicoplanin	3.034 (0.098, 116.1)
Antiseptic Rinse vs. Topical Amoxicillin	0.733 (0.031, 17.77)
IM Pen. OR IV Erythro. OR Oral OR IV Amox. vs. Topical Amoxicillin	0.922 (0.034, 28.33)
IM Pen. OR IV Erythro. OR Oral OR IV Amox. vs. Antiseptic Rinse	1.257 (0.056, 29.51)

Table 30 Indirect (Network) Significant Comparisons of Antibiotic Prophylaxes for the Prevention of Dental-related Bacteremia

Comparison
Amoxicillin favored over Placebo/No Treatment
Penicillin favored over Placebo/No Treatment
Clindamycin favored over Placebo/No Treatment
Moxifloxacin favored over Placebo/No Treatment
IV Tetracycline favored over Placebo/No Treatment
IV Cefuroxime favored over Placebo/No Treatment
Amoxicillin favored over Erythromycin
Amoxicillin favored over Josamycin
IV Tetracycline favored over Erythromycin
IV Tetracycline favored over Clindamycin
IV Tetracycline favored over Josamycin
IV Tetracycline favored over Cefaclor

Figure 37 Forest Plot of Indirect (Network) Comparisons of Antibiotics vs. Placebo/No Treatment for the Prevention of Dental-related Bacteremia

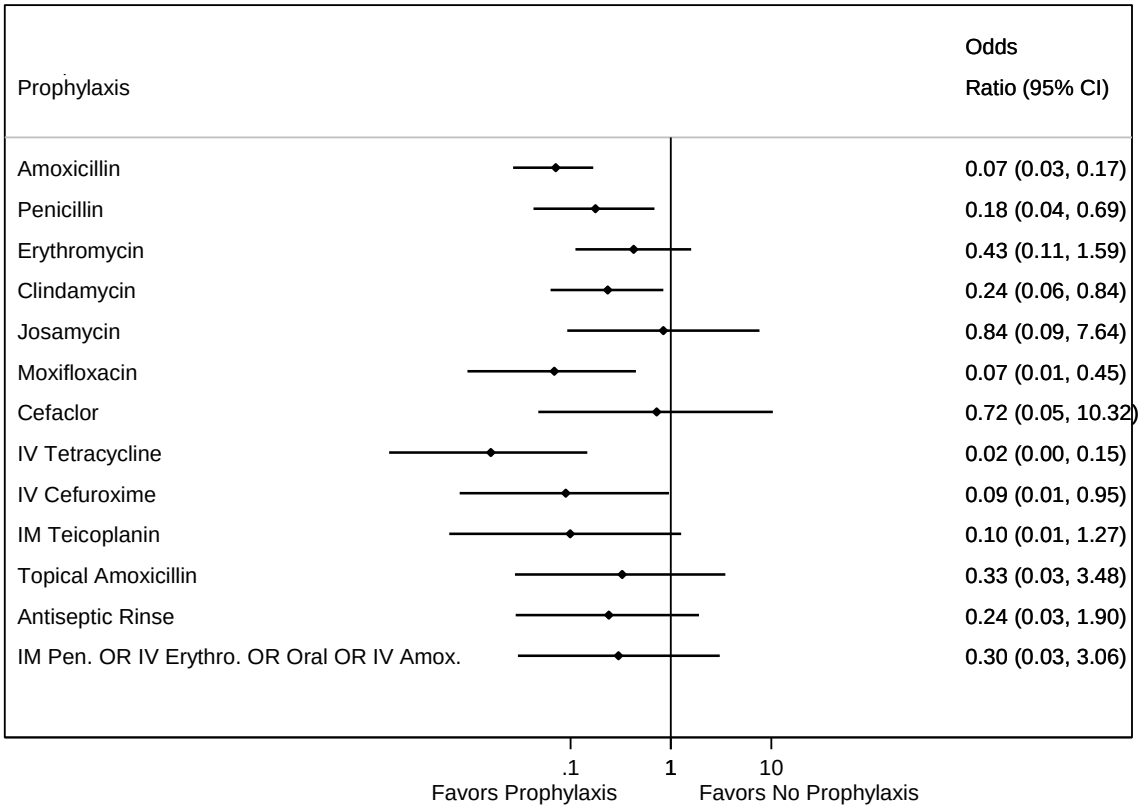


Table 31 Conversion of Odds Ratio from Figure 37 to Number Needed to Treat (NNT)

Treatment	NNT
Amoxicillin	1.8
Penicillin	2.5
Erythromycin	5.0
Clindamycin	3.0
Josamycin	14.0
Moxifloxacin	1.9
Cefaclor	9.3
IV Tetracycline	1.5
IV Cefuroxime	2.1
IM Teicoplanin	2.2
Topical Amoxicillin	4.0
Antiseptic Rinse	3.2
IM Pen. OR IV Erythro. OR Oral OR IV Amox.	3.7

Table 32 Network Meta-Analysis Rankings of Antibiotic Prophylaxes for the Prevention of Dental-related Bacteremia

Prophylaxis	Rank 1 (Best)	2	3	4	5	6	7	8	9	10	11	12	13	14 (Worst)
Placebo/No Treatment	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.5%	2.8%	10.8%	27.3%	38.4%	20.2%
Amoxicillin	1.7%	14.2%	28.9%	28.5%	16.4%	6.8%	2.5%	0.7%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%
Penicillin	0.3%	1.9%	4.2%	8.1%	13.4%	17.3%	16.8%	14.1%	10.4%	6.8%	4.0%	1.7%	0.6%	0.2%
Erythromycin	0.0%	0.1%	0.3%	0.6%	1.5%	3.3%	6.3%	10.3%	15.6%	20.3%	20.4%	13.2%	6.1%	2.0%
Clindamycin	0.0%	0.4%	1.5%	3.7%	8.1%	12.9%	16.7%	18.3%	16.7%	11.6%	6.3%	2.6%	0.9%	0.3%
Josamycin	0.1%	0.3%	0.6%	1.0%	1.5%	2.3%	3.2%	4.4%	6.0%	8.6%	11.5%	14.5%	17.4%	28.5%
Moxifloxacin	8.2%	22.1%	18.9%	15.4%	11.8%	8.5%	5.8%	3.7%	2.3%	1.5%	0.9%	0.5%	0.2%	0.1%
Cefaclor	0.5%	1.4%	1.7%	2.1%	2.8%	3.7%	4.5%	5.5%	6.7%	8.1%	9.9%	11.1%	13.8%	28.0%
IV Tetracycline	67.7%	16.2%	6.5%	3.6%	2.3%	1.4%	0.9%	0.6%	0.3%	0.2%	0.1%	0.1%	0.0%	0.0%
IV Cefuroxime	8.8%	18.3%	13.0%	11.2%	10.9%	9.0%	7.3%	6.0%	4.7%	3.9%	2.9%	1.9%	1.3%	0.9%
IM Teicoplanin	9.3%	15.5%	11.6%	10.3%	10.0%	8.6%	7.4%	6.6%	5.7%	4.7%	3.9%	2.8%	2.0%	1.6%
Topical Amoxicillin	1.1%	3.0%	3.8%	4.7%	6.3%	7.6%	8.2%	8.9%	9.6%	10.4%	10.3%	9.3%	8.1%	8.6%
Antiseptic Rinse	1.1%	3.4%	4.6%	5.8%	8.2%	10.3%	11.3%	11.1%	11.0%	10.4%	8.8%	6.3%	4.3%	3.2%
IM Pen. OR IV Erythro. OR Oral OR IV Amox.	1.1%	3.1%	4.2%	4.9%	6.8%	8.2%	9.1%	9.6%	10.2%	10.7%	10.4%	8.7%	6.8%	6.5%

RECOMMENDATION 2

We are unable to recommend for or against the use of topical oral antimicrobials in patients with prosthetic joint implants or other orthopaedic implants undergoing dental procedures.

Grade of Recommendation: Inconclusive

Description: Evidence from a single low quality study or conflicting findings that do not allow a recommendation for or against the intervention. An **Inconclusive** recommendation means that there is a lack of compelling evidence resulting in an unclear balance between benefits and potential harm.

Implications: Practitioners should feel little constraint in deciding whether to follow a recommendation labeled as **Inconclusive** and should exercise judgment and be alert to future publications that clarify existing evidence for determining balance of benefits versus potential harm. Patient preference should have a substantial influencing role.

RATIONALE

There is high quality evidence that demonstrates the occurrence of bacteremias with dental procedures. However, there is no evidence to demonstrate a direct link between dental procedure associated bacteremia and infection of prosthetic joints or other orthopaedic implants.

There is conflicting evidence regarding the effect of antimicrobial mouth rinse on the incidence of bacteremia associated dental procedures. One high quality study reports no difference in the incidence of bacteremia following antimicrobial mouth rinsing in patients undergoing dental extractions. Conversely, numerous studies suggest that topical antimicrobial prophylaxis decreases the incidence of dental procedure associated bacteremia. However, there is no evidence that application of antimicrobial mouth rinses before dental procedures prevents infection of prosthetic joints or other orthopaedic implants.

FINDINGS

As illustrated in Figure 1 there is varying quality of evidence that explains the relationship between dental procedures and orthopaedic implant infection. Only one moderate quality study of direct evidence was considered for this recommendation. The results of this study conclude that dental procedures are not risk factors for subsequent orthopaedic implant infection. However, multiple high quality studies of indirect evidence link oral procedures to bacteremia (see Figure 2 - Figure 5). Furthermore, multiple studies of indirect evidence of moderate strength suggest that topical antimicrobial prophylaxis prevents post-dental procedure bacteremia. Details of our analysis on topical antimicrobial prophylaxis are presented in the results section below.

QUALITY AND APPLICABILITY

NETWORK META-ANALYSIS

Of the 12 studies included for this recommendation, 1 was of high quality and moderate applicability, 7 were of moderate quality and moderate applicability, and 4 were of low quality and moderate applicability. For details see Table 69 and Table 87 of Appendix XII.

RESULTS

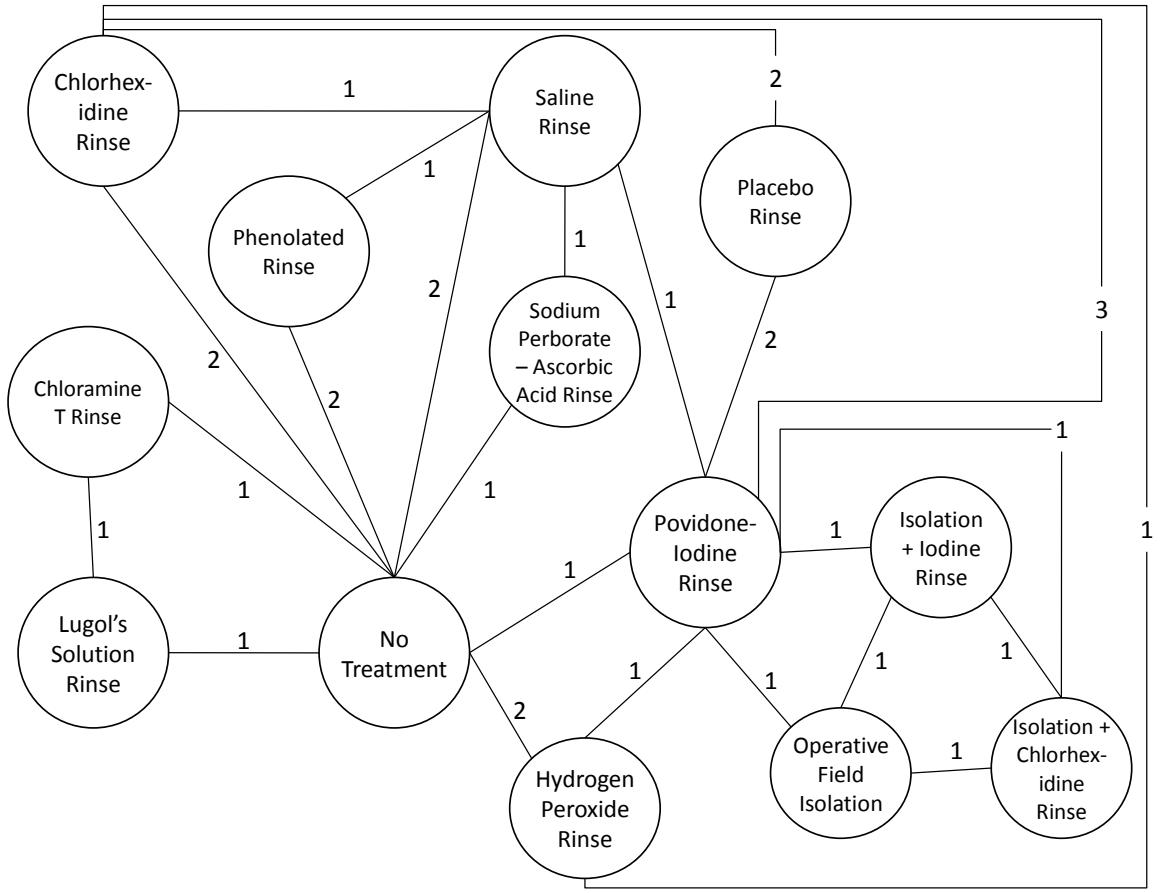
NETWORK META-ANALYSIS

Twelve studies were included that investigated the efficacy of topical antimicrobials for prevention of dental procedure related bacteremia. Direct and indirect comparisons were drawn from network meta-analysis as diagramed in Figure 38. Table 33, Table 34, and Table 35 summarize the results of these comparisons. Figure 39 and Figure 40 graphically depict the direct and indirect topical antimicrobial comparisons vs. no treatment. Odds ratios were converted to number needed to treat (NNT) for a more clinically meaningful interpretation (see Table 36). Rankings of the topicals are presented in Table 37. These rankings do not indicate statistical significance.

The overall network model was consistent. See Table 60 in Appendix XI. Goodness-of-fit statistics are also presented in Appendix XI (see

Table 61). These results suggest that our model fits the available data. Individual study results can be found in Table 25. Individual study results that could not be meta-analyzed can be found in Table 68 in Appendix XI.

Figure 38 Network Diagram of Topical Antimicrobial Prophylaxes for the Prevention of Dental-related Bacteremia



Circles denote the treatments studied. Lines between circles denote treatment comparisons that are addressed by direct evidence. The numbers on these lines show the number of trials that compared the two treatments denoted in the circles.

Table 33 Direct Comparisons of Topical Antimicrobial Prophylaxes for the Prevention of Dental-related Bacteremia

Comparison	Studies	Odds Ratio (95% CI)
Saline Rinse vs. No Treatment	2	0.778* (0.249, 2.429)
Chlorhexidine Rinse vs. No Treatment	2	0.219 (0.08, 0.597)
Povidone-Iodine Rinse vs. No Treatment	1	0.231 (0.061, 0.869)
Chloramine T Rinse/Brush vs. No Treatment	1	0.176 (0.053, 0.586)
Lugol's Solution Rinse vs. No Treatment	1	0.762 (0.179, 3.249)
Hydrogen Peroxide Rinse vs. No Treatment	2	0.379 (0.192, 0.748)
Sodium Perborate-Ascorbic Acid Rinse vs. No Treatment	1	0.211 (0.093, 0.479)
Phenolated Rinse vs. No Treatment	2	0.192* (0.067, 0.545)
Chlorhexidine Rinse vs. Saline Rinse	1	0.083 (0.019, 0.37)
Povidone-Iodine Rinse vs. Saline Rinse	1	0.167 (0.041, 0.686)
Sodium Perborate-Ascorbic Acid Rinse vs. Saline Rinse	1	0.146 (0.05, 0.43)
Phenolated Rinse vs. Saline Rinse	1	0.253 (0.115, 0.557)
Povidone-Iodine Rinse vs. Chlorhexidine Rinse	3	0.812 (0.352, 1.872)
Hydrogen Peroxide Rinse vs. Chlorhexidine Rinse	1	1.5 (0.429, 5.248)
Chlorhexidine Rinse vs. Placebo Rinse	2	0.623 (0.286, 1.356)
Hydrogen Peroxide Rinse vs. Povidone-Iodine Rinse	1	1.857 (0.522, 6.612)
Povidone-Iodine Rinse vs. Placebo Rinse	2	0.325 (0.162, 0.651)
Lugol's Solution Rinse vs. Chloramine T Rinse/Brush	1	4.333 (1.405, 13.36)
Operative Field Isolation vs. Organic Iodine Rinse	1	0.420 (0.166, 1.062)
Isolation + Iodine Rinse vs. Organic Iodine Rinse	1	0.373 (0.146, 0.953)
Isolation + Chlorhexidine Rinse vs. Organic Iodine Rinse	1	0.122 (0.039, 0.382)
Isolation + Iodine Rinse vs. Operative Field Isolation	1	0.887 (0.340, 2.314)
Isolation + Chlorhexidine Rinse vs. Operative Field Isolation	1	0.291 (0.091, 0.925)
Isolation + Chlorhexidine Rinse vs. Isolation + Iodine Rinse	1	0.328 (0.102, 1.050)

*Heterogeneity (I^2 >50%)

Figure 39 Forest Plot of Direct Comparisons of Topical Antimicrobials vs. No Treatment for the Prevention of Dental-related Bacteremia

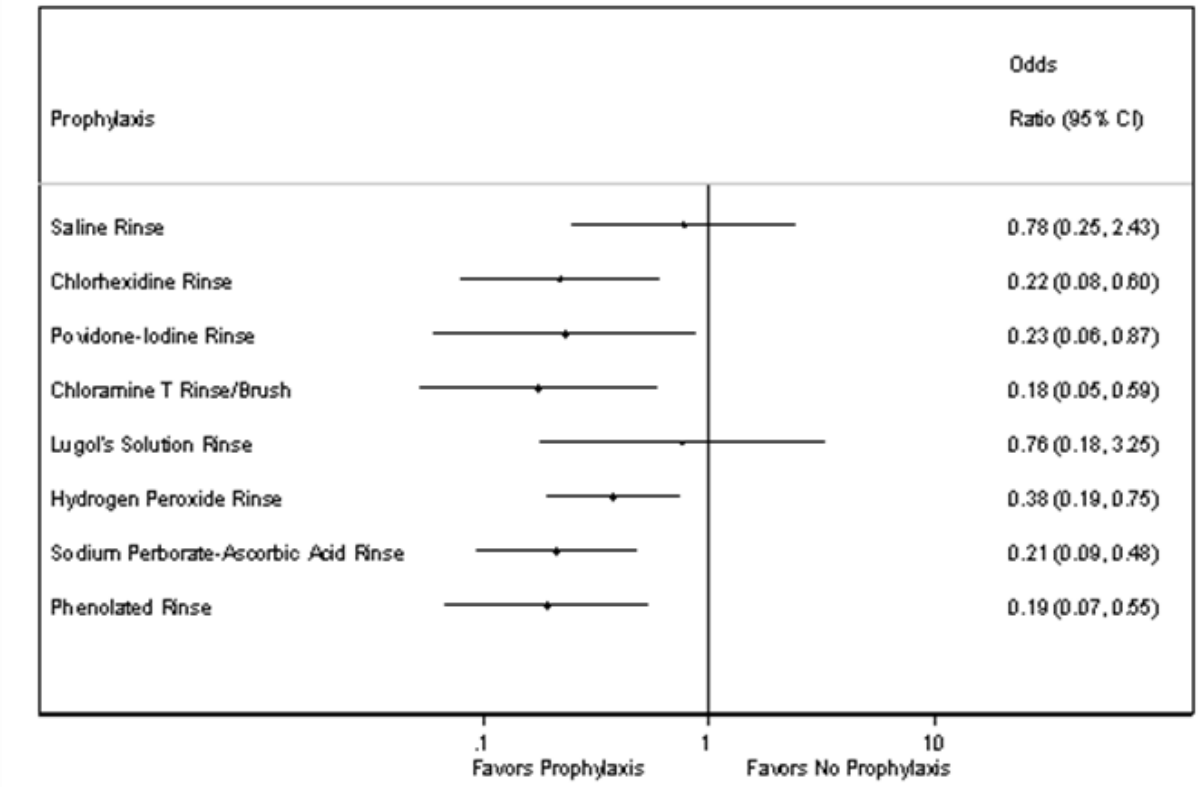


Table 34 Indirect (Network) Comparisons of Topical Antimicrobial Prophylaxes for the Prevention of Dental-related Bacteremia

Comparison	Odds Ratio (95% CI)
Saline Rinse vs. No Treatment	0.960 (0.402, 2.447)
Chlorhexidine Rinse vs. No Treatment	0.170 (0.059, 0.459)
Povidone-Iodine Rinse vs. No Treatment	0.143 (0.049, 0.412)
Chloramine T Rinse/Brush vs. No Treatment	0.158 (0.025, 0.891)
Lugol's Solution Rinse vs. No Treatment	0.740 (0.100, 5.269)
Hydrogen Peroxide Rinse vs. No Treatment	0.331 (0.108, 0.989)
Sodium Perborate-Ascorbic Acid Rinse vs. No Treatment	0.174 (0.041, 0.710)
Phenolated Rinse vs. No Treatment	0.216 (0.078, 0.612)
Placebo Rinse vs. No Treatment	0.400 (0.107, 1.485)
Operative Field Isolation vs. No Treatment	0.058 (0.008, 0.377)
Isolation + Iodine Rinse vs. No Treatment	0.051 (0.007, 0.331)
Isolation + Chlorhexidine Rinse vs. No Treatment	0.015 (0.002, 0.113)
Chlorhexidine Rinse vs. Saline Rinse	0.177 (0.051, 0.548)
Povidone-Iodine Rinse vs. Saline Rinse	0.149 (0.043, 0.475)
Chloramine T Rinse/Brush vs. Saline Rinse	0.165 (0.020, 1.147)
Lugol's Solution Rinse vs. Saline Rinse	0.771 (0.085, 6.586)
Hydrogen Peroxide Rinse vs. Saline Rinse	0.345 (0.084, 1.290)
Sodium Perborate-Ascorbic Acid Rinse vs. Saline Rinse	0.181 (0.040, 0.768)
Phenolated Rinse vs. Saline Rinse	0.225 (0.067, 0.718)
Placebo Rinse vs. Saline Rinse	0.417 (0.095, 1.714)
Operative Field Isolation vs. Saline Rinse	0.061 (0.008, 0.414)
Isolation + Iodine Rinse vs. Saline Rinse	0.054 (0.007, 0.364)
Isolation + Chlorhexidine Rinse vs. Saline Rinse	0.016 (0.001, 0.125)
Povidone-Iodine Rinse vs. Chlorhexidine Rinse	0.842 (0.349, 2.097)
Chloramine T Rinse/Brush vs. Chlorhexidine Rinse	0.932 (0.117, 7.113)
Lugol's Solution Rinse vs. Chlorhexidine Rinse	4.340 (0.474, 40.44)
Hydrogen Peroxide Rinse vs. Chlorhexidine Rinse	1.946 (0.553, 7.127)
Sodium Perborate-Ascorbic Acid Rinse vs. Chlorhexidine Rinse	1.023 (0.190, 5.708)
Phenolated Rinse vs. Chlorhexidine Rinse	1.267 (0.324, 5.328)
Placebo Rinse vs. Chlorhexidine Rinse	2.348 (0.854, 6.862)
Operative Field Isolation vs. Chlorhexidine Rinse	0.344 (0.057, 2.095)
Isolation + Iodine Rinse vs. Chlorhexidine Rinse	0.304 (0.050, 1.870)
Isolation + Chlorhexidine Rinse vs. Chlorhexidine Rinse	0.093 (0.013, 0.635)
Chloramine T Rinse/Brush vs. Povidone-Iodine Rinse	1.106 (0.136, 8.524)
Lugol's Solution Rinse vs. Povidone-Iodine Rinse	5.150 (0.552, 48.47)
Hydrogen Peroxide Rinse vs. Povidone-Iodine Rinse	2.308 (0.625, 8.364)
Sodium Perborate-Ascorbic Acid Rinse vs. Povidone-Iodine Rinse	1.214 (0.219, 6.739)
Phenolated Rinse vs. Povidone-Iodine Rinse	1.504 (0.370, 6.328)
Placebo Rinse vs. Povidone-Iodine Rinse	2.787 (1.037, 7.675)

Comparison	Odds Ratio (95% CI)
Operative Field Isolation vs. Povidone-Iodine Rinse	0.409 (0.084, 1.962)
Isolation + Iodine Rinse vs. Povidone-Iodine Rinse	0.361 (0.074, 1.709)
Isolation + Chlorhexidine Rinse vs. Povidone-Iodine Rinse	0.110 (0.019, 0.592)
Lugol's Solution Rinse vs. Chloramine T Rinse/Brush	4.655 (0.872, 26.95)
Hydrogen Peroxide Rinse vs. Chloramine T Rinse/Brush	2.087 (0.261, 17.56)
Sodium Perborate-Ascorbic Acid Rinse vs. Chloramine T Rinse/Brush	1.098 (0.114, 11.16)
Phenolated Rinse vs. Chloramine T Rinse/Brush	1.360 (0.182, 11.11)
Placebo Rinse vs. Chloramine T Rinse/Brush	2.519 (0.287, 23.78)
Operative Field Isolation vs. Chloramine T Rinse/Brush	0.369 (0.027, 4.997)
Isolation + Iodine Rinse vs. Chloramine T Rinse/Brush	0.326 (0.024, 4.499)
Isolation + Chlorhexidine Rinse vs. Chloramine T Rinse/Brush	0.100 (0.006, 1.473)
Hydrogen Peroxide Rinse vs. Lugol's Solution Rinse	0.448 (0.047, 4.263)
Sodium Perborate-Ascorbic Acid Rinse vs. Lugol's Solution Rinse	0.235 (0.020, 2.740)
Phenolated Rinse vs. Lugol's Solution Rinse	0.292 (0.031, 2.784)
Placebo Rinse vs. Lugol's Solution Rinse	0.540 (0.051, 5.766)
Operative Field Isolation vs. Lugol's Solution Rinse	0.079 (0.005, 1.206)
Isolation + Iodine Rinse vs. Lugol's Solution Rinse	0.070 (0.004, 1.070)
Isolation + Chlorhexidine Rinse vs. Lugol's Solution Rinse	0.021 (0.001, 0.358)
Sodium Perborate-Ascorbic Acid Rinse vs. Hydrogen Peroxide Rinse	0.526 (0.090, 3.089)
Phenolated Rinse vs. Hydrogen Peroxide Rinse	0.651 (0.150, 2.980)
Placebo Rinse vs. Hydrogen Peroxide Rinse	1.206 (0.267, 5.595)
Operative Field Isolation vs. Hydrogen Peroxide Rinse	0.177 (0.023, 1.340)
Isolation + Iodine Rinse vs. Hydrogen Peroxide Rinse	0.156 (0.020, 1.188)
Isolation + Chlorhexidine Rinse vs. Hydrogen Peroxide Rinse	0.048 (0.005, 0.405)
Phenolated Rinse vs. Sodium Perborate-Ascorbic Acid Rinse	1.238 (0.231, 6.868)
Placebo Rinse vs. Sodium Perborate-Ascorbic Acid Rinse	2.293 (0.346, 15.19)
Operative Field Isolation vs. Sodium Perborate-Ascorbic Acid Rinse	0.336 (0.032, 3.340)
Isolation + Iodine Rinse vs. Sodium Perborate-Ascorbic Acid Rinse	0.297 (0.029, 2.956)
Isolation + Chlorhexidine Rinse vs. Sodium Perborate-Ascorbic Acid Rinse	0.091 (0.007, 0.987)
Placebo Rinse vs. Phenolated Rinse	1.852 (0.359, 9.290)
Operative Field Isolation vs. Phenolated Rinse	0.271 (0.032, 2.172)
Isolation + Iodine Rinse vs. Phenolated Rinse	0.240 (0.028, 1.919)
Isolation + Chlorhexidine Rinse vs. Phenolated Rinse	0.073 (0.007, 0.648)
Operative Field Isolation vs. Placebo Rinse	0.146 (0.022, 0.921)
Isolation + Iodine Rinse vs. Placebo Rinse	0.129 (0.019, 0.819)
Isolation + Chlorhexidine Rinse vs. Placebo Rinse	0.039 (0.005, 0.277)
Isolation + Iodine Rinse vs. Operative Field Isolation	0.883 (0.181, 4.271)
Isolation + Chlorhexidine Rinse vs. Operative Field Isolation	0.271 (0.046, 1.478)
Isolation + Chlorhexidine Rinse vs. Isolation + Iodine Rinse	0.306 (0.052, 1.677)

Table 35 Indirect (Network) Significant Comparisons of Topical Antimicrobial Prophylaxes for the Prevention of Dental-related Bacteremia

Comparison
Chlorhexidine Rinse vs. No Treatment
Povidone-Iodine Rinse vs. No Treatment
Chloramine T Rinse/Brush vs. No Treatment
Hydrogen Peroxide Rinse vs. No Treatment
Sodium Perborate-Ascorbic Acid Rinse vs. No Treatment
Phenolated Rinse vs. No Treatment
Operative Field Isolation vs. No Treatment
Isolation + Iodine Rinse vs. No Treatment
Isolation + Chlorhexidine Rinse vs. No Treatment
Chlorhexidine Rinse vs. Saline Rinse
Povidone-Iodine Rinse vs. Saline Rinse
Sodium Perborate-Ascorbic Acid Rinse vs. Saline Rinse
Phenolated Rinse vs. Saline Rinse
Operative Field Isolation vs. Saline Rinse
Isolation + Iodine Rinse vs. Saline Rinse
Isolation + Chlorhexidine Rinse vs. Saline Rinse
Isolation + Chlorhexidine Rinse vs. Chlorhexidine Rinse
Povidone-Iodine Rinse vs. Placebo Rinse
Isolation + Chlorhexidine Rinse vs. Povidone-Iodine Rinse
Isolation + Chlorhexidine Rinse vs. Lugol's Solution Rinse
Isolation + Chlorhexidine Rinse vs. Hydrogen Peroxide Rinse
Isolation + Chlorhexidine Rinse vs. Sodium Perborate-Ascorbic Acid Rinse
Isolation + Chlorhexidine Rinse vs. Phenolated Rinse
Operative Field Isolation vs. Placebo Rinse
Isolation + Iodine Rinse vs. Placebo Rinse
Isolation + Chlorhexidine Rinse vs. Placebo Rinse

Figure 40 Forest Plot of Indirect (Network) Comparisons of Topical Antimicrobials vs. No Treatment for the Prevention of Dental-related Bacteremia

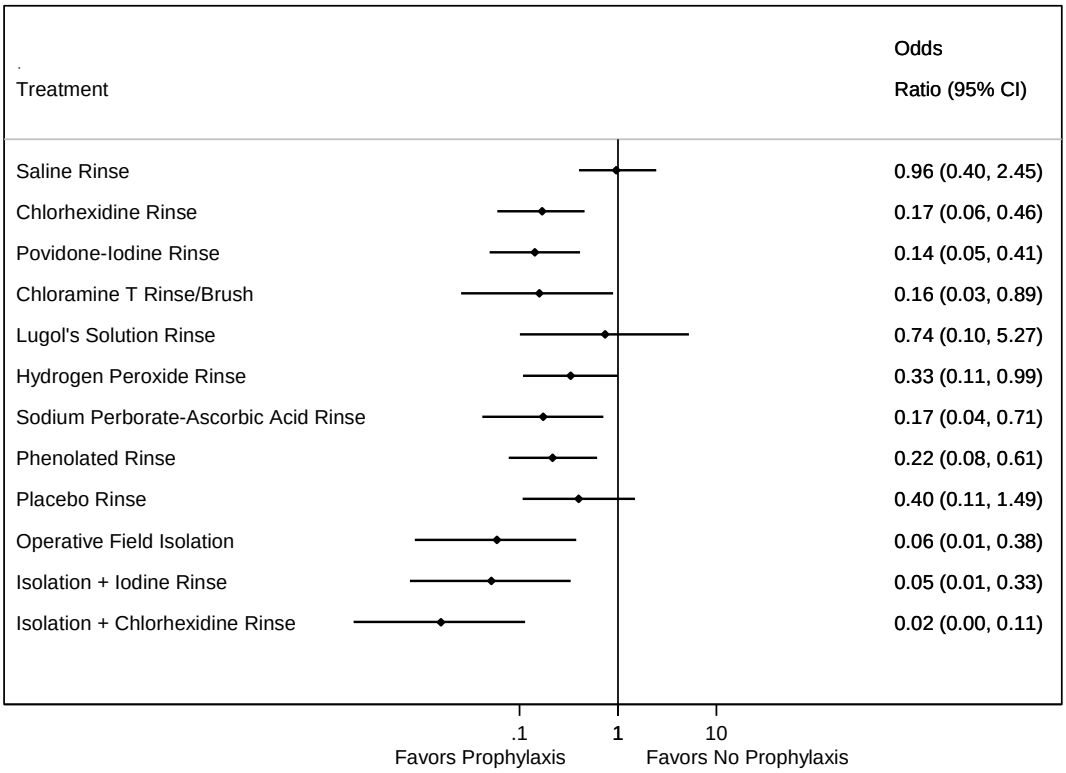


Table 36 Conversion of Odds Ratio from Figure 40 to Number Needed to Treat (NNT)

Treatment	NNT
Saline Rinse	70.0
Chlorhexidine Rinse	2.5
Povidone-Iodine Rinse	2.3
Chloramine T Rinse/Brush	2.5
Lugol's Solution Rinse	11.7
Hydrogen Peroxide Rinse	3.9
Sodium Perborate-Ascorbic Acid Rinse	2.5
Phenolated Rinse	2.8
Placebo Rinse	n/a
Operative Field Isolation	1.8
Isolation + Iodine Rinse	1.8
Isolation + Chlorhexidine Rinse	1.5

Table 37 Network Meta-Analysis Rankings of Topical Antimicrobial Prophylaxes for the Prevention of Dental-related Bacteremia

Prophylaxis	Rank 1 (Best)	2	3	4	5	6	7	8	9	10	11	12	13 (Worst)
None	0%	0%	0%	0%	0%	0%	0%	0%	1%	3%	20%	45%	32%
Saline Rinse	0%	0%	0%	0%	0%	0%	0%	1%	2%	7%	25%	34%	31%
Chlorhexidine Rinse	0%	1%	4%	11%	20%	23%	19%	13%	6%	2%	0%	0%	0%
Povidone-Iodine Rinse	0%	1%	4%	25%	27%	20%	13%	7%	3%	1%	0%	0%	0%
Chloramine T Rinse/Brush	3%	8%	9%	16%	11%	10%	10%	11%	10%	8%	2%	1%	0%
Lugol's Solution Rinse	0%	0%	1%	1%	2%	2%	3%	5%	8%	13%	21%	11%	32%
Hydrogen Peroxide Rinse	0%	0%	1%	2%	3%	6%	10%	16%	25%	23%	10%	2%	1%
Sodium Perborate-Ascorbic Acid Rinse	1%	5%	7%	14%	13%	13%	13%	12%	10%	6%	3%	1%	0%
Phenolated Rinse	0%	2%	3%	8%	11%	15%	18%	18%	14%	8%	3%	0%	0%
Placebo Rinse	0%	0%	0%	1%	1%	4%	8%	13%	21%	28%	16%	5%	3%
Operative Field Isolation	4%	31%	37%	12%	6%	4%	2%	2%	1%	1%	0%	0%	0%
Isolation + Iodine Rinse	6%	41%	31%	10%	4%	3%	2%	1%	1%	0%	0%	0%	0%
Isolation + Chlorhexidine Rinse	84%	11%	3%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%

RECOMMENDATION 3

In the absence of reliable evidence linking poor oral health to prosthetic joint infection, it is the opinion of the work group that patients with prosthetic joint implants or other orthopaedic implants maintain appropriate oral hygiene.

Grade of Recommendation: Consensus

Description: The supporting evidence is lacking and requires the work group to make a recommendation. A **Consensus** recommendation means that expert opinion supports the guideline recommendation even though there is no available empirical evidence that meets the inclusion criteria.

Implications: Practitioners should be flexible in deciding whether to follow a recommendation classified as **Consensus,** although they may set boundaries on alternatives. Patient preference should have a substantial influencing role.

RATIONALE

The lack of evidence relating oral bacteremias to prosthetic joint or other orthopaedic implant infections is the basis for the consensus rationale for this recommendation.

Oral hygiene measures are low cost, provide potential benefit, are consistent with current practice, and are in accordance with good oral health.

There is evidence of the relationship of oral microflora to bacteremia. This bacteremia may be associated with poor oral hygiene. This implies that improvement of oral hygiene (or maintenance of good oral hygiene) may be beneficial in reducing bacteremias.

FINDINGS

No direct evidence was found in support of Recommendation 3. However, several prognostic studies of indirect evidence are included that explore whether or not oral health status can predict development of bacteremia after dental procedures. These low strength studies address oral health indicators as potential risk factors for developing bacteremia as a result of undergoing a dental procedure. The results of these studies are inconsistent and summarized in the results section below. See Table 38 for a summary of study results and Table 39 - Table 47 for more detail. By optimizing oral health, one could eliminate these potential risk factors and therefore reduce their risk of developing a dental procedure related bacteremia.

QUALITY AND APPLICABILITY

Refer to Table 88 - Table 96 in Appendix XII.

Table 38 Summary of Oral Health Related Risk Factor (Proportion of studies that reported significant results)

	Brushing	Chewing	Dental Prophylaxis	Inter-dental Cleaning	Intubation	Oral Surgery	Periodontic	Restorative	Tooth Extraction
Risk Factor	**Results (%Significant, n/N)**								
# Teeth Present						0%, 0/1	0%, 0/1		
Abscess						0%, 0/1			0%, 0/2
Apical Lucency	0%, 0/1								0%, 0/1
Calculus Index/Score	100%, 1/1								0%, 1/1
Caries	0%, 0/1							0%, 0/1	0%, 0/1
Caries Depth	0%, 0/1							0%, 0/1	0%, 0/1
Clinical Attachment Loss				0%, 0/1					
Gingival Index/Score	25%, 1/4		100%, 1/1	0%, 0/1		50%, 1/2		100%, 1/1	67%, 2/3
Gingival Size								0%, 0/1	
Gingivitis	0%, 0/1	0%, 0/1	0%, 0/1						
Infected Tooth						100%, 1/1			
Odontogenic Disease									0%, 0/1
Oral Health Status					0%, 0/1	0%, 0/1			50%, 1/2
Periodontal Diagnosis			0%, 0/1						0%, 0/1
Periodontitis	0%, 0/1	0%, 0/1	100%, 1/1	0%, 0/1			50%, 1/2	0%, 0/1	
Plaque Index/Score	67%, 2/3		50%, 1/2	0%, 0/1		0%, 0/1			0%, 0/3
Probing Depth			0%, 0/2	0%, 0/1			0%, 0/1		33%, 1/3
Probing Depth Mean	0%, 0/1						100%, 1/1		0%, 0/1
Radiolucency								0%, 0/1	
Recession			0%, 0/1						

	Brushing	Chewing	Dental Prophylaxis	Inter-dental Cleaning	Intubation	Oral Surgery	Periodontic	Restorative	Tooth Extraction
Suppuration								0%, 0/1	
Swelling								0%, 0/1	
Tooth Mobility	0%, 0/1								0%, 0/1

Table 39 Oral Health Related Risk Factors for Brushing Bacteremia

Author	Strength	N	Statistical Test	Outcome	Risk Factor	Results
Ashare 2009	Low	48	Linear regression	Bacteremia (Bacterial Load @ 30s, 5m, 15m)	Plaque Index	p<0.01 @ 30s & 5m, NS @ 15m
Bhanji 2002	Low	50	logistic regression	Bacteremia	Plaque Score	OR 1.05, p=0.44
Lockhart 2009	Low	98	logistic regression	Bacteremia (Infective Endocarditis related bacteria)	Mean plaque score	OR 2.53 p=.010
Lockhart 2009	Low	98	logistic regression	Bacteremia (Infective Endocarditis related bacteria)	Plaque score ≥ 2	OR 3.78 p=.008
Ashare 2009	Low	48	Linear regression	Bacteremia (Bacterial Load @ 30s, 5m, 15m)	Gingival Index	NS for all time points
Bhanji 2002	Low	50	chi square	Bacteremia	Gingival Score	p=0.96
Lockhart 2009	Low	98	logistic regression	Bacteremia (Infective Endocarditis related bacteria)	Mean gingival score	OR 1.62 p=.203
Lockhart 2009	Low	98	logistic regression	Bacteremia (Infective Endocarditis related bacteria)	Gingival score ≥ 2	OR 1.61 p=.335
Silver 1977	Low	96	Critical ratio test	Bacteremia	Gingival Index	p<.01
Forner 2006	Low	20	Fishers exact test	Bacteremia	Gingivitis	NS
Forner 2006	Low	20	Fishers exact test	Bacteremia	Periodontitis	NS
Lockhart 2009	Low	98	logistic regression	Bacteremia (Infective Endocarditis related bacteria)	Mean calculus score	OR 1.77 p=.048
Lockhart 2009	Low	98	logistic regression	Bacteremia (Infective Endocarditis related bacteria)	Calculus score ≥ 2	OR 4.43 p=.004
Lockhart 2009	Low	98	logistic regression	Bacteremia (Infective Endocarditis related bacteria)	Bleeding with toothbrushing	OR 0.89 p=.810

Author	Strength	N	Statistical Test	Outcome	Risk Factor	Results
Lockhart 2009	Low	98	logistic regression	Bacteremia (Infective Endocarditis related bacteria)	Bleeding type with toothbrushing	OR 7.96 p=.015
Lockhart 2009	Low	98	logistic regression	Bacteremia (Infective Endocarditis related bacteria)	Mean probing depth	OR 1.02 p=.918
Lockhart 2009	Low	98	logistic regression	Bacteremia (Infective Endocarditis related bacteria)	Tooth mobility score	OR 1.93 p=.200
Lockhart 2009	Low	98	logistic regression	Bacteremia (Infective Endocarditis related bacteria)	Dental caries	OR 4.40 p=.165
Lockhart 2009	Low	98	logistic regression	Bacteremia (Infective Endocarditis related bacteria)	Depth of dental caries	OR 0.43 p=.155
Lockhart 2009	Low	98	logistic regression	Bacteremia (Infective Endocarditis related bacteria)	Apical lucency	OR 2.37 p=.086
Lockhart 2009	Low	98	logistic regression	Bacteremia (Infective Endocarditis related bacteria)	Apical lucency size (mm)	OR 0.87 p=.647

Table 40 Oral Health Related Risk Factors for Chewing Bacteremia

Author	Strength	N	Statistical Test	Outcome	Risk Factor	Results
Forner 2006	Very Low	20	Fisher's exact test	Bacteremia	Periodontitis	NS
Forner 2006	Very Low	20	Fisher's exact test	Bacteremia	Gingivitis	NS

Table 41 Oral Health Related Risk Factors for Dental Prophylaxis Bacteremia

Author	Strength	N	Statistical Test	Outcome	Risk Factor	Results
Cherry 2007	Low	60	Logistic regression	Bacteremia	Plaque Index	NS
Forner 2006	Low	20	Spearman's correlation coefficients	Bacteremia (magnitude)	Plaque Index	0.41 p=.0117
Cherry 2007	Low	60	Logistic regression	Bacteremia	Modified papilla, margin, attached gingiva index	NS

Author	Strength	N	Statistical Test	Outcome	Risk Factor	Results
Cherry 2007	Low	60	Logistic regression	Bacteremia	Probing depth	NS
Cherry 2007	Low	60	Logistic regression	Bacteremia	Recession	NS
Cherry 2007	Low	60	Logistic regression	Bacteremia	Bleeding on scaling	NS
Forner 2006	Low	20	Fishers exact test	Bacteremia	Periodontitis	p<.001
Forner 2006	Low	20	Spearman's correlation coefficients	Bacteremia (magnitude)	Periodontal diagnosis	NS
Forner 2006	Low	20	Fishers exact test	Bacteremia	Gingivitis	NS
Forner 2006	Low	20	Spearman's correlation coefficients	Bacteremia (magnitude)	Gingival Index	0.53 p<.0001
Forner 2006	Low	20	Spearman's correlation coefficients	Bacteremia (magnitude)	Bleeding on probing	0.45 p=.0089
Forner 2006	Low	20	Spearman's correlation coefficients	Bacteremia (magnitude)	Probing pocket depth >5	NS
Forner 2006	Low	20	Spearman's correlation coefficients	Bacteremia (magnitude)	Pocket sum score	NS

Table 42 Oral Health Related Risk Factors for Inter-dental Cleaning Bacteremia

Author	Strength	N	Statistical Test	Outcome	Risk Factor	Results
Crasta 2009	Low	60	Spearman's correlation coefficients	Bacteremia	Periodontitis	0.17 p=.2
Crasta 2009	Low	60	Spearman's correlation coefficients	Bacteremia	Gingival Index	0.22 p=.09
Crasta 2009	Low	60	Spearman's correlation coefficients	Bacteremia	Plaque Index	0.07 p=.6
Crasta 2009	Low	60	Spearman's correlation coefficients	Bacteremia	% of sites bleeding on flossing	0.17 p=.2
Crasta 2009	Low	60	Spearman's correlation coefficients	Bacteremia	# sites bleeding on flossing	0.17 p=.2
Crasta 2009	Low	60	Spearman's correlation coefficients	Bacteremia	% of sites bleeding on probing	0.16 p=.2

Author	Strength	N	Statistical Test	Outcome	Risk Factor	Results
Crasta 2009	Low	60	Spearman's correlation coefficients	Bacteremia	Pocket depth	0.09 p=.5
Crasta 2009	Low	60	Spearman's correlation coefficients	Bacteremia	Clinical attachment loss	0.06 p=.6
Crasta 2009	Low	60	Spearman's correlation coefficients	Bacteremia	Self-reported daily flossing	−0.12 p=.4

Table 43 Oral Health Related Risk Factors for Intubation Bacteremia

Author	Strength	N	Statistical Test	Outcome	Risk Factor	Results
Valdes 2008	Low	110	Logistic regression	Bacteremia	Oral health status	NS

Table 44 Oral Health Related Risk Factors for Oral Surgery Bacteremia

Author	Strength	N	Statistical Test	Outcome	Risk Factor	Results
Roberts 1998	Low	154	chi-square	Bacteremia	Abscess	1.878 p=.1706
Roberts 1998	Low	154	Pearson correlation coefficient	Bacteremia	Age	0.29
Tomas 2008	Low	100	not reported	Bacteremia	Age	NS
Roberts 1998	Low	154	Scheffe's multiple comparison	Bacteremia	Plaque Index	p=.47
Roberts 1998	Low	154	Scheffe's multiple comparison	Bacteremia	Gingival Index	p<.03
Takai 2005	Low	237	chi-square	Bacteremia	Gingival Index	NS
Roberts 1998	Low	154	Scheffe's multiple comparison	Bacteremia	Bleeding Index	p<.04
Takai 2005	Low	237	chi-square	Bacteremia	Oral hygiene index simplified	NS
Takai 2005	Low	237	chi-square	Bacteremia	# teeth present	NS
Takai 2005	Low	237	chi-square	Bacteremia	Blood loss	NS
Takai 2005	Low	237	chi-square	Bacteremia	Infection in extracted tooth (periodontitis, periapical infection, and pericoronitis)	p<.01

Table 45 Oral Health Related Risk Factors for Periodontic Bacteremia

Author	Strength	N	Statistical Test	Outcome	Risk Factor	Results
Daly 1997	Low	30	chi-square	Bacteremia	Periodontitis severity	p=.9
Daly 2001	Low	40	logistic regression	Bacteremia	Periodontitis	OR 5.993 CI=1.081-33.215
Daly 1997	Low	30	t-test	Bacteremia	Bleeding on probing	p=.3
Daly 2001	Low	40	logistic regression	Bacteremia	Bleeding on probing	OR 1.025 CI=1.004-1.047
Daly 2001	Low	40	logistic regression	Bacteremia	# of teeth	OR 1.0 CI=.845-1.185
Daly 2001	Low	40	logistic regression	Bacteremia	Total probing depth	OR 1.006 CI=.999-1.013
Daly 2001	Low	40	logistic regression	Bacteremia	Plaque index	OR 3.154 CI=.603-16.514
Daly 2001	Low	40	logistic regression	Bacteremia	Mean probing depth per tooth	OR 1.444 CI=.1.055-1.977

Table 46 Oral Health Related Risk Factors for Restorative Bacteremia

Author	Strength	N	Statistical Test	Outcome	Risk Factor	Results
Brennan 2007	Very Low	51	chi-square or fisher's exact	Bacteremia	Gingival Score (0-3)	p=.01
Brennan 2007	Very Low	51	chi-square or fisher's exact	Bacteremia	Gingival Size (0-3)	NS
Brennan 2007	Very Low	51	chi-square or fisher's exact	Bacteremia	Periodontal disease with probing >3mm	NS
Brennan 2007	Very Low	51	chi-square or fisher's exact	Bacteremia	Mixed Dentition	p=.08
Brennan 2007	Very Low	51	chi-square or fisher's exact	Bacteremia	Caries Present	NS
Brennan 2007	Very Low	51	chi-square or fisher's exact	Bacteremia	Depth of caries (0-3)	NS
Brennan 2007	Very Low	51	chi-square or fisher's exact	Bacteremia	Periapical radiolucency	NS
Brennan 2007	Very Low	51	chi-square or fisher's exact	Bacteremia	Size radiolucency (mm)	NS
Brennan 2007	Very Low	51	chi-square or fisher's exact	Bacteremia	Swelling	NS

Author	Strength	N	Statistical Test	Outcome	Risk Factor	Results
Brennan 2007	Very Low	51	chi-square or fisher's exact	Bacteremia	Suppuration	NS

Table 47 Oral Health Related Risk Factors for Extraction Bacteremia

Author	Strength	N	Statistical Test	Outcome	Risk Factor	Results
Barbosa 2010	Low	210	logistic regression (univariate)	Bacteremia 30s	Oral health status	OR 3.704 (1.929-7.109)
Barbosa 2010	Low	210	logistic regression (univariate)	Bacteremia 15m	Oral health status	OR 2.047 (1.138-3.683)
Wahlmann 1999	Low	59	logistic regression	Bacteremia	Oral Hygiene	NS
Wahlmann 1999	Low	59	logistic regression	Bacteremia	Periodontal status	NS
Coulter 1990	Low	58	chi-square	Bacteremia	Plaque Index	NS
Lockhart 2009	Low	96	logistic regression	Bacteremia	Mean plaque score	OR 0.74 p=.236
Lockhart 2009	Low	96	logistic regression	Bacteremia	Plaque score ≥ 2	OR 0.90 p=.811
Roberts 1998	Low	154	Scheffe's multiple comparison	Bacteremia	Plaque Index	p=.47
Coulter 1990	Low	58	chi-square	Bacteremia	Gingival Index	NS
Lockhart 2009	Low	96	logistic regression	Bacteremia	Mean gingival score	OR 0.71 p=.217
Lockhart 2009	Low	96	logistic regression	Bacteremia	Gingival score ≥ 2	OR 0.76 p=.518
Roberts 1998	Low	154	Scheffe's multiple comparison	Bacteremia	Gingival Index	p<.03
Coulter 1990	Low	58	Fisher's	Bacteremia	Abscess	p=0.2088
Roberts 1998	Low	154	chi-square	Bacteremia	Abscess	1.878 p=.1706
Lockhart 1996	Low	70	chi-square or Fisher's exact	Bacteremia	Odontogenic disease severity	NS
Lockhart 2009	Low	96	logistic regression	Bacteremia	Mean calculus score	OR 0.93 p=.724
Lockhart 2009	Low	96	logistic regression	Bacteremia	Calculus score ≥ 2	OR 0.82 p=.715
Lockhart 2009	Low	96	logistic regression	Bacteremia	Bleeding with toothbrushing	NA
Lockhart 2009	Low	96	logistic regression	Bacteremia	Bleeding type with toothbrushing	NA

Author	Strength	N	Statistical Test	Outcome	Risk Factor	Results
Okabe 1995	Low	183	Mann-Whitney	Bacteremia	Blood loss (ml)	3997.5 p<.05
Roberts 1998	Low	154	Scheffe's multiple comparison	Bacteremia	Bleeding Index	p<.04
Lockhart 2009	Low	96	logistic regression	Bacteremia	Mean probing depth	OR 0.95 p=.735
Lockhart 2009	Low	96	logistic regression	Bacteremia	Tooth mobility score	OR 1.01 p=.978
Lockhart 2009	Low	96	logistic regression	Bacteremia	Dental caries	OR 1.66 p=.452
Lockhart 2009	Low	96	logistic regression	Bacteremia	Depth of dental caries	OR 0.21 p=.156
Lockhart 2009	Low	96	logistic regression	Bacteremia	Apical lucency	OR 0.86 p=.724
Lockhart 2009	Low	96	logistic regression	Bacteremia	Apical lucency size (mm)	OR 1.00 p=.995

FUTURE RESEARCH

The grades of recommendation in this clinical practice guideline are "limited" at best due to the lack of evidence in some cases and conflicting evidence in others. Only one study that met the inclusion criteria attempted to define the relationship, or lack thereof, between dental procedures and subsequent orthopaedic implant infections and preventive effect of antibiotic prophylaxis. Relying on evidence that does not directly address this relationship to inform clinical practice assumes that bacteremia is an appropriate surrogate outcome for prosthetic joint or other orthopaedic implant associated infection. Additional research is necessary to assess the pros and cons of providing antimicrobial prophylaxis for this study population and definitively determine if there is an association between dental procedures and orthopaedic implant infections.

Specifically:

- Prospective, controlled (ideally randomized), adequately powered trials investigating the effect of prophylactic interventions with the primary outcome of implant infection.
- Research investigating the relationship between bacteremias and orthopaedic implant infection.
- Research determining if bacteremia is an appropriate surrogate outcome for orthopaedic implant infection
- Research investigating the relationship between oral health and orthopaedic implant infection
- Cost-benefit analysis of antimicrobial prophylaxis for patients with orthopaedic implants undergoing dental procedures

APPENDICES

APPENDIX I
WORK GROUP

Prevention of Orthopaedic Implant Infection in Patients Undergoing Dental Procedures Clinical Practice Guideline Work Group

American Academy of Orthopaedic Surgeons
William Watters, III, MD, Co-Chair
Bone and Joint Clinic of Houston
6624 Fannin Street, #2600
Houston, TX 77030

American Dental Association
Michael P. Rethman, DDS, MS, Co-Chair
47-140 Heno Place
Kaneohe, HI 96744

American Academy of Orthopaedic Surgeons
Richard Parker Evans, MD
Professor and Margaret Sue Neal
Endowed Chair of Orthopaedic Surgery
University of Missouri- Kansas City
School of Medicine
2301 Holmes Street
Kansas City, MO 64108

American Academy of Orthopaedic Surgeons
Calin Moucha, MD
Associate Chief, Joint Replacement Surgery
Mount Sinai Medical Center
Assistant Professor
Leni & Peter W. May Department of Orthopaedic Surgery
Mount Sinai School of Medicine
5 E. 98th Street, Box 1188, 7th Floor
New York, NY 10029

American Academy of Orthopaedic Surgeons
Richard J. O'Donnell, MD
Chief, UCSF Orthopaedic Oncology Service
UCSF Sarcoma Program
UCSF Helen Diller Family Comprehensive Cancer Center
1600 Divisadero Street, 4th Floor
San Francisco, CA 94115

American Academy of Orthopaedic Surgeons & Congress of Neurological Surgeons
Paul A. Anderson, MD
Professor Department of Orthopedics & Rehabilitation
University of Wisconsin
K4/735 600 Highland Avenue
Madison WI 53792

American Dental Association
Elliot Abt, DDS
4709 Golf Road, Suite 1005
Skokie, IL 60076

American Dental Association
Harry C. Futrell, DMD
330 W 23rd Street, Suite J
Panama City, FL 32405

American Dental Association
Stephen O. Glenn, DDS
5319 S Lewis Avenue, Suite 222
Tulsa, OK 74105-6543

American Dental Association
John Hellstein, DDS, MS
The University of Iowa, College of Dentistry
Department of Oral Pathology, Radiology and Medicine, DSB S356
Iowa City, IA 52242

American Association of Hip and Knee Surgeons
David Kolessar, MD
Geisinger Wyoming Valley Medical Center
1000 East Mountain Boulevard
Valley Medical Building
Wilkes-Barre, PA 18711

American Association of Neurological Surgeons/Congress of Neurological Surgeons
John E. O'Toole, MD
Assistant Professor of Neurosurgery
Rush University Medical Center
1725 W. Harrison Street, Suite 970
Chicago, IL 60612

American Association of Oral and Maxillofacial Surgeons
Mark J. Steinberg DDS, MD
1240 Meadow Road, Suite 300
Northbrook, IL 60062

College of American Pathologist
Karen C. Carroll MD, FCAP
Johns Hopkins Hospital
Department of Pathology-Microbiology Division
600 N Wolfe Street
Meyer B1-193
Baltimore, MD 21287

Knee Society
Kevin Garvin, MD
University of Nebraska Medical Center
Creighton/Nebraska Health Fund
Department of Orthopaedic Surgery
981080 Nebraska Medical Center
Omaha, Nebraska 68198-1080

Musculoskeletal Infection Society
Douglas R. Osmon, MD
200 1st Street SW
Rochester, MN 55905

Scoliosis Research Society
Anthony Rinella, MD
Illinois Spine & Scoliosis Center
12701 West 143rd Street, Suite 110
Homer Glen, Illinois 60491

Society for Healthcare Epidemiology of America
Angela Hewlett, MD, MS
Assistant Professor, Section of Infectious Diseases
University of Nebraska Medical Center
985400 Nebraska Medical Center
Omaha, Nebraska 68198

Guidelines Oversight Chair
Michael J. Goldberg, MD
Children's Hospital and Regional Medical Center
1221 1st Avenue, Apt #24E
Seattle, WA 98101

AAOS Staff
Deborah S. Cummins, PhD
Director, Research and Scientific Affairs
6300 N. River Road
Rosemont, IL 60018

Sharon Song, PhD
Manager, Clinical Practice Guidelines

Patrick Sluka, MPH
Former AAOS Lead Research Analyst

Kevin Boyer, MPH
Former Appropriate Use Criteria Unit Manager
Former Interim Clinical Practice Guidelines Manager

Anne Woznica, MLIS
Medical Research Librarian

ADA Staff
Helen Ristic, PhD.
Director, Scientific Information
ADA Division of Science
211 E. Chicago Avenue
Chicago, IL 60611

Nicholas Buck Hanson, MPH
ADA Lead Research Analyst
hansonn@ada.org

Special Recognitions
William Robert Martin, III, MD
American Academy of Orthopaedic Surgeons
Medical Director
317 Massachusetts Avenue NE
Washington, D.C. 20002-5769

APPENDIX II
CREATING PRELIMINARY RECOMMENDATIONS

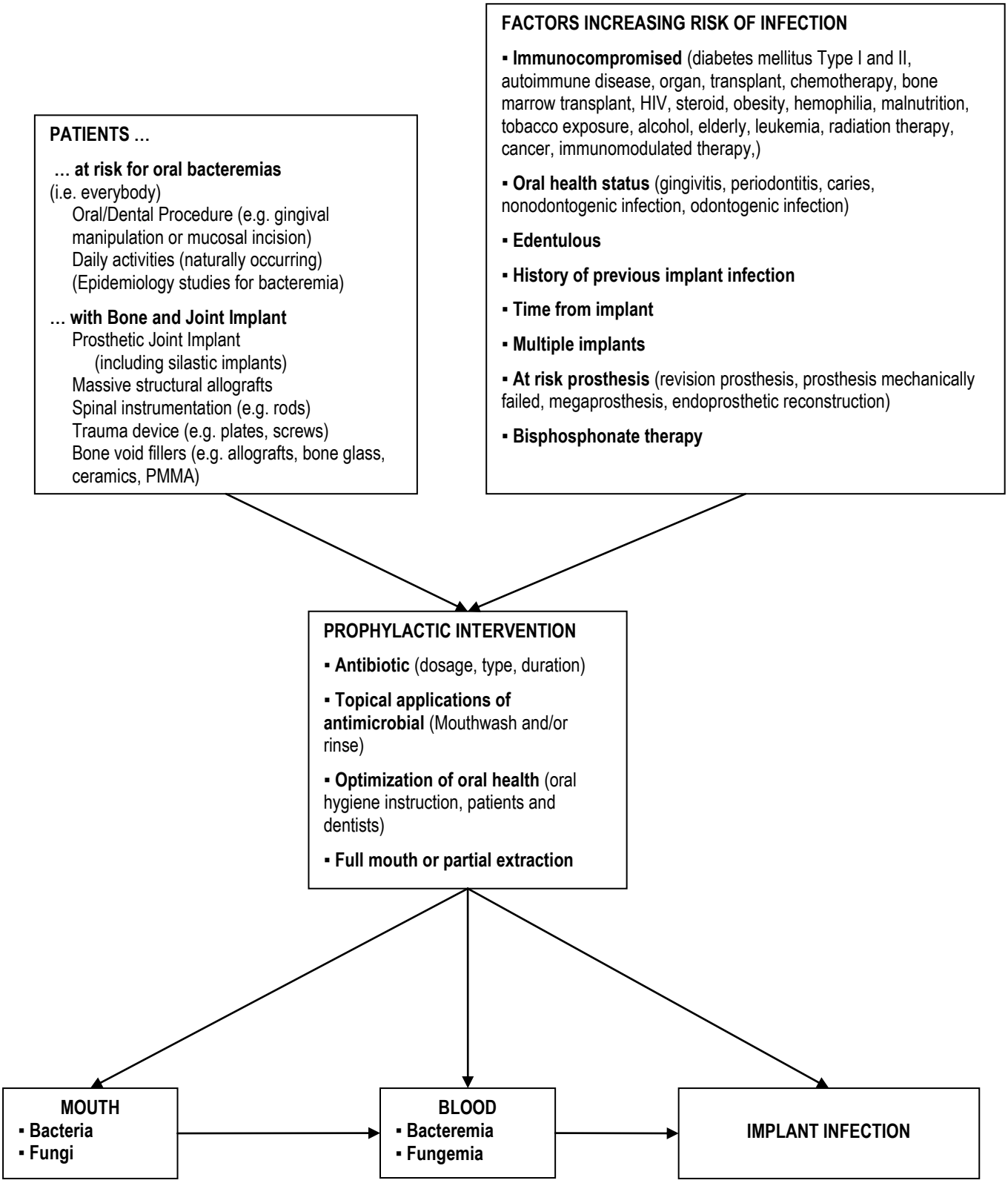
In an effort to ensure the broadest literature search possible and to evaluate the many aspects related to preventing orthopaedic implant infection in patients undergoing dental procedures, the work group constructed a causal pathway for orthopaedic implant infection consisting of the following factors:

- Patients
- Patient Characteristics Increasing Risk of Infection
- Prophylactic Interventions
- Effect of Intervention on:
    - Bacteria/Fungi in the Mouth
    - Bacteremia/Fungemia in the Blood
    - Implant Infection

The factors and their components were then combined to create a series of questions from which our literature searches were derived. The components of each factor listed above are illustrated in the figure below. The questions for which we derived our literature searches are listed below.

Preliminary recommendations were then created based on the interventions selected for the causal pathway. Remaining questions not directly related to an intervention (e.g. questions about no intervention, the relationship between bacteremia and implant infection) were assessed in order to further inform the discussion among work group members when they met at the final recommendation meeting.

Causal Pathway



Questions Derived from Causal Pathway

Relationships Between Mouth, Blood, and Implant Infection

1. What is the relationship between bacteria in the mouth and implant infection?

2. What is the relationship between fungi in the mouth and implant infection?

3. What is the relationship between bacteria in the mouth (after an oral/dental procedure) and bacteremia?

4. What is the relationship between fungi in the mouth (after an oral/dental procedure) and fungemia?

5. What is the relationship between bacteremia from an oral source after an oral/dental procedure and implant infection?

6. What is the relationship between fungemia from an oral source after an oral/dental procedure and implant infection?

Patients Without Bone and Joint Implants

7. In patients without an implant having an oral/dental procedure or undertaking daily activities who have immunocompromising factors, what are the incidence, nature, duration, and magnitude of bacteria in the mouth?

8. In patients without an implant having an oral/dental procedure or undertaking daily activities who have immunocompromising factors, what are the incidence, nature, duration, and magnitude of fungi in the mouth?

9. In patients without an implant having an oral/dental procedure or undertaking daily activities who have immunocompromising factors, what are the incidence, nature, duration, and magnitude of bacteremia in the blood?

10. In patients without an implant having an oral/dental procedure or undertaking daily activities who have immunocompromising factors, what are the incidence, nature, duration, and magnitude of fungemia in the blood?

11. In patients without an implant having an oral/dental procedure or undertaking daily activities and who have Poor/Good oral health status, what are the incidence, nature, duration, and magnitude of bacteria in the mouth?

12. In patients without an implant having an oral/dental procedure or undertaking daily activities and who have Poor/Good oral health status, what are the incidence, nature, duration, and magnitude of fungi in the mouth?

13. In patients without an implant having an oral/dental procedure or undertaking daily activities and who have Poor/Good oral health status, what are the incidence, nature, duration, and magnitude of bacteremia in the blood?

14. In patients without an implant having an oral/dental procedure or undertaking daily activities and who have Poor/Good oral health status, what are the incidence, nature, duration, and magnitude of fungemia in the blood?

15. In patients without an implant having an oral/dental procedure or undertaking daily activities and who have no teeth (edentulous), what are the incidence, nature, duration, and magnitude of bacteria in the mouth?

16. In patients without an implant having an oral/dental procedure or undertaking daily activities and who have no teeth (edentulous), what are the incidence, nature, duration, and magnitude of fungi in the mouth?

17. In patients without an implant having an oral/dental procedure or undertaking daily activities and who have no teeth (edentulous), what are the incidence, nature, duration, and magnitude of bacteremia in the blood?

18. In patients without an implant having an oral/dental procedure or undertaking daily activities and who have no teeth (edentulous), what are the incidence, nature, duration, and magnitude of fungemia in the blood?

19. In patients without an implant having an oral/dental procedure or undertaking daily activities and who have bisphosphonate therapy, what are the incidence, nature, duration, and magnitude of bacteria in the mouth?

20. In patients without an implant having an oral/dental procedure or undertaking daily activities and who have bisphosphonate therapy, what are the incidence, nature, duration, and magnitude of fungi in the mouth?

21. In patients without an implant having an oral/dental procedure or undertaking daily activities and who have bisphosphonate therapy, what are the incidence, nature, duration, and magnitude of bacteremia in the blood?

22. In patients without an implant having an oral/dental procedure or undertaking daily activities and who have bisphosphonate therapy, what are the incidence, nature, duration, and magnitude of fungemia in the blood?

Patients With Bone and Joint Implants

23. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have immunocompromising factors, what is the effect of no intervention on the incidence, nature, duration, and magnitude of bacteria in the mouth?

24. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have immunocompromising factors, what is the effect of no intervention on the incidence, nature, duration, and magnitude of fungi in the mouth?

25. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have immunocompromising factors, what is the effect of no intervention on the incidence, nature, duration, and magnitude of bacteremia?

26. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have immunocompromising factors, what is the effect of no intervention on the incidence, nature, duration, and magnitude of fungemia?

27. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have immunocompromising factors, what is the effect of no intervention on the incidence, nature, duration, and magnitude of implant infection?

28. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have immunocompromising factors, what is the effect of antibiotic prophylaxis on the incidence, nature, duration, and magnitude of bacteria in the mouth?

29. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have immunocompromising factors, what is the effect of antibiotic prophylaxis on the incidence, nature, duration, and magnitude of fungi in the mouth?

30. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have immunocompromising factors, what is the effect of antibiotic prophylaxis on the incidence, nature, duration, and magnitude of bacteremia?

31. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have immunocompromising factors, what is the effect of antibiotic prophylaxis on the incidence, nature, duration, and magnitude of fungemia?

32. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have immunocompromising factors, what is the effect of antibiotic prophylaxis on the incidence, nature, duration, and magnitude of implant infection?

33. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have immunocompromising factors, what is the effect of topical application of antimicrobials on the incidence, nature, duration, and magnitude of bacteria in the mouth?

34. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have immunocompromising factors, what is the effect of topical application of antimicrobials on the incidence, nature, duration, and magnitude of fungi in the mouth?

35. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have immunocompromising factors, what is the effect of topical application of antimicrobials on the incidence, nature, duration, and magnitude of bacteremia?

36. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have immunocompromising factors, what is the effect of topical application of antimicrobials on the incidence, nature, duration, and magnitude of fungemia?

37. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have immunocompromising factors, what is the effect of topical application of antimicrobials on the incidence, nature, duration, and magnitude of implant infection?

38. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have immunocompromising factors, what is the effect of optimization of oral health instructions on the incidence, nature, duration, and magnitude of bacteria in the mouth?

39. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have immunocompromising factors, what is the effect of optimization of oral health instructions on the incidence, nature, duration, and magnitude of fungi in the mouth?

40. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have immunocompromising factors, what is the effect of optimization of oral health instructions on the incidence, nature, duration, and magnitude of bacteremia?

41. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have immunocompromising factors, what is the effect of optimization of oral health instructions on the incidence, nature, duration, and magnitude of fungemia?

42. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have immunocompromising factors, what is the effect of optimization of oral health instructions on the incidence, nature, duration, and magnitude of implant infection?

43. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have immunocompromising factors, what is the effect of extraction (full or partial mouth) on the incidence, nature, duration, and magnitude of bacteria in the mouth?

44. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have immunocompromising factors, what is the effect of extraction (full or partial mouth) on the incidence, nature, duration, and magnitude of fungi in the mouth?

45. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have immunocompromising factors, what is the effect of extraction (full or partial mouth) on the incidence, nature, duration, and magnitude of bacteremia?

46. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have immunocompromising factors, what is the effect of extraction (full or partial mouth) on the incidence, nature, duration, and magnitude of fungemia?

47. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have immunocompromising factors, what is the effect of extraction (full or partial mouth) on the incidence, nature, duration, and magnitude of implant infection?

48. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have Poor/Good oral health status, what is the effect of no intervention on the incidence, nature, duration, and magnitude of bacteria in the mouth?

49. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have Poor/Good oral health status, what is the effect of no intervention on the incidence, nature, duration, and magnitude of fungi in the mouth?

50. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have Poor/Good oral health status, what is the effect of no intervention on the incidence, nature, duration, and magnitude of bacteremia?

51. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have Poor/Good oral health status, what is the effect of no intervention on the incidence, nature, duration, and magnitude of fungemia?

52. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have Poor/Good oral health status, what is the effect of no intervention on the incidence, nature, duration, and magnitude of implant infection?

53. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have Poor/Good oral health status, what is the effect of antibiotic prophylaxis on the incidence, nature, duration, and magnitude of bacteria in the mouth?

54. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have Poor/Good oral health status, what is the effect of antibiotic prophylaxis on the incidence, nature, duration, and magnitude of fungi in the mouth?

55. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have Poor/Good oral health status, what is the effect of antibiotic prophylaxis on the incidence, nature, duration, and magnitude of bacteremia?

56. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have Poor/Good oral health status, what is the effect of antibiotic prophylaxis on the incidence, nature, duration, and magnitude of fungemia?

57. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have Poor/Good oral health status, what is the effect of antibiotic prophylaxis on the incidence, nature, duration, and magnitude of implant infection?

58. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have Poor/Good oral health status, what is the effect of topical application of antimicrobials on the incidence, nature, duration, and magnitude of bacteria in the mouth?

59. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have Poor/Good oral health status, what is the effect of topical application of antimicrobials on the incidence, nature, duration, and magnitude of fungi in the mouth?

60. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have Poor/Good oral health status, what is the effect of topical application of antimicrobials on the incidence, nature, duration, and magnitude of bacteremia?

61. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have Poor/Good oral health status, what is the effect of topical application of antimicrobials on the incidence, nature, duration, and magnitude of fungemia?

62. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have Poor/Good oral health status, what is the effect of topical application of antimicrobials on the incidence, nature, duration, and magnitude of implant infection?

63. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have Poor/Good oral health status, what is the effect of optimization of oral health instructions on the incidence, nature, duration, and magnitude of bacteria in the mouth?

64. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have Poor/Good oral health status, what is the effect of optimization of oral health instructions on the incidence, nature, duration, and magnitude of fungi in the mouth?

65. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have Poor/Good oral health status, what is the effect of optimization of oral health instructions on the incidence, nature, duration, and magnitude of bacteremia?

66. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have Poor/Good oral health status, what is the effect of optimization of oral health instructions on the incidence, nature, duration, and magnitude of fungemia?

67. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have Poor/Good oral health status, what is the effect of optimization of oral health instructions on the incidence, nature, duration, and magnitude of implant infection?

68. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have Poor/Good oral health status, what is the effect of extraction (full or partial mouth) on the incidence, nature, duration, and magnitude of bacteria in the mouth?

69. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have Poor/Good oral health status, what is the effect of extraction (full or partial mouth) on the incidence, nature, duration, and magnitude of fungi in the mouth?

70. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have Poor/Good oral health status, what is the effect of extraction (full or partial mouth) on the incidence, nature, duration, and magnitude of bacteremia?

71. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have Poor/Good oral health status, what is the effect of extraction (full or partial mouth) on the incidence, nature, duration, and magnitude of fungemia?

72. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have Poor/Good oral health status, what is the effect of extraction (full or partial mouth) on the incidence, nature, duration, and magnitude of implant infection?

73. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have a history of previous implant infection, what is the effect of no intervention on the incidence, nature, duration, and magnitude of bacteria in the mouth?

74. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have a history of previous implant infection, what is the effect of no intervention on the incidence, nature, duration, and magnitude of fungi in the mouth?

75. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have a history of previous implant infection, what is the effect of no intervention on the incidence, nature, duration, and magnitude of bacteremia?

76. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have a history of previous implant infection, what is the effect of no intervention on the incidence, nature, duration, and magnitude of fungemia?

77. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have a history of previous implant infection, what is the effect of no intervention on the incidence, nature, duration, and magnitude of implant infection?

78. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have history of previous implant infection, what is the effect of antibiotic prophylaxis on the incidence, nature, duration, and magnitude of bacteria in the mouth?

79. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have history of previous implant infection, what is the effect of antibiotic prophylaxis on the incidence, nature, duration, and magnitude of fungi in the mouth?

80. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have history of previous implant infection, what is the effect of antibiotic prophylaxis on the incidence, nature, duration, and magnitude of bacteremia?

81. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have history of previous implant infection, what is the effect of antibiotic prophylaxis on the incidence, nature, duration, and magnitude of fungemia?

82. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have history of previous implant infection, what is the effect of antibiotic prophylaxis on the incidence, nature, duration, and magnitude of implant infection?

83. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have history of previous implant infection, what is the effect of topical application of antimicrobials on the incidence, nature, duration, and magnitude of bacteria in the mouth?

84. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have history of previous implant infection, what is the effect of topical application of antimicrobials on the incidence, nature, duration, and magnitude of fungi in the mouth?

85. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have history of previous implant infection, what is the effect of topical application of antimicrobials on the incidence, nature, duration, and magnitude of bacteremia?

86. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have history of previous implant infection, what is the effect of topical application of antimicrobials on the incidence, nature, duration, and magnitude of fungemia?

87. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have history of previous implant infection, what is the effect of topical application of antimicrobials on the incidence, nature, duration, and magnitude of implant infection?

88. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have history of previous implant infection, what is the effect of optimization of oral health instructions on the incidence, nature, duration, and magnitude of bacteria in the mouth?

89. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have history of previous implant infection, what is the effect of optimization of oral health instructions on the incidence, nature, duration, and magnitude of fungi in the mouth?

90. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have history of previous implant infection, what is the effect of optimization of oral health instructions on the incidence, nature, duration, and magnitude of bacteremia?

91. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have history of previous implant infection, what is the effect of optimization of oral health instructions on the incidence, nature, duration, and magnitude of fungemia?

92. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have history of previous implant infection, what is the effect of optimization of oral health instructions on the incidence, nature, duration, and magnitude of implant infection?

93. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have history of previous implant infection, what is the effect of extraction (full or partial mouth) on the incidence, nature, duration, and magnitude of bacteria in the mouth?

94. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have history of previous implant infection, what is the effect of extraction (full or partial mouth) on the incidence, nature, duration, and magnitude of fungi in the mouth?

95. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have history of previous implant infection, what is the effect of extraction (full or partial mouth) on the incidence, nature, duration, and magnitude of bacteremia?

96. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have history of previous implant infection, what is the effect of extraction (full or partial mouth) on the incidence, nature, duration, and magnitude of fungemia?

97. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have history of previous implant infection, what is the effect of extraction (full or partial mouth) on the incidence, nature, duration, and magnitude of implant infection?

98. In patients with an implant having an oral/dental procedure or undertaking daily activities and [insert duration] since implant surgery, what is the effect of no intervention on the incidence, nature, duration, and magnitude of bacteria in the mouth?

99. In patients with an implant having an oral/dental procedure or undertaking daily activities and [insert duration] since implant surgery, what is the effect of no intervention on the incidence, nature, duration, and magnitude of fungi in the mouth?

100. In patients with an implant having an oral/dental procedure or undertaking daily activities and [insert duration] since implant surgery, what is the effect of no intervention on the incidence, nature, duration, and magnitude of bacteremia?

101. In patients with an implant having an oral/dental procedure or undertaking daily activities and [insert duration] since implant surgery, what is the effect of no intervention on the incidence, nature, duration, and magnitude of fungemia?

102. In patients with an implant having an oral/dental procedure or undertaking daily activities and [insert duration] since implant surgery, what is the effect of no intervention on the incidence, nature, duration, and magnitude of implant infection?

103. In patients with an implant having an oral/dental procedure or undertaking daily activities and [insert duration] since implant surgery, what is the effect of antibiotic prophylaxis on the incidence, nature, duration, and magnitude of bacteria in the mouth?

104. In patients with an implant having an oral/dental procedure or undertaking daily activities and [insert duration] since implant surgery, what is the effect of antibiotic prophylaxis on the incidence, nature, duration, and magnitude of fungi in the mouth?

105. In patients with an implant having an oral/dental procedure or undertaking daily activities and [insert duration] since implant surgery, what is the effect of antibiotic prophylaxis on the incidence, nature, duration, and magnitude of bacteremia?

106. In patients with an implant having an oral/dental procedure or undertaking daily activities and [insert duration] since implant surgery, what is the effect of antibiotic prophylaxis on the incidence, nature, duration, and magnitude of fungemia?

107. In patients with an implant having an oral/dental procedure or undertaking daily activities and [insert duration] since implant surgery, what is the effect of antibiotic prophylaxis on the incidence, nature, duration, and magnitude of implant infection?

108. In patients with an implant having an oral/dental procedure or undertaking daily activities and [insert duration] since implant surgery, what is the effect of topical application of antimicrobials on the incidence, nature, duration, and magnitude of bacteria in the mouth?

109. In patients with an implant having an oral/dental procedure or undertaking daily activities and [insert duration] since implant surgery, what is the effect of topical application of antimicrobials on the incidence, nature, duration, and magnitude of fungi in the mouth?

110. In patients with an implant having an oral/dental procedure or undertaking daily activities and [insert duration] since implant surgery, what is the effect of topical application of antimicrobials on the incidence, nature, duration, and magnitude of bacteremia?

111. In patients with an implant having an oral/dental procedure or undertaking daily activities and [insert duration] since implant surgery, what is the effect of topical application of antimicrobials on the incidence, nature, duration, and magnitude of fungemia?

112. In patients with an implant having an oral/dental procedure or undertaking daily activities and [insert duration] since implant surgery, what is the effect of topical application of antimicrobials on the incidence, nature, duration, and magnitude of implant infection?

113. In patients with an implant having an oral/dental procedure or undertaking daily activities and [insert duration] since implant surgery, what is the effect of optimization of oral health instructions on the incidence, nature, duration, and magnitude of bacteria in the mouth?

114. In patients with an implant having an oral/dental procedure or undertaking daily activities and [insert duration] since implant surgery, what is the effect of optimization of oral health instructions on the incidence, nature, duration, and magnitude of fungi in the mouth?

115. In patients with an implant having an oral/dental procedure or undertaking daily activities and [insert duration] since implant surgery, what is the effect of optimization of oral health instructions on the incidence, nature, duration, and magnitude of bacteremia?

116. In patients with an implant having an oral/dental procedure or undertaking daily activities and [insert duration] since implant surgery, what is the effect of optimization of oral health instructions on the incidence, nature, duration, and magnitude of fungemia?

117. In patients with an implant having an oral/dental procedure or undertaking daily activities and [insert duration] since implant surgery, what is the effect of optimization of oral health instructions on the incidence, nature, duration, and magnitude of implant infection?

118. In patients with an implant having an oral/dental procedure or undertaking daily activities and [insert duration] since implant surgery, what is the effect of extraction (full or partial mouth) on the incidence, nature, duration, and magnitude of bacteria in the mouth?

119. In patients with an implant having an oral/dental procedure or undertaking daily activities and [insert duration] since implant surgery, what is the effect of extraction (full or partial mouth) on the incidence, nature, duration, and magnitude of fungi in the mouth?

120. In patients with an implant having an oral/dental procedure or undertaking daily activities and [insert duration] since implant surgery, what is the effect of extraction (full or partial mouth) on the incidence, nature, duration, and magnitude of bacteremia?

121. In patients with an implant having an oral/dental procedure or undertaking daily activities and [insert duration] since implant surgery, what is the effect of extraction (full or partial mouth) on the incidence, nature, duration, and magnitude of fungemia?

122. In patients with an implant having an oral/dental procedure or undertaking daily activities and [insert duration] since implant surgery, what is the effect of extraction (full or partial mouth) on the incidence, nature, duration, and magnitude of implant infection?

123. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have multiple implants, what is the effect of no intervention on the incidence, nature, duration, and magnitude of bacteria in the mouth?

124. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have multiple implants, what is the effect of no intervention on the incidence, nature, duration, and magnitude of fungi in the mouth?

125. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have multiple implants, what is the effect of no intervention on the incidence, nature, duration, and magnitude of bacteremia?

126. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have multiple implants, what is the effect of no intervention on the incidence, nature, duration, and magnitude of fungemia?

127. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have multiple implants, what is the effect of no intervention on the incidence, nature, duration, and magnitude of implant infection?

128. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have multiple implants, what is the effect of antibiotic prophylaxis on the incidence, nature, duration, and magnitude of bacteria in the mouth?

129. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have multiple implants, what is the effect of antibiotic prophylaxis on the incidence, nature, duration, and magnitude of fungi in the mouth?

130. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have multiple implants, what is the effect of antibiotic prophylaxis on the incidence, nature, duration, and magnitude of bacteremia?

131. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have multiple implants, what is the effect of antibiotic prophylaxis on the incidence, nature, duration, and magnitude of fungemia?

132. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have multiple implants, what is the effect of antibiotic prophylaxis on the incidence, nature, duration, and magnitude of implant infection?

133. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have multiple implants, what is the effect of topical application of antimicrobials on the incidence, nature, duration, and magnitude of bacteria in the mouth?

134. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have multiple implants, what is the effect of topical application of antimicrobials on the incidence, nature, duration, and magnitude of fungi in the mouth?

135. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have multiple implants, what is the effect of topical application of antimicrobials on the incidence, nature, duration, and magnitude of bacteremia?

136. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have multiple implants, what is the effect of topical application of antimicrobials on the incidence, nature, duration, and magnitude of fungemia?

137. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have multiple implants, what is the effect of topical application of antimicrobials on the incidence, nature, duration, and magnitude of implant infection?

138. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have multiple implants, what is the effect of optimization of oral health instructions on the incidence, nature, duration, and magnitude of bacteria in the mouth?

139. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have multiple implants, what is the effect of optimization of oral health instructions on the incidence, nature, duration, and magnitude of fungi in the mouth?

140. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have multiple implants, what is the effect of optimization of oral health instructions on the incidence, nature, duration, and magnitude of bacteremia?

141. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have multiple implants, what is the effect of optimization of oral health instructions on the incidence, nature, duration, and magnitude of fungemia?

142. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have multiple implants, what is the effect of optimization of oral health instructions on the incidence, nature, duration, and magnitude of implant infection?

143. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have multiple implants, what is the effect of extraction (full or partial mouth) on the incidence, nature, duration, and magnitude of bacteria in the mouth?

144. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have multiple implants, what is the effect of extraction (full or partial mouth) on the incidence, nature, duration, and magnitude of fungi in the mouth?

145. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have multiple implants, what is the effect of extraction (full or partial mouth) on the incidence, nature, duration, and magnitude of bacteremia?

146. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have multiple implants, what is the effect of extraction (full or partial mouth) on the incidence, nature, duration, and magnitude of fungemia?

147. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have multiple implants, what is the effect of extraction (full or partial mouth) on the incidence, nature, duration, and magnitude of implant infection?

148. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have "at-risk" prosthesis, what is the effect of no intervention on the incidence, nature, duration, and magnitude of bacteria in the mouth?

149. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have "at-risk" prosthesis, what is the effect of no intervention on the incidence, nature, duration, and magnitude of fungi in the mouth?

150. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have "at-risk" prosthesis, what is the effect of no intervention on the incidence, nature, duration, and magnitude of bacteremia?

151. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have "at-risk" prosthesis, what is the effect of no intervention on the incidence, nature, duration, and magnitude of fungemia?

152. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have "at-risk" prosthesis, what is the effect of no intervention on the incidence, nature, duration, and magnitude of implant infection?

153. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have "at-risk" prosthesis, what is the effect of antibiotic prophylaxis on the incidence, nature, duration, and magnitude of bacteria in the mouth?

154. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have "at-risk" prosthesis, what is the effect of antibiotic prophylaxis on the incidence, nature, duration, and magnitude of fungi in the mouth?

155. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have "at-risk" prosthesis, what is the effect of antibiotic prophylaxis on the incidence, nature, duration, and magnitude of bacteremia?

156. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have "at-risk" prosthesis, what is the effect of antibiotic prophylaxis on the incidence, nature, duration, and magnitude of fungemia?

157. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have "at-risk" prosthesis, what is the effect of antibiotic prophylaxis on the incidence, nature, duration, and magnitude of implant infection?

158. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have "at-risk" prosthesis, what is the effect of topical application of antimicrobials on the incidence, nature, duration, and magnitude of bacteria in the mouth?

159. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have "at-risk" prosthesis, what is the effect of topical application of antimicrobials on the incidence, nature, duration, and magnitude of fungi in the mouth?

160. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have "at-risk" prosthesis, what is the effect of topical application of antimicrobials on the incidence, nature, duration, and magnitude of bacteremia?

161. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have "at-risk" prosthesis, what is the effect of topical application of antimicrobials on the incidence, nature, duration, and magnitude of fungemia?

162. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have "at-risk" prosthesis, what is the effect of topical application of antimicrobials on the incidence, nature, duration, and magnitude of implant infection?

163. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have "at-risk" prosthesis, what is the effect of optimization of oral health instructions on the incidence, nature, duration, and magnitude of bacteria in the mouth?

164. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have "at-risk" prosthesis, what is the effect of optimization of oral health instructions on the incidence, nature, duration, and magnitude of fungi in the mouth?

165. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have "at-risk" prosthesis, what is the effect of optimization of oral health instructions on the incidence, nature, duration, and magnitude of bacteremia?

166. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have "at-risk" prosthesis, what is the effect of optimization of oral health instructions on the incidence, nature, duration, and magnitude of fungemia?

167. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have "at-risk" prosthesis, what is the effect of optimization of oral health instructions on the incidence, nature, duration, and magnitude of implant infection?

168. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have "at-risk" prosthesis, what is the effect of extraction (full or partial mouth) on the incidence, nature, duration, and magnitude of bacteria in the mouth?

169. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have "at-risk" prosthesis, what is the effect of extraction (full or partial mouth) on the incidence, nature, duration, and magnitude of fungi in the mouth?

170. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have "at-risk" prosthesis, what is the effect of extraction (full or partial mouth) on the incidence, nature, duration, and magnitude of bacteremia?

171. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have "at-risk" prosthesis, what is the effect of extraction (full or partial mouth) on the incidence, nature, duration, and magnitude of fungemia?

172. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have "at-risk" prosthesis, what is the effect of extraction (full or partial mouth) on the incidence, nature, duration, and magnitude of implant infection?

173. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have no teeth (edentulous), what is the effect of no intervention on the incidence, nature, duration, and magnitude of bacteria in the mouth?

174. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have no teeth (edentulous), what is the effect of no intervention on the incidence, nature, duration, and magnitude of fungi in the mouth?

175. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have no teeth (edentulous), what is the effect of no intervention on the incidence, nature, duration, and magnitude of bacteremia?

176. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have no teeth (edentulous), what is the effect of no intervention on the incidence, nature, duration, and magnitude of fungemia?

177. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have no teeth (edentulous), what is the effect of no intervention on the incidence, nature, duration, and magnitude of implant infection?

178. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have no teeth (edentulous), what is the effect of antibiotic prophylaxis on the incidence, nature, duration, and magnitude of bacteria in the mouth?

179. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have no teeth (edentulous), what is the effect of antibiotic prophylaxis on the incidence, nature, duration, and magnitude of fungi in the mouth?

180. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have no teeth (edentulous), what is the effect of antibiotic prophylaxis on the incidence, nature, duration, and magnitude of bacteremia?

181. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have no teeth (edentulous), what is the effect of antibiotic prophylaxis on the incidence, nature, duration, and magnitude of fungemia?

182. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have no teeth (edentulous), what is the effect of antibiotic prophylaxis on the incidence, nature, duration, and magnitude of implant infection?

183. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have no teeth (edentulous), what is the effect of topical application of antimicrobials on the incidence, nature, duration, and magnitude of bacteria in the mouth?

184. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have no teeth (edentulous), what is the effect of topical application of antimicrobials on the incidence, nature, duration, and magnitude of fungi in the mouth?

185. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have no teeth (edentulous), what is the effect of topical application of antimicrobials on the incidence, nature, duration, and magnitude of bacteremia?

186. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have no teeth (edentulous), what is the effect of topical application of antimicrobials on the incidence, nature, duration, and magnitude of fungemia?

187. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have no teeth (edentulous), what is the effect of topical application of antimicrobials on the incidence, nature, duration, and magnitude of implant infection?

188. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have no teeth (edentulous), what is the effect of optimization of oral health instructions on the incidence, nature, duration, and magnitude of bacteria in the mouth?

189. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have no teeth (edentulous), what is the effect of optimization of oral health instructions on the incidence, nature, duration, and magnitude of fungi in the mouth?

190. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have no teeth (edentulous), what is the effect of optimization of oral health instructions on the incidence, nature, duration, and magnitude of bacteremia?

191. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have no teeth (edentulous), what is the effect of optimization of oral health instructions on the incidence, nature, duration, and magnitude of fungemia?

192. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have no teeth (edentulous), what is the effect of optimization of oral health instructions on the incidence, nature, duration, and magnitude of implant infection.

193. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have no teeth (edentulous), what is the effect of extraction (full or partial mouth) on the incidence, nature, duration, and magnitude of bacteria in the mouth?

194. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have no teeth (edentulous), what is the effect of extraction (full or partial mouth) on the incidence, nature, duration, and magnitude of fungi in the mouth?

195. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have no teeth (edentulous), what is the effect of extraction (full or partial mouth) on the incidence, nature, duration, and magnitude of bacteremia?

196. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have no teeth (edentulous), what is the effect of extraction (full or partial mouth) on the incidence, nature, duration, and magnitude of fungemia?

197. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have no teeth (edentulous), what is the effect of extraction (full or partial mouth) on the incidence, nature, duration, and magnitude of implant infection?

198. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have bisphosphonate therapy, what is the effect of no intervention on the incidence, nature, duration, and magnitude of bacteria in the mouth?

199. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have bisphosphonate therapy, what is the effect of no intervention on the incidence, nature, duration, and magnitude of fungi in the mouth?

200. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have bisphosphonate therapy, what is the effect of no intervention on the incidence, nature, duration, and magnitude of bacteremia?

201. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have bisphosphonate therapy, what is the effect of no intervention on the incidence, nature, duration, and magnitude of fungemia?

202. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have bisphosphonate therapy, what is the effect of no intervention on the incidence, nature, duration, and magnitude of implant infection?

203. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have bisphosphonate therapy, what is the effect of antibiotic prophylaxis on the incidence, nature, duration, and magnitude of bacteria in the mouth?

204. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have bisphosphonate therapy, what is the effect of antibiotic prophylaxis on the incidence, nature, duration, and magnitude of fungi in the mouth?

205. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have bisphosphonate therapy, what is the effect of antibiotic prophylaxis on the incidence, nature, duration, and magnitude of bacteremia?

206. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have bisphosphonate therapy, what is the effect of antibiotic prophylaxis on the incidence, nature, duration, and magnitude of fungemia?

207. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have bisphosphonate therapy, what is the effect of antibiotic prophylaxis on the incidence, nature, duration, and magnitude of implant infection?

208. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have bisphosphonate therapy, what is the effect of topical application of antimicrobials on the incidence, nature, duration, and magnitude of bacteria in the mouth?

209. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have bisphosphonate therapy, what is the effect of topical application of antimicrobials on the incidence, nature, duration, and magnitude of fungi in the mouth?

210. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have bisphosphonate therapy, what is the effect of topical application of antimicrobials on the incidence, nature, duration, and magnitude of bacteremia?

211. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have bisphosphonate therapy, what is the effect of topical application of antimicrobials on the incidence, nature, duration, and magnitude of fungemia?

212. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have bisphosphonate therapy, what is the effect of topical application of antimicrobials on the incidence, nature, duration, and magnitude of implant infection?

213. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have bisphosphonate therapy, what is the effect of optimization of oral health instructions on the incidence, nature, duration, and magnitude of bacteria in the mouth?

214. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have bisphosphonate therapy, what is the effect of optimization of oral health instructions on the incidence, nature, duration, and magnitude of fungi in the mouth?

215. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have bisphosphonate therapy, what is the effect of optimization of oral health instructions on the incidence, nature, duration, and magnitude of bacteremia?

216. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have bisphosphonate therapy, what is the effect of optimization of oral health instructions on the incidence, nature, duration, and magnitude of fungemia?

217. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have bisphosphonate therapy, what is the effect of optimization of oral health instructions on the incidence, nature, duration, and magnitude of implant infection?

218. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have bisphosphonate therapy, what is the effect of extraction (full or partial mouth) on the incidence, nature, duration, and magnitude of bacteria in the mouth?

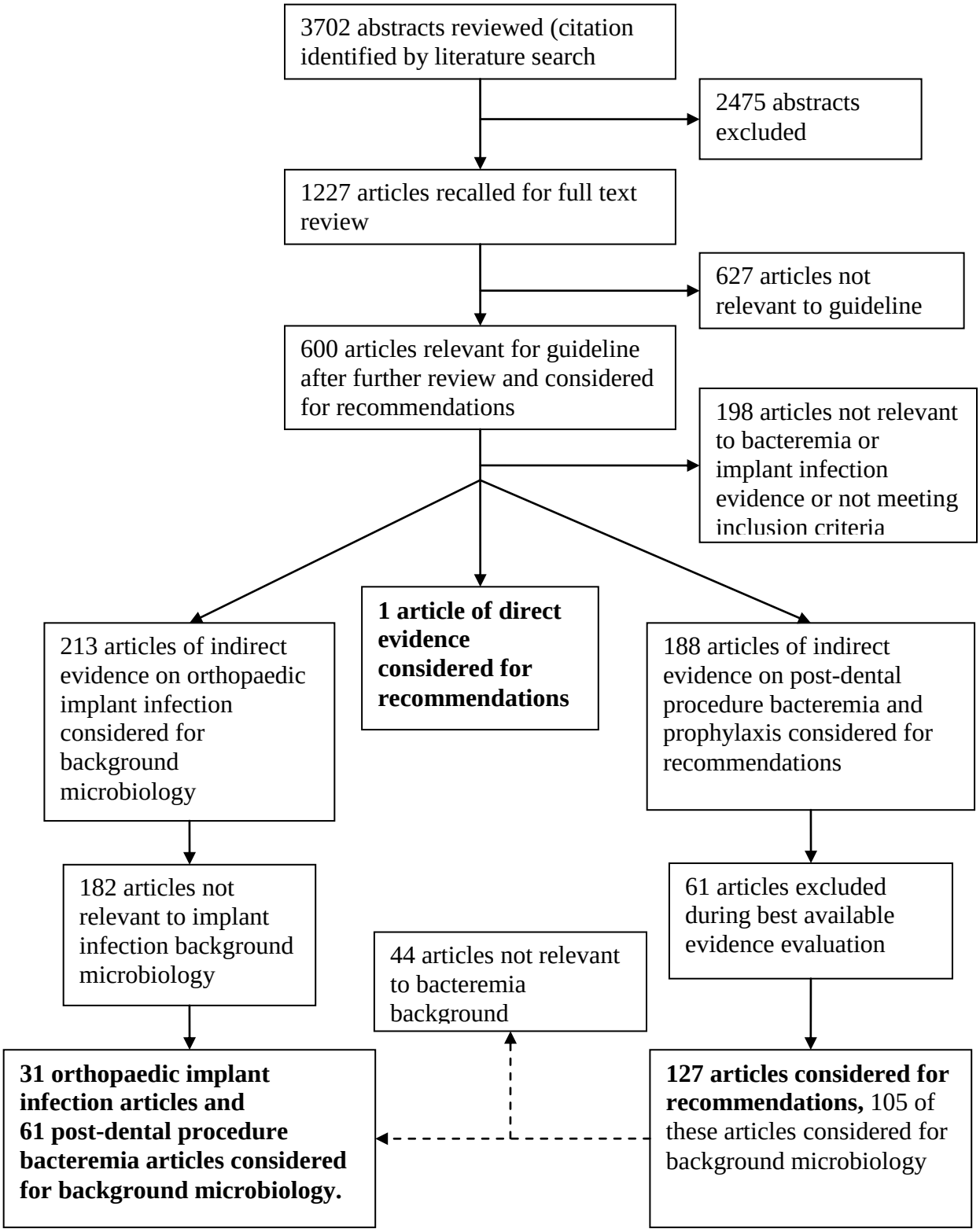
219. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have bisphosphonate therapy, what is the effect of extraction (full or partial mouth) on the incidence, nature, duration, and magnitude of fungi in the mouth?

220. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have bisphosphonate therapy, what is the effect of extraction (full or partial mouth) on the incidence, nature, duration, and magnitude of bacteremia?

221. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have bisphosphonate therapy, what is the effect of extraction (full or partial mouth) on the incidence, nature, duration, and magnitude of fungemia?

222. In patients with an implant having an oral/dental procedure or undertaking daily activities and who have bisphosphonate therapy, what is the effect of extraction (full or partial mouth) on the incidence, nature, duration, and magnitude of implant infection?

APPENDIX III
STUDY ATTRITION DIAGRAM



INCLUDED STUDIES TABLES

RECOMMENDATION 1

Table 48 Included Studies for Recommendation 1

Author(s)	Year	Title
Berbari EF;Osmon DR;Carr A;Hanssen AD;Baddour LM;Greene D;Kupp LI;Baughan LW;Harmsen WS;Mandrekar JN;Therneau TM;Steckelberg JM;Virk A;Wilson WR;	2010	Dental procedures as risk factors for prosthetic hip or knee infection: a hospital-based prospective case-control study
Morozumi T;Kubota T;Abe D;Shimizu T;Komatsu Y;Yoshie H;	2010	Effects of irrigation with an antiseptic and oral administration of azithromycin on bacteremia caused by scaling and root planing
Lockhart PB;Brennan MT;Sasser HC;Fox PC;Paster BJ;Bahrani-Mougeot FK;	2008	Bacteremia associated with toothbrushing and dental extraction
Brennan MT;Kent ML;Fox PC;Norton HJ;Lockhart PB;	2007	The impact of oral disease and nonsurgical treatment on bacteremia in children
Diz DP;Tomas C;Limeres PJ;Medina HJ;Fernandez FJ;Alvarez FM;	2006	Comparative efficacies of amoxicillin, clindamycin, and moxifloxacin in prevention of bacteremia following dental extractions
Lockhart PB;Brennan MT;Kent ML;Norton HJ;Weinrib DA;	2004	Impact of amoxicillin prophylaxis on the incidence, nature, and duration of bacteremia in children after intubation and dental procedures
Vergis EN;Demas PN;Vaccarello SJ;Yu VL;	2001	Topical antibiotic prophylaxis for bacteremia after dental extractions
Wahlmann U;Al-Nawas B;Jutte M;Wagner W;	1999	Clinical and microbiological efficacy of single dose cefuroxime prophylaxis for dental surgical procedures

Table 48 Included Studies for Recommendation 1

Author(s)	Year	Title
Hall G;Heimdahl A;Nord CE;	1996	Effects of prophylactic administration of cefaclor on transient bacteremia after dental extraction
Hall G;Nord CE;Heimdahl A;	1996	Elimination of bacteraemia after dental extraction: comparison of erythromycin and clindamycin for prophylaxis of infective endocarditis
Aitken C;Cannell H;Sefton AM;Kerawala C;Seymour A;Murphy M;Whiley RA;Williams JD;	1995	Comparative efficacy of oral doses of clindamycin and erythromycin in the prevention of bacteraemia
Hall G;Hedstrom SA;Heimdahl A;Nord CE;	1993	Prophylactic administration of penicillins for endocarditis does not reduce the incidence of postextraction bacteremia
Goker K;Guvener O;	1992	Antibacterial effects of ofloxacin, clindamycin and sultamicillin on surgical removal of impacted third molars
Katoh H;	1992	Incidence of transient bacteremia following dental surgery--prophylactic use of cefuroxime, ceftriaxone or clindamycin
Cannell H;Kerawala C;Sefton AM;Maskell JP;Seymour A;Sun ZM;Williams JD;	1991	Failure of two macrolide antibiotics to prevent post-extraction bacteraemia
Coulter WA;Coffey A;Saunders ID;Emmerson AM;	1990	Bacteremia in children following dental extraction
Casolari C;Neglia R;Forabosco A;Galetti R;Fabio U;	1989	Incidence of oral bacteremia and antimicrobial prophylaxis
Roberts GJ;Radford P;Holt R;	1987	Prophylaxis of dental bacteraemia with oral amoxycillin in children

Table 48 Included Studies for Recommendation 1

Author(s)	Year	Title
Shanson DC;Shehata A;Tadayon M;Harris M;	1987	Comparison of intravenous teicoplanin with intramuscular amoxycillin for the prophylaxis of streptococcal bacteraemia in dental patients
Maskell JP;Carter JL;Boyd RB;Williams RJ;	1986	Teicoplanin as a prophylactic antibiotic for dental bacteraemia
Josefsson K;Heimdahl A;von KL;Nord CE;	1985	Effect of phenoxymethylpenicillin and erythromycin prophylaxis on anaerobic bacteraemia after oral surgery
Shanson DC;Akash S;Harris M;Tadayon M;	1985	Erythromycin stearate, 1.5 g, for the oral prophylaxis of streptococcal bacteraemia in patients undergoing dental extraction: efficacy and tolerance
Head TW;Bentley KC;Millar EP;deVries JA;	1984	A comparative study of the effectiveness of metronidazole and penicillin V in eliminating anaerobes from postextraction bacteremias
Appleman MD;Sutter VL;Sims TN;	1982	Value of antibiotic prophylaxis in periodontal surgery
Baltch AL;Schaffer C;Hammer MC;Sutphen NT;Smith RP;Conroy J;Shayegani M;	1982	Bacteremia following dental cleaning in patients with and without penicillin prophylaxis
Shanson DC;Cannon P;Wilks M;	1978	Amoxycillin compared with penicillin V for the prophylaxis of dental bacteraemia
DeVries J;Francis LE;Lang D;	1972	Control of post-extraction bacteraemias in the penicillin-hypersensitive patient
Jokinen MA;	1970	Bacteremia following dental extraction and its prophylaxis

Table 48 Included Studies for Recommendation 1

Author(s)	Year	Title
Khairat O;	1966	An effective antibiotic cover for the prevention of endocarditis following dental and other post-operative bacteraemias
Martin WJ;Schirger A;	1964	Prevention of bacteremia after oral surgery
Gutverg M;	1962	Studies on bacteremia following oral surgery: Some prophylactic approaches to bacteremia and the results of tissue examination of excised gingival

RECOMMENDATION 2

Table 49 Included Studies for Recommendation 2

Author(s)	Year	Title
Fine DH;Furgang D;McKiernan M;Tereski-Bischio D;Ricci-Nittel D;Zhang P;Araujo MW;	2010	An investigation of the effect of an essential oil mouthrinse on induced bacteraemia: a pilot study
Morozumi T;Kubota T;Abe D;Shimizu T;Komatsu Y;Yoshie H;	2010	Effects of irrigation with an antiseptic and oral administration of azithromycin on bacteremia caused by scaling and root planing
Pineiro A;Tomas I;Blanco J;Alvarez M;Seoane J;Diz P;	2010	Bacteraemia following dental implants' placement
Cherry M;Daly CG;Mitchell D;Highfield J;	2007	Effect of rinsing with povidone-iodine on bacteraemia due to scaling: a randomized-controlled trial
Tomas I;Alvarez M;Limeres J;Tomas M;Medina J;Otero JL;Diz P;	2007	Effect of a chlorhexidine mouthwash on the risk of postextraction bacteremia
Fourrier F;Dubois D;Pronnier P;Herbecq P;Leroy O;Desmettre T;Pottier-Cau E;Boutigny H;Di PC;Durocher A;Roussel-Delvallez M;	2005	Effect of gingival and dental plaque antiseptic decontamination on nosocomial infections acquired in the intensive care unit: a double-blind placebo-controlled multicenter study
Erverdi N;Acar A;Isguden B;Kadir T;	2001	Investigation of bacteremia after orthodontic banding and debanding following chlorhexidine mouth wash application
Brown AR;Papasian CJ;Shultz P;Theisen FC;Shultz RE;	1998	Bacteremia and intraoral suture removal: can an antimicrobial rinse help?
Fine DH;Korik I;Furgang D;Myers R;Olshan A;Barnett ML;Vincent J;	1996	Assessing pre-procedural subgingival irrigation and rinsing with an antiseptic mouthrinse to reduce bacteremia
Lockhart PB;	1996	An analysis of bacteremias during dental extractions. A double-blind, placebo-controlled study of chlorhexidine

Table 49 Included Studies for Recommendation 2

Author(s)	Year	Title
Rahn R;Schneider S;Diehl O;Schafer V;Shah PM;	1995	Preventing post-treatment bacteremia: comparing topical povidone-iodine and chlorhexidine
Yamalik MK;Yucetas S;Abbasoglu U;	1992	Effects of various antiseptics on bacteremia following tooth extraction
Lofthus JE;Waki MY;Jolkovsky DL;Otomo-Corgel J;Newman MG;Flemmig T;Nachnani S;	1991	Bacteremia following subgingival irrigation and scaling and root planing
Waki MY;Jolkovsky DL;Otomo-Corgel J;Lofthus JE;Nachnani S;Newman MG;Flemmig TF;	1990	Effects of subgingival irrigation on bacteremia following scaling and root planing
Casolari C;Neglia R;Forabosco A;Galetti R;Fabio U;	1989	Incidence of oral bacteremia and antimicrobial prophylaxis
MacFarlane TW;Ferguson MM;Mulgrew CJ;	1984	Post-extraction bacteraemia: role of antiseptics and antibiotics
Jokinen MA;	1978	Prevention of postextraction bacteremia by local prophylaxis
Sweet JB;Gill VJ;Chusid MJ;Elin RJ;	1978	Nitroblue tetrazolium and Limulus assays for bacteremia after dental extraction: effect of topical antiseptics
Nasif AS;	1977	The incidence of post-extraction bacteremia after irrigation of the gingival sulcus with hydrogen peroxide solution
Brenman HS;Randall E;	1974	Local degerming with povidone-iodine, II. Prior to gingivectomy
Huffman GG;Wood WH;Hausler WJ;Jensen J;	1974	The effects of preoperative rinsing with cetylpyridinium chloride on bacteremia associated with the surgical removal of impacted third molars

Table 49 Included Studies for Recommendation 2

Author(s)	Year	Title
Madsen KL;	1974	Effect of chlorhexidine mouthrinse and periodontal treatment upon bacteremia produced by oral hygiene procedures
Francis LE;DeVries J;Lang D;	1973	An oral antiseptic for the control of post-extraction bacteraemia
Cutcher JL;Goldberg JR;Lilly GE;Jones JC;	1971	Control of bacteremia associated with extraction of teeth. II
Scopp IW;Orvieto LD;	1971	Gingival degerming by povidone-iodine irrigation: bacteremia reduction in extraction procedures
Jones JC;Cutcher JL;Goldberg JR;Lilly GE;	1970	Control of bacteremia associated with extraction of teeth

RECOMMENDATION 3

Table 50 Included Studies for Recommendation 3

Author(s)	Year	Title
Barbosa M;Carmona IT;Amaral B;Limeres J;Alvarez M;Cerqueira C;Diz P;	2010	General anesthesia increases the risk of bacteremia following dental extractions
Ashare A;Stanford C;Hancock P;Stark D;Lilli K;Birrer E;Nymon A;Doerschug KC;Hunninghake GW;	2009	Chronic liver disease impairs bacterial clearance in a human model of induced bacteremia
Crasta K;Daly CG;Mitchell D;Curtis B;Stewart D;Heitz-Mayfield LJ;	2009	Bacteraemia due to dental flossing
Lockhart PB;Brennan MT;Thornhill M;Michalowicz BS;Noll J;Bahrani-Mougeot FK;Sasser HC;	2009	Poor oral hygiene as a risk factor for infective endocarditis-related bacteremia
Enabulele OI;Aluyi HSA;Omokao O;	2008	Incidence of bacteraemia following teeth extraction at the dental clinic of the University of Benin Teaching Hospital, Benin city, Nigeria
Tomas I;Pereira F;Llucian R;Poveda R;Diz P;Bagan JV;	2008	Prevalence of bacteraemia following third molar surgery
Valdes C;Tomas I;Alvarez M;Limeres J;Medina J;Diz P;	2008	The incidence of bacteraemia associated with tracheal intubation
Brennan MT;Kent ML;Fox PC;Norton HJ;Lockhart PB;	2007	The impact of oral disease and nonsurgical treatment on bacteremia in children
Cherry M;Daly CG;Mitchell D;Highfield J;	2007	Effect of rinsing with povidone-iodine on bacteraemia due to scaling: a randomized-controlled trial

Table 50 Included Studies for Recommendation 3

Author(s)	Year	Title
Forner L;Larsen T;Kilian M;Holmstrup P;	2006	Incidence of bacteremia after chewing, tooth brushing and scaling in individuals with periodontal inflammation
Takai S;Kuriyama T;Yanagisawa M;Nakagawa K;Karasawa T;	2005	Incidence and bacteriology of bacteremia associated with various oral and maxillofacial surgical procedures
Bhanji S;Williams B;Sheller B;Elwood T;Mancl L;	2002	Transient bacteremia induced by toothbrushing a comparison of the Sonicare toothbrush with a conventional toothbrush
Daly CG;Mitchell DH;Highfield JE;Grossberg DE;Stewart D;	2001	Bacteremia due to periodontal probing: a clinical and microbiological investigation
Wahlmann U;Al-Nawas B;Jutte M;Wagner W;	1999	Clinical and microbiological efficacy of single dose cefuroxime prophylaxis for dental surgical procedures
Roberts GJ;Watts R;Longhurst P;Gardner P;	1998	Bacteremia of dental origin and antimicrobial sensitivity following oral surgical procedures in children
Daly C;Mitchell D;Grossberg D;Highfield J;Stewart D;	1997	Bacteraemia caused by periodontal probing
Lockhart PB;	1996	An analysis of bacteremias during dental extractions. A double-blind, placebo-controlled study of chlorhexidine
Okabe K;Nakagawa K;Yamamoto E;	1995	Factors affecting the occurrence of bacteremia associated with tooth extraction
Coulter WA;Coffey A;Saunders ID;Emmerson AM;	1990	Bacteremia in children following dental extraction
Trivedi DN;	1984	Bacteraemia due to operative procedure

Table 50 Included Studies for Recommendation 3

Author(s)	Year	Title
Silver JG;Martin AW;McBride BC;	1977	Experimental transient bacteraemias in human subjects with varying degrees of plaque accumulation and gingival inflammation
De Leo AA;Schoenknecht FD;Anderson MW;Peterson JC;	1974	The incidence of bacteremia following oral prophylaxis on pediatric patients
Lineberger LT;De Marco TJ;	1973	Evaluation of transient bacteremia following routine periodontal procedures

DENTAL PROCEDURES AND BACTEREMIA

Table 51 Included Studies for Dental Procedures and Bacteremia

Author(s)	Year	Title
Barbosa M;Carmona IT;Amaral B;Limeres J;Alvarez M;Cerqueira C;Diz P;	2010	General anesthesia increases the risk of bacteremia following dental extractions
Morozumi T;Kubota T;Abe D;Shimizu T;Komatsu Y;Yoshie H;	2010	Effects of irrigation with an antiseptic and oral administration of azithromycin on bacteremia caused by scaling and root planing
Pineiro A;Tomas I;Blanco J;Alvarez M;Seoane J;Diz P;	2010	Bacteraemia following dental implants' placement
Crasta K;Daly CG;Mitchell D;Curtis B;Stewart D;Heitz-Mayfield LJ;	2009	Bacteraemia due to dental flossing
Gurel HG;Basciftci FA;Arslan U;	2009	Transient bacteremia after removal of a bonded maxillary expansion appliance
Nixon PP;Littler P;Davies K;Krishnam MS;	2009	Does sialography require antibiotic prophylaxis?
Sonbol H;Spratt D;Roberts GJ;Lucas VS;	2009	Prevalence, intensity and identity of bacteraemia following conservative dental procedures in children
Enabulele OI;Aluyi HSA;Omokao O;	2008	Incidence of bacteraemia following teeth extraction at the dental clinic of the University of Benin Teaching Hospital, Benin city, Nigeria
Lockhart PB;Brennan MT;Sasser HC;Fox PC;Paster BJ;Bahrani-Mougeot FK;	2008	Bacteremia associated with toothbrushing and dental extraction
Tomas I;Pereira F;Llucian R;Poveda R;Diz P;Bagan JV;	2008	Prevalence of bacteraemia following third molar surgery

Table 51 Included Studies for Dental Procedures and Bacteremia

Author(s)	Year	Title
Valdes C;Tomas I;Alvarez M;Limeres J;Medina J;Diz P;	2008	The incidence of bacteraemia associated with tracheal intubation
Cherry M;Daly CG;Mitchell D;Highfield J;	2007	Effect of rinsing with povidone-iodine on bacteraemia due to scaling: a randomized-controlled trial
Lafaurie GI;Mayorga-Fayad I;Torres MF;Castillo DM;Aya MR;Baron A;Hurtado PA;	2007	Periodontopathic microorganisms in peripheric blood after scaling and root planing
Tomas I;Alvarez M;Limeres J;Potel C;Medina J;Diz P;	2007	Prevalence, duration and aetiology of bacteraemia following dental extractions
Tomas I;Alvarez M;Limeres J;Tomas M;Medina J;Otero JL;Diz P;	2007	Effect of a chlorhexidine mouthwash on the risk of postextraction bacteremia
Forner L;Larsen T;Kilian M;Holmstrup P;	2006	Incidence of bacteremia after chewing, tooth brushing and scaling in individuals with periodontal inflammation
Forner L;Nielsen CH;Bendtzen K;Larsen T;Holmstrup P;	2006	Increased plasma levels of IL-6 in bacteremic periodontis patients after scaling
Murphy AM;Daly CG;Mitchell DH;Stewart D;Curtis BH;	2006	Chewing fails to induce oral bacteraemia in patients with periodontal disease
Oncag O;Aydemir S;Ersin N;Koca H;	2006	Bacteremia incidence in pediatric patients under dental general anesthesia
Kinane DF;Riggio MP;Walker KF;MacKenzie D;Shearer B;	2005	Bacteraemia following periodontal procedures
Oncag O;Cokmez B;Aydemir S;Balcioglu T;	2005	Investigation of bacteremia following nasotracheal intubation

Table 51 Included Studies for Dental Procedures and Bacteremia

Author(s)	Year	Title
Savarrio L;MacKenzie D;Riggio M;Saunders WP;Bagg J;	2005	Detection of bacteraemias during non-surgicalroot canal treatment
Takai S;Kuriyama T;Yanagisawa M;Nakagawa K;Karasawa T;	2005	Incidence and bacteriology of bacteremia associated with various oral and maxillofacial surgical procedures
Burden DJ;Coulter WA;Johnston CD;Mullally B;Stevenson M;	2004	The prevalence of bacteraemia on removal of fixed orthodontic appliances
Rajasuo A;Nyfors S;Kanervo A;Jousimies-Somer H;Lindqvist C;Suuronen R;	2004	Bacteremia after plate removal and tooth extraction
Rajasuo A;Perkki K;Nyfors S;Jousimies-Somer H;Meurman JH;	2004	Bacteremia following surgical dental extraction with an emphasis on anaerobic strains
Bhanji S;Williams B;Sheller B;Elwood T;Mancl L;	2002	Transient bacteremia induced by toothbrushing a comparison of the Sonicare toothbrush with a conventional toothbrush
Daly CG;Mitchell DH;Highfield JE;Grossberg DE;Stewart D;	2001	Bacteremia due to periodontal probing: a clinical and microbiological investigation
Lucas V;Roberts GJ;	2000	Odontogenic bacteremia following tooth cleaning procedures in children
Roberts GJ;Gardner P;Longhurst P;Black AE;Lucas VS;	2000	Intensity of bacteraemia associated with conservative dental procedures in children
Erverdi N;Kadir T;Ozkan H;Acar A;	1999	Investigation of bacteremia after orthodontic banding
Brown AR;Papasian CJ;Shultz P;Theisen FC;Shultz RE;	1998	Bacteremia and intraoral suture removal: can an antimicrobial rinse help?

Table 51 Included Studies for Dental Procedures and Bacteremia

Author(s)	Year	Title
Roberts GJ;Simmons NB;Longhurst P;Hewitt PB;	1998	Bacteraemia following local anaesthetic injections in children
Roberts GJ;Watts R;Longhurst P;Gardner P;	1998	Bacteremia of dental origin and antimicrobial sensitivity following oral surgical procedures in children
Daly C;Mitchell D;Grossberg D;Highfield J;Stewart D;	1997	Bacteraemia caused by periodontal probing
Roberts GJ;Holzel HS;Sury MR;Simmons NA;Gardner P;Longhurst P;	1997	Dental bacteremia in children
Debelian GJ;Olsen I;Tronstad L;	1995	Bacteremia in conjunction with endodontic therapy
Rahn R;Schneider S;Diehl O;Schafer V;Shah PM;	1995	Preventing post-treatment bacteremia: comparing topical povidone-iodine and chlorhexidine
Ali MT;Tremewen DR;Hay AJ;Wilkinson DJ;	1992	The occurrence of bacteraemia associated with the use of oral and nasopharyngeal airways
Giglio JA;Rowland RW;Dalton HP;Laskin DM;	1992	Suture removal-induced bacteremia: a possible endocarditis risk
Lucartorto FM;Franker CK;Maza J;	1992	Postscaling bacteremia in HIV-associated gingivitis and periodontitis
Roberts GJ;Gardner P;Simmons NA;	1992	Optimum sampling time for detection of dental bacteraemia in children
Lofthus JE;Waki MY;Jolkovsky DL;Otomo-Corgel J;Newman MG;Flemmig T;Nachnani S;	1991	Bacteremia following subgingival irrigation and scaling and root planing

Table 51 Included Studies for Dental Procedures and Bacteremia

Author(s)	Year	Title
Coulter WA;Coffey A;Saunders ID;Emmerson AM;	1990	Bacteremia in children following dental extraction
Flood TR;Samaranayake LP;MacFarlane TW;McLennan A;MacKenzie D;Carmichael F;	1990	Bacteraemia following incision and drainage of dento-alveolar abscesses
Heimdahl A;Hall G;Hedberg M;Sandberg H;Soder PO;Tuner K;Nord CE;	1990	Detection and quantitation by lysis-filtration of bacteremia after different oral surgical procedures
Waki MY;Jolkovsky DL;Otomo-Corgel J;Lofthus JE;Nachnani S;Newman MG;Flemmig TF;	1990	Effects of subgingival irrigation on bacteremia following scaling and root planing
Casolari C;Neglia R;Forabosco A;Galetti R;Fabio U;	1989	Incidence of oral bacteremia and antimicrobial prophylaxis
Hansen CP;Westh H;Brok KE;Jensen R;Bertelsen S;	1989	Bacteraemia following orotracheal intubation and oesophageal balloon dilatation
King RC;Crawford JJ;Small EW;	1988	Bacteremia following intraoral suture removal
Dinner M;Tjeuw M;Artusio JF;	1987	Bacteremia as a complication of nasotracheal intubation
Shanson DC;Shehata A;Tadayon M;Harris M;	1987	Comparison of intravenous teicoplanin with intramuscular amoxycillin for the prophylaxis of streptococcal bacteraemia in dental patients
Maskell JP;Carter JL;Boyd RB;Williams RJ;	1986	Teicoplanin as a prophylactic antibiotic for dental bacteraemia
Josefsson K;Heimdahl A;von KL;Nord CE;	1985	Effect of phenoxymethylpenicillin and erythromycin prophylaxis on anaerobic bacteraemia after oral surgery

Table 51 Included Studies for Dental Procedures and Bacteremia

Author(s)	Year	Title
Lamey PJ;MacFarlane TW;Patton DW;Samaranayake LP;Ferguson MM;	1985	Bacteraemia consequential to sialography
Trivedi DN;	1984	Bacteraemia due to operative procedure
Marzoni FA;Kelly DR;	1983	Bacteremia following cleft palate repair--a prospective study
Sconyers JR;Albers DD;Kelly R;	1979	Relationship of bacteremia to toothbrushing in clinically healthy patients
Silver JG;Martin AW;McBride BC;	1979	Experimental transient bacteraemias in human subjects with clinically healthy gingivae
Shanson DC;Cannon P;Wilks M;	1978	Amoxycillin compared with penicillin V for the prophylaxis of dental bacteraemia
Wampole HS;Allen AL;Gross A;	1978	The incidence of transient bacteremia during periodontal dressing change
Baumgartner JC;Heggers JP;Harrison JW;	1977	Incidence of bacteremias related to endodontic procedures. II. Surgical endodontics
Soliman NA;el-Batawy YA;Abdallah AK;	1977	Studies on bacteremia following oral surgery: Some prophylactic approaches to bacteremia and the results of tissue examination of excised gingiva
Baumgartner JC;Heggers JP;Harrison JW;	1976	The incidence of bacteremias related to endodontic procedures. I. Nonsurgical endodontics
Peterson LJ;Peacock R;	1976	The incidence of bacteremia in pediatric patients following tooth extraction

Table 51 Included Studies for Dental Procedures and Bacteremia

Author(s)	Year	Title
Wank HA;Levison ME;Rose LF;Cohen DW;	1976	A quantitative measurement of bacteremia and its relationship to plaque control
Ramadan AE;Zaki SA;Nour ZM;	1975	A study of transient bacteremia following the use of dental floss silk and interdental stimulators
Berger SA;Weitzman S;Edberg SC;Casey JI;	1974	Bacteremia after the use of an oral irrigation device. A controlled study in subjects with normal-appearing gingiva: comparison with use of toothbrush
Crawford JJ;Sconyers JR;Moriarty JD;King RC;West JF;	1974	Bacteremia after tooth extractions studied with the aid of prereduced anaerobically sterilized culture media
De Leo AA;Schoenknecht FD;Anderson MW;Peterson JC;	1974	The incidence of bacteremia following oral prophylaxis on pediatric patients
Berry FA;Blankenbaker WL;Ball CG;	1973	Comparison of bacteremia occurring with nasotracheal and orotracheal intubation
Francis LE;DeVries J;Lang D;	1973	An oral antiseptic for the control of post-extraction bacteraemia
Lineberger LT;De Marco TJ;	1973	Evaluation of transient bacteremia following routine periodontal procedures
Sconyers JR;Crawford JJ;Moriarty JD;	1973	Relationship of bacteremia to toothbrushing in patients with periodontitis
Degling TE;	1972	Orthodontics, bacteremia, and the heart damaged patient
DeVries J;Francis LE;Lang D;	1972	Control of post-extraction bacteraemias in the penicillin-hypersensitive patient

Table 51 Included Studies for Dental Procedures and Bacteremia

Author(s)	Year	Title
The American Academy of Periodontology	1972	Oral irrigation and bacteremia
Felix JE;Rosen S;App GR;	1971	Detection of bacteremia after the use of an oral irrigation device in subjects with periodontitis
Romans AR;App GR;	1971	Bacteremia, a result from oral irrigation in subjects with gingivitis
Wada K;Tomizawa M;Sasaki I;	1968	Study on bacteriemia in patients with pyorrhea alveolaris caused by surgical operations
Conner HD;Haberman S;Collings CK;Winford TE;	1967	Bacteremias following periodontal scaling in patients with healthy appearing gingiva
Khairat O;	1966	The non-aerobes of post-extraction bacteremia
Martin WJ;Schirger A;	1964	PREVENTION OF BACTEREMIA AFTER ORAL SURGERY
Bender IB;SELTZER S;TASHMAN S;MELOFF G;	1963	Dental procedures in patients with rheumatic heart disease
Gutverg M;	1962	Studies on bacteremia following oral surgery: Some prophylactic approaches to bacteremia and the results of tissue examination of excised gingiva
ROGOSA M;HAMPP EG;NEVIN TA;WAGNER HN;DRISCOLL EJ;Baer PN;	1960	Blood sampling and cultural studies in the detection of postoperative bacteremias
Winslow MB;KOBERNICK SD;	1960	Bacteremia after prophylaxis

BACKGROUND MICROBIOLOGY

Table 52 Included Studies for Background Microbiology

Author(s)	Year	Title
Munoz-Mahamud E;Garcia S;Bori G;Martinez-Pastor JC;Zumbado JA;Riba J;Mensa J;Soriano A;	2011	Comparison of a low-pressure and a high-pressure pulsatile lavage during debridement for orthopaedic implant infection
Berbari EF;Osmon DR;Carr A;Hanssen AD;Baddour LM;Greene D;Kupp LI;Baughan LW;Harmsen WS;Mandrekar JN;Therneau TM;Steckelberg JM;Virk A;Wilson WR;	2010	Dental procedures as risk factors for prosthetic hip or knee infection: a hospital-based prospective case-control study
Morozumi T;Kubota T;Abe D;Shimizu T;Komatsu Y;Yoshie H;	2010	Effect of irrigation with antiseptic and oral administration of azithromycin on bacteremia caused by scaling and root planing
Pineiro A;Tomas I;Blanco J;Alvarez M;Seoane J;Diz P;	2010	Bacteraemia following dental implants' placement
Cordero-Ampuero J;Esteban J;Garcia-Cimbrelo E;	2009	Oral antibiotics are effective for highly resistant hip arthroplasty infections
Crasta K;Daly CG;Mitchell D;Curtis B;Stewart D;Heitz-Mayfield LJ;	2009	Bacteraemia due to dental flossing
Gurel HG;Basciftci FA;Arslan U;	2009	Transient bacteremia after removal of a bonded maxillary expansion appliance
Rodriguez D;Pigrau C;Euba G;Cobo J;Garcia-Lechuz J;Palomino J;Riera M;Del Toro MD;Granados A;Ariza X;	2009	Acute Hematogenous Prosthetic Joint Infection: Prospective Evaluation of Medical and Surgical Management
Sancheti KH;Laud NS;Bhende H;Reddy G;Pramod N;Mani JN;	2009	The INDUS knee prosthesis - Prospective multicentric trial of a posteriorly stabilized high-flex design: 2 years follow-up

Table 52 Included Studies for Background Microbiology

Author(s)	Year	Title
Uckay I;Lubbeke A;Emonet S;Tovmirzaeva L;Stern R;Ferry T;Assal M;Bernard L;Lew D;Hoffmeyer P;	2009	Low incidence of haematogenous seeding to total hip and knee prostheses in patients with remote infections
Enabulele OI;Aluyi HSA;Omokao O;	2008	Incidence of bacteraemia following teeth extraction
Fink B;Makowiak C;Fuerst M;Berger I;Schafer P;Frommelt L;	2008	The value of synovial biopsy, joint aspiration and C-reactive protein in the diagnosis of late peri-prosthetic infection of total knee replacements
Hamilton H;Jamieson J;	2008	Deep infection in total hip arthroplasty
Valdes C;Tomas I;Alvarez M;Limeres J;Medina J;Diz P;	2008	The incidence of bacteraemia associated with tracheal intubation
Cherry M;Daly CG;Mitchell D;Highfield J;	2007	Effect of rinsing with povidone-iodine on bacteraemia due to scaling: a randomized-controlled trial
Chiu FY;Chen CM;	2007	Surgical debridement and parenteral antibiotics in infected revision total knee arthroplasty
Choong PF;Dowsey MM;Carr D;Daffy J;Stanley P;	2007	Risk factors associated with acute hip prosthetic joint infections and outcome of treatment with a rifampinbased regimen
Cordero-Ampuero J;Esteban J;Garcia-Cimbrelo E;Munuera L;Escobar R;	2007	Low relapse with oral antibiotics and two-stage exchange for late arthroplasty infections in 40 patients after 2-9 years
Lafaurie GI;Mayorga-Fayad I;Torres MF;Castillo DM;Aya MR;Baron A;Hurtado PA;	2007	Periodontopathic microorganisms in peripheric blood after scaling and root planning

Table 52 Included Studies for Background Microbiology

Author(s)	Year	Title
Soriano A;Gomez J;Gomez L;Azanza JR;Perez R;Romero F;Pons M;Bella F;Velasco M;Mensa J;	2007	Efficacy and tolerability of prolonged linezolid therapy in the treatment of orthopedic implant infections
Forner L;Larsen T;Kilian M;Holmstrup P;	2006	Incidence of bacteremia after chewing, tooth brushing and scaling in individuals with periodontal inflammation
Forner L;Nielsen CH;Bendtzen K;Larsen T;Holmstrup P;	2006	Increased plasma levels of IL-6 in bacteremic periodontis patients after scaling
Goodman SB;Oh KJ;Imrie S;Hwang K;Shegog M;	2006	Revision total hip arthroplasty in juvenile chronic arthritis: 17 revisions in 11 patients followed for 4-12 years
Oncag O;Aydemir S;Ersin N;Koca H;	2006	Bacteremia incidence in pediatric patients under dental general anesthesia
Soriano A;Garcia S;Bori G;Almela M;Gallart X;Macule F;Sierra J;Martinez JA;Suso S;Mensa J;	2006	Treatment of acute post-surgical infection of joint arthroplasty
Hoad-Reddick DA;Evans CR;Norman P;Stockley I;	2005	Is there a role for extended antibiotic therapy in a two-stage revision of the infected knee arthroplasty?
Kinane DF;Riggio MP;Walker KF;MacKenzie D;Shearer B;	2005	Bacteremia folloing periodontal procedures
Oncag O;Cokmez B;Aydemir S;Balcioglu T;	2005	Bacteremia incidence in pediatric patients under dental general anesthesia
Burden DJ;Coulter WA;Johnston CD;Mullally B;Stevenson M;	2004	The prevalence of bacteraemia on removal of fixed orthodontic appliances

Table 52 Included Studies for Background Microbiology

Author(s)	Year	Title
Rajasuo A;Nyfors S;Kanervo A;Jousimies-Somer H;Lindqvist C;Suuronen R;	2004	Bacteremia after plate removal and tooth extraction
Jerosch J;Schneppenheim M;	2003	Management of infected shoulder replacement
Rao N;Crossett LS;Sinha RK;Le Frock JL;	2003	Long-term suppression of infection in total joint arthroplasty
Soultanis K;Mantelos G;Pagiatakis A;Soucacos PN;	2003	Late infection in patients with scoliosis treated with spinal instrumentation
Daly CG;Mitchell DH;Highfield JE;Grossberg DE;Stewart D;	2001	Bacteremia due to periodontal probing: a clinical and micobiological investigation
Lucas V;Roberts GJ;	2000	Odontogenic bacteremia following tooth cleaning procedures in children
Wagner M;Wagner H;	2000	Medium-term results of a modern metal-on-metal system in total hip replacement
Waldman BJ;Hostin E;Mont MA;Hungerford DS;	2000	Infected total knee arthroplasty treated by arthroscopic irrigation and debridement
Erverdi N;Kadir T;Ozkan H;Acar A;	1999	Investigation of bacteremia after orthodontic banding
Mont MA;Yoon TR;Krackow KA;Hungerford DS;	1999	Clinical experience with a proximally porous-coated second-generation cementless total hip prosthesis: minimum 5-year follow-up
Crockarell JR;Hanssen AD;Osmon DR;Morrey BF;	1998	Treatment of infection with debridement and retention of the components following hip arthroplasty

Table 52 Included Studies for Background Microbiology

Author(s)	Year	Title
Petrie RS;Hanssen AD;Osmon DR;Ilstrup D;	1998	Metal-backed patellar component failure in total knee arthroplasty: a possible risk for late infection
Smith JA;Dunn HK;Manaster BJ;	1998	Cementless femoral revision arthroplasty. 2- to 5-year results with a modular titanium alloy stem
Wimmer C;Nogler M;Frischhut B;	1998	Influence of antibiotics on infection in spinal surgery: a prospective study of 110 patients
Daly C;Mitchell D;Grossberg D;Highfield J;Stewart D;	1997	Bacteremia caused by periodontal probing
Mont MA;Waldman B;Banerjee C;Pacheco IH;Hungerford DS;	1997	Multiple irrigation, debridement, and retention of components in infected total knee arthroplasty
Debelian GJ;Olsen I;Tronstad L;	1995	Bacteremia in conjunction with endodontic therapy
Goker K;Guvener O;	1992	Antibacterial Effects of Ofloxacin, Clindamycin and Sultamicillin on Surgical Removal of Impacted Third Molars
Klenerman L;Seal D;Sullens K;	1991	Combined prophylactic effect of ultraclean air and cefuroxime for reducing infection in prosthetic surgery
Flood TR;Samaranayake LP;MacFarlane TW;McLennan A;MacKenzie D;Carmichael F;	1990	Bacteraemia following incision and drainage of dento-alveolar abscesses
Heimdahl A;Hall G;Hedberg M;Sandberg H;Soder PO;Tuner K;Nord CE;	1990	Detection and Quantitation by Lysis-Filtration of Bacteremia after Different Oral Surgical Procedures
Waki MY;Jolkovsky DL;Otomo-Corgel J;Lofthus JE;Nachnani S;Newman MG;Flemmig TF;	1990	Effects of subgingival irrigation on bacteremia following scaling and rootplaning

Table 52 Included Studies for Background Microbiology

Author(s)	Year	Title
Windsor RE;Insall JN;Urs WK;Miller DV;Brause BD;	1990	Two-stage reimplantation for the salvage of total knee arthroplasty complicated by infection. Further follow-up and refinement of indications
Casolari C;Neglia R;Forabosco A;Galetti R;Fabio U;	1989	Incidence of oral bacteremia and antimicrobial prophylaxis
Hansen CP;Westh H;Brok KE;Jensen R;Bertelsen S;	1989	Bacteraemia following orotracheal intubation and oesophageal balloon dilatation
Dinner M;Tjeuw M;Artusio JF;	1987	Bacteremia as a Complication of Nasotrachael intubation
Shanson DC;Shehata A;Tadayon M;Harris M;	1987	Comparison of intravenous teicoplanin with intramuscular amoxycillin for the prophylaxis of streptococcal bacteraemia in dental patients
Maskell JP;Carter JL;Boyd RB;Williams RJ;	1986	Teicoplanin as a prophylactic antibiotic for dental bacteraemia
Wroblewski BM;	1986	One-stage revision of infected cemented total hip arthroplasty
Lamey PJ;MacFarlane TW;Patton DW;Samaranayake LP;Ferguson MM;	1985	Bacteraemia consequential to sialography
Ainscow DA;Denham RA;	1984	The risk of haematogenous infection in total joint replacements
Insall JN;Thompson FM;Brause BD;	1983	Two-stage reimplantation for the salvage of infected total knee arthroplasty
Marzoni FA;Kelly DR;	1983	Bacteremia following cleft palate repair--a prospective study

Table 52 Included Studies for Background Microbiology

Author(s)	Year	Title
Silver JG;Martin AW;McBride BC;	1979	Experimental transient bacteraemias in human subjects with clinically healthy gingivae
Shanson DC;Cannon P;Wilks M;	1978	Amoxycillin compared with penicillin V for the prophylaxis of dental bacteraemia
Baumgartner JC;Heggers JP;Harrison JW;	1977	Incidence of bacteremias related to endodontic procedures. II. Surgical endodontics
Soliman NA;el-Batawy YA;Abdallah AK;	1977	Bacteriologic study of the systemic disturbances accompanying primary teething
Baumgartner JC;Heggers JP;Harrison JW;	1976	The incidence of bacteremias related to endodontic procedures. I. Nonsurgical endodontics
Peterson LJ;Peacock R;	1976	The incidence of bacteremia in pediatric patients following tooth extraction
Wank HA;Levison ME;Rose LF;Cohen DW;	1976	A quantitative measurement of bacteremia and its relationship to plaque control
Ramadan AE;Zaki SA;Nour ZM;	1975	A study of transient bacteremia following the use of dental floss silk and interdental stimulators
Berger SA;Weitzman S;Edberg SC;Casey JI;	1974	Bacteremia after the use of an oral irrigation device. A controlled study in subjects with normal-appearing gingiva: comparison with use of toothbrush
Brenman HS;Randall E;	1974	Local degerming with providone-iodine II. Prior ro gingivectomy

Table 52 Included Studies for Background Microbiology

Author(s)	Year	Title
De Leo AA;Schoenknecht FD;Anderson MW;Peterson JC;	1974	The incidence of bacteremia following oral prophylaxis on pediatric patients
Berry FA;Blankenbaker WL;Ball CG;	1973	A Comparison of Bacteremia Occurring With Nasotracheal and Orotracheal lntubation
Crawford JJ;Sconyers JR;Moriarty JD;King RC;West JF;	1973	Bacteremia after tooth extractions studied with the aid of prereduced anaerobically sterilized culture media
Lineberger LT;De Marco TJ;	1973	Evaluation of transient bacteremia following routine periodontal procedures
Sconyers JR;Crawford JJ;Moriarty JD;	1973	Relationship of bacteremia to toothbrushing in patients with periodontitis
Felix JE;Rosen S;App GR;	1971	Detection of bacteremia after the use of an oral irrigation device in subjects with periodontitis
Romans AR;App GR;	1971	Bacteremia, a result from oral irrigation in subjects with gingivitis
Conner HD;Haberman S;Collings CK;Winford TE;	1967	Bacteremias following periodontal scaling in patients with healthy appearing gingiva
Khairat O;	1966	The non-aerobes of post-extraction bacteremia
Martin WJ;Schirger A;	1964	Prevention of bacteremia after oral surgery
Gutverg M;	1962	Studies on bacteremia following oral surgery: some prophylactic approaches to bacteremia and the result of tissue examination of excised gingiva

Table 52 Included Studies for Background Microbiology

Author(s)	Year	Title
ROGOSA M;HAMPP EG;NEVIN TA;WAGNER HN;DRISCOLL EJ;Baer PN;	1960	Blood sampling and cultural studies in the detection of postoperative bacteremias
Winslow MB;KOBERNICK SD;	1960	Bacteremia after prophylaxis

EXCLUDED STUDIES TABLES

RECOMMENDATION 1

Table 53 Excluded Studies for Recommendation 1

Author(s)	Year	Title	Reason for Exclusion
Bahrani-Mougeot FK;Paster BJ;Coleman S;Ashar J;Barbuto S;Lockhart PB;	2008	Diverse and novel oral bacterial species in blood following dental procedures	Relevant data previously published
Jeon HS;Hong SP;Cho BO;Mulyukin A;Choi JY;Kim SG;	2005	Hematogenous infection of the human temporomandibular joint	Not best available evidence
Roberts GJ;Holzel HS;Sury MR;Simmons NA;Gardner P;Longhurst P;	1997	Dental bacteremia in children	Split mouth design
Aoki T;Kobayashi I;	1996	Blood culture positive rate of 3 media (Bactec(registered trademark), FAN(registered trademark), and VITAL ANA(registered trademark)) after tooth extraction using imipenem	n<10
Kaneko A;Sasaki J;Yamazaki J;Kobayashi I;	1995	Intravenous administration of vancomycin is ineffective against bacteremia following tooth extraction	No control group
Nohara T;Kobayashi I;	1995	Transient bacteremia after tooth extraction with intravenous cefuroxime prophylaxis	No control group
Shirai T;Kobayashi I;	1995	Transient bacteremia after tooth extraction using ceftriaxone intravenously	No control group

Table 53 Excluded Studies for Recommendation 1

Author(s)	Year	Title	Reason for Exclusion
Sasaki J;Otsuka T;Ozawa H;Takakura J;Kobayashi I;	1994	Transient bacteremia after tooth extraction using ampicillin intravenously	No control group
Sefton AM;Maskell JP;Kerawala C;Cannell H;Seymour A;Sun ZM;Williams JD;	1990	Comparative efficacy and tolerance of erythromycin and josamycin in the prevention of bacteraemia following dental extraction	Duplicate publication
Gismondo MR;Nicoletti G;	1989	Prophylaxis of dental bacteremia	Insufficient data for analysis
Baltch AL;Pressman HL;Schaffer C;Smith RP;Hammer MC;Shayegani M;Michelsen P;	1988	Bacteremia in patients undergoing oral procedures. Study following parenteral antimicrobial prophylaxis as recommended by the American Heart Association, 1977	Insufficient data for analysis
Hess J;Holloway Y;Dankert J;	1983	Incidence of postextraction bacteremia under penicillin cover in children with cardiac disease	No control group
Baltch AL;Pressman HL;Hammer MC;Sutphen NC;Smith RP;Shayegani M;	1982	Bacteremia following dental extractions in patients with and without penicillin prophylaxis	Insufficient data for analysis
Tolman DE;Schirger A;Martin WJ;Washington JA;	1972	Ampicillin administered prophylactically in oral surgery	No control group
Martin WJ;Waite DE;Miller JJ;Schirger A;	1971	Oral surgery. Cloxacillin for prophylaxis	No control group

Table 53 Excluded Studies for Recommendation 1

Author(s)	Year	Title	Reason for Exclusion
Benson DD;Waite DE;Hall WH;Carroll GW;	1970	Omnipen (ampicillin) for prophylaxis. Prior to oral surgery	No control group
Elliott RH;Dunbar JM;	1968	Streptococcal bacteraemia in children following dental extractions	Not best available evidence
Schirger A;Waite DE;Martin WJ;	1968	Erythromycin for prophylaxis prior to oral surgery in patients allergic to panicillin	No control group
Waite DE;Schirger A;Martin WJ;	1967	Cloxacillin for prophylaxis in oral surgery	No control group
Schirger A;Martin WJ;ROYER RO;NEEDHAM GM;	1960	Bacterial invasion of blood after oral surgical procedures	Duplicate publication

RECOMMENDATION 2

Table 54 Excluded Studies for Recommendation 2

Author(s)	Year	Title	Reason for Exclusion
Assaf M;Yilmaz S;Kuru B;Ipci SD;Noyun U;Kadir T;	2007	Effect of the diode laser on bacteremia associated with dental ultrasonic scaling: a clinical and microbiological study	Split mouth design
Aguada E;Olona IL;Salazar MB;	1997	Gingival degerming by povidone-iodine irrigation: bacteremia reduction in extraction procedures	Blood drawn from sulcus
Rahn R;Diehl O;Schafer V;Shah PM;Fleischer W;Reimer K;	1994	The effect of topical Povidone-Iodine and Chlorhexidine on the incidence of bacteremia following dental treatment procedures	Duplicate publication
Allison C;Simor AE;Mock D;Tenenbaum HC;	1993	Prosol-chlorhexidine irrigation reduces the incidence of bacteremia during ultrasonic scaling with the Cavi-Med: a pilot investigation	Split mouth design
Reinhardt RA;Bolton RW;Hlava G;	1982	Effect of nonsterile versus sterile water irrigation with ultrasonic scaling on postoperative bacteremias	Split mouth design
Witzenberger T;O'Leary TJ;Gillette WB;	1982	Effect of a local germicide on the occurrence of bacteremia during subgingival scaling	Split mouth design
Madsen KL;	1975	Effect of chlorhexidine mouthrinse and periodontal treatment upon bacteremia produced by oral hygiene procedures	Duplicate publication

Table 54 Excluded Studies for Recommendation 2

Author(s)	Year	Title	Reason for Exclusion
Tamini HA;Norwood RS;August AA;Dunkin RT;Eversole LR;Moser EH;	1975	Use of antiseptics before injection to minimize incidence of bacteremia	Split mouth design
Bartlett RC;Howell RM;	1973	Topical vancomycin as a deterrent to bacteremias following dental procedures	Split mouth design
Eldirini AH;	1968	Effectiveness of epinephrine in local anesthetic solutions on the bacteremia following dental extraction	Not topical antimicrobial
Winslow MB;Millstone SH;	1965	Bacteremia after prophylaxis	No control group
Louis JD;	1960	The influence of epinephrine on the incidence of bacteremia	Not topical antimicrobial

RECOMMENDATION 3

Table 55 Excluded Studies for Recommendation 3

Author(s)	Year	Title	Reason for Exclusion
Lafaurie GI;Mayorga-Fayad I;Torres MF;Castillo DM;Aya MR;Baron A;Hurtado PA;	2007	Periodontopathic microorganisms in peripheric blood after scaling and root planing	No statistical test for prognostic factors
Tomas I;Alvarez M;Limeres J;Potel C;Medina J;Diz P;	2007	Prevalence, duration and aetiology of bacteraemia following dental extractions	Not best available evidence
Murphy AM;Daly CG;Mitchell DH;Stewart D;Curtis BH;	2006	Chewing fails to induce oral bacteraemia in patients with periodontal disease	No statistical test for prognostic factors
Roberts GJ;Gardner P;Longhurst P;Black AE;Lucas VS;	2000	Intensity of bacteraemia associated with conservative dental procedures in children	No statistical test for prognostic factors
Witzenberger T;O'Leary TJ;Gillette WB;	1982	Effect of a local germicide on the occurrence of bacteremia during subgingival scaling	Split mouth design
Wank HA;Levison ME;Rose LF;Cohen DW;	1976	A quantitative measurement of bacteremia and its relationship to plaque control	Not best available evidence
Madsen KL;	1974	Effect of chlorhexidine mouthrinse and periodontal treatment upon bacteremia produced by oral hygiene procedures	Not best available evidence

DENTAL PROCEDURES AND BACTEREMIA

Table 56 Excluded Studies for Dental Procedures and Bacteremia

Author(s)	Year	Title	Reason for Exclusion
Fine DH;Furgang D;McKiernan M;Tereski-Bischio D;Ricci-Nittel D;Zhang P;Araujo MW;	2010	An investigation of the effect of an essential oil mouthrinse on induced bacteraemia: a pilot study	Not best available evidence
Jones DJ;Munro CL;Grap MJ;Kitten T;Edmond M;	2010	Oral care and bacteremia risk in mechanically ventilated adults	Not best available evidence
Ashare A;Stanford C;Hancock P;Stark D;Lilli K;Birrer E;Nymon A;Doerschug KC;Hunninghake GW;	2009	Chronic liver disease impairs bacterial clearance in a human model of induced bacteremia	Not best available evidence
Bahrani-Mougeot FK;Paster BJ;Coleman S;Ashar J;Barbuto S;Lockhart PB;	2008	Diverse and novel oral bacterial species in blood following dental procedures	Duplicate publication
Lucas VS;Gafan G;Dewhurst S;Roberts GJ;	2008	Prevalence, intensity and nature of bacteraemia after toothbrushing	Not best available evidence
Assaf M;Yilmaz S;Kuru B;Ipci SD;Noyun U;Kadir T;	2007	Effect of the diode laser on bacteremia associated with dental ultrasonic scaling: a clinical and microbiological study	Split mouth design
Lucas VS;Kyriazidou A;Gelbier M;Roberts GJ;	2007	Bacteraemia following debanding and gold chain adjustment	Not best available evidence
Diz DP;Tomas C;Limeres PJ;Medina HJ;Fernandez FJ;Alvarez FM;	2006	Comparative efficacies of amoxicillin, clindamycin, and moxifloxacin in prevention of bacteremia following dental extractions	Duplicate publication

Table 56 Excluded Studies for Dental Procedures and Bacteremia

Author(s)	Year	Title	Reason for Exclusion
Roberts GJ;Jaffray EC;Spratt DA;Petrie A;Greville C;Wilson M;Lucas VS;	2006	Duration, prevalence and intensity of bacteraemia after dental extractions in children	Insufficient data for analysis
Hartzell JD;Torres D;Kim P;Wortmann G;	2005	Incidence of bacteremia after routine tooth brushing	Not best available evidence
Rosa EA;Rached RN;Tanaka O;Fronza F;Fronza F;Araujo AR;	2005	Preliminary investigation of bacteremia incidence after removal of the Haas palatal expander	n<10
Lucas VS;Omar J;Vieira A;Roberts GJ;	2002	The relationship between odontogenic bacteraemia and orthodontic treatment procedures	Not best available evidence
Erverdi N;Acar A;Isguden B;Kadir T;	2001	Investigation of bacteremia after orthodontic banding and debanding following chlorhexidine mouth wash application	Not best available evidence
Vergis EN;Demas PN;Vaccarello SJ;Yu VL;	2001	Topical antibiotic prophylaxis for bacteremia after dental extractions	n<10
Erverdi N;Biren S;Kadir T;Acar A;	2000	Investigation of bacteremia following orthodontic debanding	Not best available evidence
Messini M;Skourti I;Markopulos E;Koutsia-Carouzou C;Kyriakopoulou E;Kostaki S;Lambraki D;Georgopoulos A;	1999	Bacteremia after dental treatment in mentally handicapped people	Cannot determine bacteremia incidence

Table 56 Excluded Studies for Dental Procedures and Bacteremia

Author(s)	Year	Title	Reason for Exclusion
Roberts GJ;Holzel HS;Sury MR;Simmons NA;Gardner P;Longhurst P;	1997	Dental bacteremia in children	Split mouth design
McLaughlin JO;Coulter WA;Coffey A;Burden DJ;	1996	The incidence of bacteremia after orthodontic banding	Not best available evidence
Okabe K;Nakagawa K;Yamamoto E;	1995	Factors affecting the occurrence of bacteremia associated with tooth extraction	Not best available evidence
Morishima T;Sasaki J;	1994	Transient bacteremia after tooth extraction	Cannot determine bacteremia incidence
Rahn R;Diehl O;Schafer V;Shah PM;Fleischer W;Reimer K;	1994	The effect of topical Povidone-Iodine and Chlorhexidine on the incidence of bacteremia following dental treatment procedures	Duplicate publication
Allison C;Simor AE;Mock D;Tenenbaum HC;	1993	Prosol-chlorhexidine irrigation reduces the incidence of bacteremia during ultrasonic scaling with the Cavi-Med: a pilot investigation	Split mouth design
Yamalik MK;Yucetas S;Abbasoglu U;	1992	Effects of various antiseptics on bacteremia following tooth extraction	Not best available evidence
Schlein RA;Kudlick EM;Reindorf CA;Gregory J;Royal GC;	1991	Toothbrushing and transient bacteremia in patients undergoing orthodontic treatment	Not best available evidence

Table 56 Excluded Studies for Dental Procedures and Bacteremia

Author(s)	Year	Title	Reason for Exclusion
Hunter KM;Holborow DW;Kardos TB;Lee-Knight CT;Ferguson MM;	1989	Bacteraemia and tissue damage resulting from air polishing	Not best available evidence
Baltch AL;Pressman HL;Schaffer C;Smith RP;Hammer MC;Shayegani M;Michelsen P;	1988	Bacteremia in patients undergoing oral procedures. Study following parenteral antimicrobial prophylaxis as recommended by the American Heart Association, 1977	Insufficient data for analysis
Lewis HJ;Culligan GA;Pochee E;de Wet FA;Crewe-Brown HH;	1987	A microbiological investigation of post-extraction bacteraemia in black subjects	Not best available evidence
Roberts GJ;Radford P;Holt R;	1987	Prophylaxis of dental bacteraemia with oral amoxycillin in children	Not best available evidence
Chung A;Kudlick EM;Gregory JE;Royal GC;Reindorf CA;	1986	Toothbrushing and transient bacteremia in patients undergoing orthodontic treatment	Not best available evidence
Appleman MD;Sutter VL;Sims TN;	1982	Value of antibiotic prophylaxis in periodontal surgery	Not best available evidence
Baltch AL;Schaffer C;Hammer MC;Sutphen NT;Smith RP;Conroy J;Shayegani M;	1982	Bacteremia following dental cleaning in patients with and without penicillin prophylaxis	Not best available evidence
Reinhardt RA;Bolton RW;Hlava G;	1982	Effect of nonsterile versus sterile water irrigation with ultrasonic scaling on postoperative bacteremias	Split mouth design

Table 56 Excluded Studies for Dental Procedures and Bacteremia

Author(s)	Year	Title	Reason for Exclusion
Witzenberger T;O'Leary TJ;Gillette WB;	1982	Effect of a local germicide on the occurrence of bacteremia during subgingival scaling	Split mouth design
Carroll GC;Sebor RJ;	1980	Dental flossing and its relationship to transient bacteremia	n<10
Sweet JB;Gill VJ;Chusid MJ;Elin RJ;	1978	Nitroblue tetrazolium and Limulus assays for bacteremia after dental extraction: effect of topical antiseptics	Not best available evidence
Hockett RN;Loesche WJ;Sodeman TM;	1977	Bacteraemia in asymptomatic human subjects	Insufficient data for analysis
Nasif AS;	1977	The incidence of post-extraction bacteremia after irrigation of the gingival sulcus with hydrogen peroxide solution	Not best available evidence
Silver JG;Martin AW;McBride BC;	1977	Experimental transient bacteraemias in human subjects with varying degrees of plaque accumulation and gingival inflammation	Not best available evidence
Speck WT;Spear SS;Krongrad E;Mandel L;Gersony WM;	1976	Transient bacteremia in pediatric patients after dental extraction	Not best available evidence
Faigel HC;Gaskill WF;	1975	Bacteremia in pediatric patients following dental manipulations	Cannot determine bacteremia incidence

Table 56 Excluded Studies for Dental Procedures and Bacteremia

Author(s)	Year	Title	Reason for Exclusion
Madsen KL;	1975	Effect of chlorhexidine mouthrinse and periodontal treatment upon bacteremia produced by oral hygiene procedures	Duplicate publication
Symington JM;	1975	Streptococci isolated from post-extraction bacteraemias	Insufficient data for analysis
Tamini HA;Norwood RS;August AA;Dunkin RT;Eversole LR;Moser EH;	1975	Use of antiseptics before injection to minimize incidence of bacteremia	Split mouth design
Madsen KL;	1974	Effect of chlorhexidine mouthrinse and periodontal treatment upon bacteremia produced by oral hygiene procedures	Cannot determine bacteremia incidence
Bartlett RC;Howell RM;	1973	Topical vancomycin as a deterrent to bacteremias following dental procedures	Split mouth design
Berry FA;Yarbrough S;Yarbrough N;Russell CM;Carpenter MA;Hendley JO;	1973	Transient bacteremia during dental manipulation in children	Cannot determine bacteremia incidence
Farrington FH;	1973	The incidence of transient bacteremia following pulpotomies on primary teeth	Not best available evidence
Cutcher JL;Goldberg JR;Lilly GE;Jones JC;	1971	Control of bacteremia associated with extraction of teeth. II	Not best available evidence
Hurwitz GA;Speck WT;Keller GB;	1971	Absence of bacteremia in children after prophylaxis	Not best available evidence

Table 56 Excluded Studies for Dental Procedures and Bacteremia

Author(s)	Year	Title	Reason for Exclusion
Speck WT;Hurwitz GA;Keller GB;	1971	Transient bacteremia in pediatric patients following dental manipulatin	Not best available evidence
Tamimi HA;Thomassen PR;Moser EH;	1969	Bacteremia study using a water irrigation device	Not best available evidence
de Vries JA;Francis LE;Platonow M;	1968	Adjunctive use of antibiotics in traumatic dental procedures	Insufficient data for analysis
Eldirini AH;	1968	Effectiveness of epinephrine in local anesthetic solutions on the bacteremia following dental extraction	Not best available evidence
Khairat O;	1966	An effective antibiotic cover for the prevention of endocarditis following dental and other post-operative bacteraemias	Not best available evidence

BACKGROUND MICROBIOLOGY

Table 57 Excluded Studies for Background Microbiology

Author(s)	Year	Title	Reason for Exclusion
Le D;Smith K;Tanzer D;Tanzer M;	2011	Modular femoral sleeve and stem implant provides long-term total hip survivorship	Insufficient data for analysis
Aslam S;Reitman C;Darouiche RO;	2010	Risk factors for subsequent diagnosis of prosthetic joint infection	Retrospective study
Barbosa M;Carmona IT;Amaral B;Limeres J;Alvarez M;Cerqueira C;Diz P;	2010	General anesthesia increases the risk of bacteremia following dental extractions	Insufficient data on bacteremia for background microbiology
Burnett RS;Aggarwal A;Givens SA;McClure JT;Morgan PM;Barrack RL;	2010	Prophylactic antibiotics do not affect cultures in the treatment of an infected TKA: a prospective trial	Insufficient data for analysis
Cordero-Ampuero J;Esteban J;Garcia-Rey E;	2010	Results after late polymicrobial, gram-negative, and methicillin-resistant infections in knee arthroplasty	Insufficient data for analysis
Erhart J;Jaklitsch K;Schurz M;Vecsei V;Ehall R;	2010	Cementless two-staged total hip arthroplasty with a short term interval period for chronic deep periprosthetic infection. Technique and long-term results	Review
Estes CS;Beauchamp CP;Clarke HD;Spangehl MJ;	2010	A two-stage retention debridement protocol for acute periprosthetic joint infections	Retrospective study

Table 57 Excluded Studies for Background Microbiology

Author(s)	Year	Title	Reason for Exclusion
Goddard NJ;Mann HA;Lee CA;	2010	Total knee replacement in patients with end-stage haemophilic arthropathy: 25-year results	Retrospective study
McCleery MA;Leach WJ;Norwood T;	2010	Rates of infection and revision in patients with renal disease undergoing total knee replacement in Scotland	Insufficient data for analysis
Ocguder A;Firat A;Tecimel O;Solak S;Bozkurt M;	2010	Two-stage total infected knee arthroplasty treatment with articulating cement spacer	Insufficient data for analysis
Ritter MA;Farris A;	2010	Outcome of Infected Total Joint Replacement	Retrospective study
Rodriguez D;Pigrau C;Euba G;Cobo J;Garcia-Lechuz J;Palomino J;Riera M;Del Toro MD;Granados A;Ariza X;	2010	Acute haematogenous prosthetic joint infection: prospective evaluation of medical and surgical management	Duplicate Publication
Sousa R;Pereira A;Massada M;da Silva MV;Lemos R;Costa e Castro;	2010	Empirical antibiotic therapy in prosthetic joint infections	Retrospective study
Zywiel MG;Johnson AJ;Stroh DA;Martin J;Marker DR;Mont MA;	2010	Prophylactic oral antibiotics reduce reinfection rates following two-stage revision total knee arthroplasty	Retrospective study
Bin D;Noble PC;	2009	Aseptic loosening of cemented stem following cemented hip arthroplasty: Analysis of 36 revised specimens	Insufficient data for analysis

Table 57 Excluded Studies for Background Microbiology

Author(s)	Year	Title	Reason for Exclusion
Byren I;Bejon P;Atkins BL;Angus B;Masters S;McLardy-Smith P;Gundle R;Berendt A;	2009	One hundred and twelve infected arthroplasties treated with 'DAIR' (debridement, antibiotics and implant retention): antibiotic duration and outcome	Retrospective study
Carrington NC;Sierra RJ;Gie GA;Hubble MJ;Timperley AJ;Howell JR;	2009	The Exeter Universal cemented femoral component at 15 to 17 years: an update on the first 325 hips	Insufficient data for analysis
Cavusoglu AT;Er MS;Inal S;Ozsoy MH;Dincel VE;Sakaogullari A;	2009	Pin site care during circular external fixation using two different protocols	Insufficient data for analysis
Chen WS;Fu TH;Wang JW;	2009	Two-stage reimplantation of infected hip arthroplasties	Insufficient data for analysis
Dale H;Hallan G;Hallan G;Espehaug B;Havelin LI;Engesaeter LB;	2009	Increasing risk of revision due to deep infection after hip arthroplasty	Retrospective study
Dauchy FA;Dupon M;Dutronc H;de BB;Lawson-Ayayi S;Dubuisson V;Souillac V;	2009	Association between psoas abscess and prosthetic hip infection: a case-control study	Insufficient data for analysis
Goebel D;Schultz W;	2009	The Mayo cementless femoral component in active patients with osteoarthritis	Insufficient data for analysis
Hooper GJ;Rothwell AG;Stringer M;Frampton C;	2009	Revision following cemented and uncemented primary total hip replacement: a seven-year analysis from the New Zealand Joint Registry	Insufficient data for analysis

Table 57 Excluded Studies for Background Microbiology

Author(s)	Year	Title	Reason for Exclusion
Martinez-Pastor JC;Munoz-Mahamud E;Vilchez F;Garcia-Ramiro S;Bori G;Sierra J;Martinez JA;Font L;Mensa J;Soriano A;	2009	Outcome of acute prosthetic joint infections due to gram-negative bacilli treated with open debridement and retention of the prosthesis	Retrospective study
Nixon PP;Littler P;Davies K;Krishnam MS;	2009	Does sialography require antibiotic prophylaxis?	Insufficient data on bacteremia for background microbiology
Ong KL;Kurtz SM;Lau E;Bozic KJ;Berry DJ;Parvizi J;	2009	Prosthetic joint infection risk after total hip arthroplasty in the Medicare population	Insufficient data for analysis
Ren W;Blasier R;Peng X;Shi T;Wooley PH;Markel D;	2009	Effect of oral erythromycin therapy in patients with aseptic loosening of joint prostheses	Insufficient data for analysis
Sonbol H;Spratt D;Roberts GJ;Lucas VS;	2009	Prevalence, intensity and identity of bacteraemia following conservative dental procedures in children	Insufficient data on bacteremia for background microbiology
Stefansdottir A;Johansson D;Knutson K;Lidgren L;Robertsson O;	2009	Microbiology of the infected knee arthroplasty: report from the Swedish Knee Arthroplasty Register on 426 surgically revised cases	Retrospective study
Tintle SM;Forsberg JA;Potter BK;Islinger RB;Andersen RC;	2009	Prosthesis retention, serial debridement, and antibiotic bead use for the treatment of infection following total joint arthroplasty	Review

Table 57 Excluded Studies for Background Microbiology

Author(s)	Year	Title	Reason for Exclusion
Yoo JJ;Kwon YS;Koo KH;Yoon KS;Kim YM;Kim HJ;	2009	One-stage cementless revision arthroplasty for infected hip replacements	Review
Zeller V;Lavigne M;Leclerc P;Lhotellier L;Graff W;Ziza JM;Desplaces N;Mamoudy P;	2009	Group B streptococcal prosthetic joint infections: a retrospective study of 30 cases	Retrospective study
Brook I;	2008	Microbiology and management of joint and bone infections due to anaerobic bacteria	Review
Gosheger G;Goetze C;Hardes J;Joosten U;Winkelmann W;von EC;	2008	The influence of the alloy of megaprostheses on infection rate	Retrospective study
Lau TW;Leung F;Chan CF;Chow SP;	2008	Wound complication of minimally invasive plate osteosynthesis in distal tibia fractures	Retrospective study
Leclercq S;Benoit JY;de Rosa JP;Euvrard P;Leteurtre C;Girardin P;	2008	Results of the Evora dual-mobility socket after a minimum follow-up of five years	Insufficient data for analysis
Lockhart PB;Brennan MT;Sasser HC;Fox PC;Paster BJ;Bahrani-Mougeot FK;	2008	Bacteremia associated with toothbrushing and dental extraction	Insufficient data on bacteremia for background microbiology
Oussedik SI;Haddad FS;	2008	The use of linezolid in the treatment of infected total joint arthroplasty	Retrospective study
Parvizi J;Ghanem E;Azzam K;Davis E;Jaberi F;Hozack W;	2008	Periprosthetic infection: are current treatment strategies adequate?	Retrospective study

Table 57 Excluded Studies for Background Microbiology

Author(s)	Year	Title	Reason for Exclusion
Poeschl PW;Ploder O;Seemann R;Poeschl E;	2008	Maxillomandibular fixation using intraoral cortical bone screws and specially designed metal hooks (Ottenhaken) in the conservative treatment of mandibular fractures	Insufficient data for analysis
Ritter MA;Meneghini RM;	2008	Twenty-year survivorship of cementless anatomic graduated component (AGC) total knee replacement	Insufficient data for analysis
Schafer P;Fink B;Sandow D;Margull A;Berger I;Frommelt L;	2008	Prolonged bacterial culture to identify late periprosthetic joint infection: a promising strategy	Insufficient data for analysis
Tomas I;Pereira F;Llucian R;Poveda R;Diz P;Bagan JV;	2008	Prevalence of bacteraemia following third molar surgery	Insufficient data on bacteremia for background microbiology
Aboltins CA;Page MA;Buising KL;Jenney AW;Daffy JR;Choong PF;Stanley PA;	2007	Treatment of staphylococcal prosthetic joint infections with debridement, prosthesis retention and oral rifampicin and fusidic acid	Retrospective study
Byrne AM;Morris S;McCarthy T;Quinlan W;O'byrne JM;	2007	Outcome following deep wound contamination in cemented arthroplasty	Study on perioperative contamination
Cook JL;Scott RD;Long WJ;	2007	Late hematogenous infections after total knee arthroplasty: experience with 3013 consecutive total knees	Retrospective study

Table 57 Excluded Studies for Background Microbiology

Author(s)	Year	Title	Reason for Exclusion
Frances A;Moro E;Cebrian JL;Marco F;Garcia-Lopez A;Serfaty D;Lopez-Duran L;	2007	Reconstruction of bone defects with impacted allograft in femoral stem revision surgery	Insufficient data for analysis
Kowalski TJ;Berbari EF;Huddleston PM;Steckelberg JM;Mandrekar JN;Osmon DR;	2007	The management and outcome of spinal implant infections: contemporary retrospective cohort study	Retrospective study
Rao N;Hamilton CW;	2007	Efficacy and safety of linezolid for Gram-positive orthopedic infections: a prospective case series	Insufficient data for analysis
Renvert S;Roos-Jansaker AM;Lindahl C;Renvert H;Rutger PG;	2007	Infection at titanium implants with or without a clinical diagnosis of inflammation	Insufficient data for analysis
Sundararaj GD;Babu N;Amritanand R;Venkatesh K;Nithyananth M;Cherian VM;Lee VN;	2007	Treatment of haematogenous pyogenic vertebral osteomyelitis by single-stage anterior debridement, grafting of the defect and posterior instrumentation	Insufficient data for analysis
Tomas I;Alvarez M;Limeres J;Potel C;Medina J;Diz P;	2007	Prevalence, duration and aetiology of bacteraemia following dental extractions	Insufficient data on bacteremia for background microbiology
Tomas I;Alvarez M;Limeres J;Tomas M;Medina J;Otero JL;Diz P;	2007	Effect of a chlorhexidine mouthwash on the risk of postextraction bacteremia	Insufficient data on bacteremia for background microbiology
You JH;Lee GC;So RK;Cheung KW;Hui M;	2007	Linezolid versus vancomycin for prosthetic joint infections: a cost analysis	Simulation model

Table 57 Excluded Studies for Background Microbiology

Author(s)	Year	Title	Reason for Exclusion
Barberan J;	2006	Management of infections of osteoarticular prosthesis	Review
Barberan J;Aguilar L;Carroquino G;Gimenez MJ;Sanchez B;Martinez D;Prieto J;	2006	Conservative treatment of staphylococcal prosthetic joint infections in elderly patients	Retrospective study
Comba F;Buttaro M;Pusso R;Piccaluga F;	2006	Acetabular reconstruction with impacted bone allografts and cemented acetabular components: a 2- to 13-year follow-up study of 142 aseptic revisions	Insufficient data for analysis
Diz DP;Tomas C;Limeres PJ;Medina HJ;Fernandez FJ;Alvarez FM;	2006	Comparative efficacies of amoxicillin, clindamycin, and moxifloxacin in prevention of bacteremia following dental extractions	Insufficient data on bacteremia for background microbiology
Engesaeter LB;Espehaug B;Lie SA;Furnes O;Havelin LI;	2006	Does cement increase the risk of infection in primary total hip arthroplasty? Revision rates in 56,275 cemented and uncemented primary THAs followed for 0-16 years in the Norwegian Arthroplasty Register	Insufficient data for analysis
Fulkerson E;Valle CJ;Wise B;Walsh M;Preston C;Di Cesare PE;	2006	Antibiotic susceptibility of bacteria infecting total joint arthroplasty sites	Review
Laffer RR;Graber P;Ochsner PE;Zimmerli W;	2006	Outcome of prosthetic knee-associated infection: evaluation of 40 consecutive episodes at a single centre	Retrospective study

Table 57 Excluded Studies for Background Microbiology

Author(s)	Year	Title	Reason for Exclusion
Lin C;Hsu H;Huang C;Chen S;	2006	Late-onset infection of total knee arthroplasty caused by the Klebsiella pneumoniae bacteremia	Insufficient data for analysis
Lindeboom JA;Frenken JW;Tuk JG;Kroon FH;	2006	A randomized prospective controlled trial of antibiotic prophylaxis in intraoral bone-grafting procedures: preoperative single-dose penicillin versus preoperative single-dose clindamycin	Insufficient data for analysis
Lotke PA;Carolan GF;Puri N;	2006	Impaction grafting for bone defects in revision total knee arthroplasty	Insufficient data for analysis
Murphy AM;Daly CG;Mitchell DH;Stewart D;Curtis BH;	2006	Chewing fails to induce oral bacteraemia in patients with periodontal disease	Insufficient data on bacteremia for background microbiology
Rallis G;Mourouzis C;Papakosta V;Papanastasiou G;Zachariades N;	2006	Reasons for miniplate removal following maxillofacial trauma: a 4-year study	Insufficient data for analysis
Theodossy T;Jackson O;Petrie A;Lloyd T;	2006	Risk factors contributing to symptomatic plate removal following sagittal split osteotomy	Insufficient data for analysis
Bassetti M;Vitale F;Melica G;Righi E;Di BA;Molfetta L;Pipino F;Cruciani M;Bassetti D;	2005	Linezolid in the treatment of Gram-positive prosthetic joint infections	Retrospective study
Belthur MV;Bradish CF;Gibbons PJ;	2005	Late orthopaedic sequelae following meningococcal septicaemia. A multicentre study	Insufficient data for analysis

Table 57 Excluded Studies for Background Microbiology

Author(s)	Year	Title	Reason for Exclusion
Chu VH;Crosslin DR;Friedman JY;Reed SD;Cabell CH;Griffiths RI;Masselink LE;Kaye KS;Corey GR;Reller LB;Stryjewski ME;Schulman KA;Fowler VG;	2005	Staphylococcus aureus bacteremia in patients with prosthetic devices: costs and outcomes	Insufficient data for analysis
Khatri M;Stirrat AN;	2005	Souter-Strathclyde total elbow arthroplasty in rheumatoid arthritis: medium-term results	Retrospective study
Marculescu CE;Berbari EF;Hanssen AD;Steckelberg JM;Osmon DR;	2005	Prosthetic joint infection diagnosed postoperatively by intraoperative culture	Retrospective study
Silva M;Luck JV;	2005	Long-term results of primary total knee replacement in patients with hemophilia	Review
Takai S;Kuriyama T;Yanagisawa M;Nakagawa K;Karasawa T;	2005	Incidence and bacteriology of bacteremia associated with various oral and maxillofacial surgical procedures	Insufficient data on bacteremia for background microbiology
Durbhakula SM;Czajka J;Fuchs MD;Uhl RL;	2004	Spacer endoprosthesis for the treatment of infected total hip arthroplasty	Retrospective study
Forster H;Marotta JS;Heseltine K;Milner R;Jani S;	2004	Bactericidal activity of antimicrobial coated polyurethane sleeves for external fixation pins	Insufficient data for analysis
Ikavalko M;Belt EA;Kautiainen H;Lehto MU;	2004	Souter arthroplasty for elbows with severe destruction	Insufficient data for analysis

Table 57 Excluded Studies for Background Microbiology

Author(s)	Year	Title	Reason for Exclusion
Muschik M;Luck W;Schlenzka D;	2004	Implant removal for late-developing infection after instrumented posterior spinal fusion for scoliosis: reinstrumentation reduces loss of correction. A retrospective analysis of 45 cases	Retrospective study
Pavoni GL;Giannella M;Falcone M;Scorzolini L;Liberatore M;Carlesimo B;Serra P;Venditti M;	2004	Conservative medical therapy of prosthetic joint infections: retrospective analysis of an 8-year experience	Retrospective study
Rajasuo A;Perkki K;Nyfors S;Jousimies-Somer H;Meurman JH;	2004	Bacteremia Following Surgical Dental Extraction with an Emphasis on Anaerobic Stra	Insufficient data on bacteremia for background microbiology
Rao N;Ziran BH;Hall RA;Santa ER;	2004	Successful treatment of chronic bone and joint infections with oral linezolid	Insufficient data for analysis
Savarrio L;MacKenzie D;Riggio M;Saunders WP;Bagg J;	2004	Detection of bacteraemias during non-surgicalroot canal treatment	Insufficient data on bacteremia for background microbiology
Stavrev VP;Stavrev PV;	2004	Complications in total hip replacement	Insufficient data for analysis
Bago J;Ramirez M;Pellise F;Villanueva C;	2003	Survivorship analysis of Cotrel-Dubousset instrumentation in idiopathic scoliosis	Retrospective study
Davis III CM;Berry DJ;Harmsen WS;	2003	Cemented revision of failed uncemented femoral components of total hip arthroplasty	Insufficient data for analysis

Table 57 Excluded Studies for Background Microbiology

Author(s)	Year	Title	Reason for Exclusion
Engesaeter LB;Lie SA;Espehaug B;Furnes O;Vollset SE;Havelin LI;	2003	Antibiotic prophylaxis in total hip arthroplasty: Effects of antibiotic prophylaxis systemically and in bone cement on the revision rate of 22,170 primary hip replacements followed 0-14 years in the Norwegian Arthroplasty Register	Insufficient data for analysis
Gallo J;Kolar M;Novotny R;Rihakova P;Ticha V;	2003	Pathogenesis of prosthesis-related infection	Review
Ross JJ;Saltzman CL;Carling P;Shapiro DS;	2003	Pneumococcal septic arthritis: review of 190 cases	Retrospective study
Bhanji S;Williams B;Sheller B;Elwood T;Mancl L;	2002	Transient bacteremia induced by toothbrushing a comparison of the Sonicare toothbrush with a conventional toothbrush	Insufficient data on bacteremia for background microbiology
Husted H;Toftgaard JT;	2002	Clinical outcome after treatment of infected primary total knee arthroplasty	Retrospective study
Norian JM;Ries MD;Karp S;Hambleton J;	2002	Total knee arthroplasty in hemophilic arthropathy	Retrospective study
Perkins TR;Gunckle W;	2002	Unicompartmental knee arthroplasty: 3- to 10-year results in a community hospital setting	Insufficient data for analysis
van Koeveringe AJ;Ochsner PE;	2002	Revision cup arthroplasty using Burch-Schneider anti-protrusio cage	Insufficient data for analysis

Table 57 Excluded Studies for Background Microbiology

Author(s)	Year	Title	Reason for Exclusion
Acklin YP;Berli BJ;Frick W;Elke R;Morscher EW;	2001	Nine-year results of Muller cemented titanium Straight Stems in total hip replacement	Insufficient data for analysis
Chiu KY;Ng TP;Tang WM;Poon KC;Ho WY;Yip D;	2001	Charnley total hip arthroplasty in Chinese patients less than 40 years old	Insufficient data for analysis
Fowler VG;Fey PD;Reller LB;Chamis AL;Corey GR;Rupp ME;	2001	The intercellular adhesin locus ica is present in clinical isolates of Staphylococcus aureus from bacteremic patients with infected and uninfected prosthetic joints	Insufficient data for analysis
Ikavalko M;Lehto MU;	2001	Fractured rheumatoid elbow: treatment with Souter elbow arthroplasty--a clinical and radiologic midterm follow-up study	Insufficient data for analysis
Murdoch DR;Roberts SA;Fowler Jr VGJ;Shah MA;Taylor SL;Morris AJ;Corey GR;	2001	Infection of orthopedic prostheses after Staphylococcus aureus bacteremia	Insufficient data for analysis
Richards BR;Emara KM;	2001	Delayed infections after posterior TSRH spinal instrumentation for idiopathic scoliosis: revisited	Retrospective study
Vergis EN;Demas PN;Vaccarello SJ;Yu VL;	2001	Topical antibiotic prophylaxis for bacteremia after dental extractions	Insufficient data on bacteremia for background microbiology

Table 57 Excluded Studies for Background Microbiology

Author(s)	Year	Title	Reason for Exclusion
Abumi K;Saita M;Iida T;Kaneda K;	2000	Reduction and fixation of sacroiliac joint dislocation by the combined use of S1 pedicle screws and the galveston technique	Insufficient data for analysis
De LF;Viola R;Pellizzer G;Lazzarini L;Tramarin A;Fabris P;	2000	Regional prophylaxis with teicoplanin in monolateral or bilateral total knee replacement: an open study	Insufficient data for analysis
Gordon JE;Kelly-Hahn J;Carpenter CJ;Schoenecker PL;	2000	Pin site care during external fixation in children: results of a nihilistic approach	Insufficient data for analysis
Houshian S;Zawadski AS;Riegels-Nielsen P;	2000	Duration of postoperative antibiotic therapy following revision for infected knee and hip arthroplasties	Retrospective study
Mohler DG;Kessler JI;Earp BE;	2000	Augmented amputations of the lower extremity	Retrospective study
Roberts GJ;Gardner P;Longhurst P;Black AE;Lucas VS;	2000	Intensity of bacteraemia associated with conservative dental procedures in children	Insufficient data on bacteremia for background microbiology
Aydinli U;Karaeminogullari O;Tiskaya K;	1999	Postoperative deep wound infection in instrumented spinal surgery	Retrospective study
Brown EC;Lachiewicz PF;	1999	Precoated femoral component in total hip arthroplasty. Results of 5- to 9-year followup	Retrospective study

Table 57 Excluded Studies for Background Microbiology

Author(s)	Year	Title	Reason for Exclusion
Dearborn JT;Harris WH;	1999	High placement of an acetabular component inserted without cement in a revision total hip arthroplasty. Results after a mean of ten years	Retrospective study
Fehring TK;Calton TF;Griffin WL;	1999	Cementless fixation in 2-stage reimplantation for periprosthetic sepsis	Retrospective study
Hyman JL;Salvati EA;Laurencin CT;Rogers DE;Maynard M;Brause DB;	1999	The arthroscopic drainage, irrigation, and debridement of late, acute total hip arthroplasty infections: average 6-year follow-up	Retrospective study
Isiklar ZU;Demirors H;Akpinar S;Tandogan RN;Alparslan M;	1999	Two-stage treatment of chronic staphylococcal orthopaedic implant-related infections using vancomycin impregnated PMMA spacer and rifampin containing antibiotic protocol	Insufficient data for analysis
Leopold SS;Berger RA;Rosenberg AG;Jacobs JJ;Quigley LR;Galante JO;	1999	Impaction allografting with cement for revision of the femoral component. A minimum four-year follow-up study with use of a precoated femoral stem	Insufficient data for analysis
Lucas V;Roberts GJ;	1999	Odontogenic bacteremia following tooth cleaning procedures in children	Insufficient data on bacteremia for background microbiology
Mont MA;Yoon TR;Krackow KA;Hungerford DS;	1999	Eliminating patellofemoral complications in total knee arthroplasty: clinical and radiographic results of 121 consecutive cases using the Duracon system	Insufficient data for analysis

Table 57 Excluded Studies for Background Microbiology

Author(s)	Year	Title	Reason for Exclusion
Segawa H;Tsukayama DT;Kyle RF;Becker DA;Gustilo RB;	1999	Infection after total knee arthroplasty. A retrospective study of the treatment of eighty-one infections	Retrospective study
Vena VE;Hsu J;Rosier RN;O'Keefe RJ;	1999	Pelvic reconstruction for severe periacetabular metastatic disease	Retrospective study
Bohm P;Bosche R;	1998	Survival analysis of the Harris-Galante I acetabular cup	Insufficient data for analysis
Hartofilakidis G;Stamos K;Karachalios T;	1998	Treatment of high dislocation of the hip in adults with total hip arthroplasty. Operative technique and long-term clinical results	Insufficient data for analysis
Kofoed H;Sorensen TS;	1998	Ankle arthroplasty for rheumatoid arthritis and osteoarthritis: prospective long-term study of cemented replacements	Insufficient data for analysis
Lo NN;Tan JS;Tan SK;Vathsala A;	1998	Results of total hip replacement in renal transplant recipients	Insufficient data for analysis
Roberts GJ;Simmons NB;Longhurst P;Hewitt PB;	1998	Bacteraemia following local anaesthetic injections in children	Insufficient data on bacteremia for background microbiology
Roberts GJ;Watts R;Longhurst P;Gardner P;	1998	Bacteremia of dental origin and antimicrobial sensitivity following oral surgical procedures in children	Insufficient data on bacteremia for background microbiology

Table 57 Excluded Studies for Background Microbiology

Author(s)	Year	Title	Reason for Exclusion
Stein A;Bataille JF;Drancourt M;Curvale G;Argenson JN;Groulier P;Raoult D;	1998	Ambulatory treatment of multidrug-resistant Staphylococcus-infected orthopedic implants with high-dose oral co-trimoxazole (trimethoprim-sulfamethoxazole)	Insufficient data for analysis
Diduch DR;Insall JN;Scott WN;Scuderi GR;Font-Rodriguez D;	1997	Total knee replacement in young, active patients. Long-term follow-up and functional outcome	Insufficient data for analysis
Drancourt M;Stein A;Argenson JN;Roiron R;Groulier P;Raoult D;	1997	Oral treatment of Staphylococcus spp. infected orthopaedic implants with fusidic acid or ofloxacin in combination with rifampicin	Insufficient data for analysis
Grunig R;Morscher E;Ochsner PE;	1997	Three-to 7-year results with the uncemented SL femoral revision prosthesis	Insufficient data for analysis
Kaandorp CJ;Dinant HJ;van de Laar MA;Moens HJ;Prins AP;Dijkmans BA;	1997	Incidence and sources of native and prosthetic joint infection: a community based prospective survey	Insufficient data for analysis
Madey SM;Callaghan JJ;Olejniczak JP;Goetz DD;Johnston RC;	1997	Charnley total hip arthroplasty with use of improved techniques of cementing. The results after a minimum of fifteen years of follow-up	Insufficient data for analysis
McLaughlin JR;Lee KR;	1997	Total hip arthroplasty with an uncemented femoral component. Excellent results at ten-year follow-up	Insufficient data for analysis

Table 57 Excluded Studies for Background Microbiology

Author(s)	Year	Title	Reason for Exclusion
Nijhof MW;Oyen WJ;van KA;Claessens RA;van der Meer JW;Corstens FH;	1997	Hip and knee arthroplasty infection. In-111-IgG scintigraphy in 102 cases	Retrospective study
Ozaki T;Hillmann A;Bettin D;Wuisman P;Winkelmann W;	1997	Intramedullary, antibiotic-loaded cemented, massive allografts for skeletal reconstruction. 26 cases compared with 19 uncemented allografts	Insufficient data for analysis
Roberts GJ;Holzel HS;Sury MR;Simmons NA;Gardner P;Longhurst P;	1997	Dental bacteremia in children	Insufficient data on bacteremia for background microbiology
Hauser R;Berchtold W;Schreiber A;	1996	Incidence of deep sepsis in uncemented total hip arthroplasty using clean air facility as a function of antibiotic prophylaxis	Retrospective study
Lai KA;Shen WJ;Yang CY;Lin RM;Lin CJ;Jou IM;	1996	Two-stage cementless revision THR after infection. 5 recurrences in 40 cases followed 2.5-7 years	Retrospective study
Lu H;Mehdi G;Zhou D;Lin J;	1996	Simultaneous bilateral total knee arthroplasty for rheumatoid arthritis	Insufficient data for analysis
Silverton C;Rosenberg AO;Barden RM;Sheinkop MB;Galante JO;	1996	The prosthesis-bone interface adjacent to tibial components inserted without cement. Clinical and radiographic follow-up at nine to twelve years	Insufficient data for analysis

Table 57 Excluded Studies for Background Microbiology

Author(s)	Year	Title	Reason for Exclusion
Tsukayama DT;Estrada R;Gustilo RB;	1996	Infection after total hip arthroplasty. A study of the treatment of one hundred and six infections	Retrospective study
Wimmer C;Gluch H;	1996	Management of postoperative wound infection in posterior spinal fusion with instrumentation	Retrospective study
Aglietti P;Buzzi R;Segoni F;Zaccherotti G;	1995	Insall-Burstein posterior-stabilized knee prosthesis in rheumatoid arthritis	Insufficient data for analysis
Hanssen AD;Trousdale RT;Osmon DR;	1995	Patient outcome with reinfection following reimplantation for the infected total knee arthroplasty	Retrospective study
Bell RS;Davis A;Allan DG;Langer F;Czitrom AA;Gross AE;	1994	Fresh osteochondral allografts for advanced giant cell tumors at the knee	Insufficient data for analysis
Ivarsson I;Wahlstrom O;Djerf K;Jacobsson SA;	1994	Revision of infected hip replacement. Two-stage procedure with a temporary gentamicin spacer	Retrospective study
Mauriello JA;Hargrave S;Yee S;Mostafavi R;Kapila R;	1994	Infection after insertion of alloplastic orbital floor implants	Retrospective study
Nasser S;	1994	The incidence of sepsis after total hip replacement arthroplasty	Insufficient data for analysis
Petrou G;Gavras M;Diamantopoulos A;Kapetsis T;Kremmydas N;Kouzoupis A;	1994	Uncemented total hip replacements and thigh pain	Retrospective study

Table 57 Excluded Studies for Background Microbiology

Author(s)	Year	Title	Reason for Exclusion
Rahn R;Schneider S;Diehl O;Schafer V;Shah PM;	1994	Preventing post-treatment bacteremia: comparing topical povidone-iodine and chlorhexidine	Insufficient data on bacteremia for background microbiology
Stromberg CN;Herberts P;	1994	A multicenter 10-year study of cemented revision total hip arthroplasty in patients younger than 55 years old. A follow-up report	Insufficient data for analysis
Drancourt M;Stein A;Argenson JN;Zannier A;Curvale G;Raoult D;	1993	Oral rifampin plus ofloxacin for treatment of Staphylococcus-infected orthopedic implants	Insufficient data for analysis
Laus M;Pignatti G;Tigani D;Alfonso C;Giunti A;	1993	Anterior decompression and plate fixation in fracture dislocations of the lower cervical spine	Insufficient data for analysis
Moeckel B;Huo MH;Salvati EA;Pellicci PM;	1993	Total hip arthroplasty in patients with diabetes mellitus	Insufficient data for analysis
Putz PA;	1993	A pilot study of oral fleroxacin given once daily in patients with bone and joint infections	Insufficient data for analysis
Riska EB;	1993	Ceramic endoprosthesis in total hip arthroplasty	Insufficient data for analysis
Ali MT;Tremewen DR;Hay AJ;Wilkinson DJ;	1992	The occurrence of bacteremia associated with the use of oral and nasopharyngeal airways	Insufficient data on bacteremia for background microbiology

Table 57 Excluded Studies for Background Microbiology

Author(s)	Year	Title	Reason for Exclusion
Davey PG;Rowley DR;Phillips GA;	1992	Teicoplanin--home therapy for prosthetic joint infections	Insufficient data for analysis
Lucartorto FM;Franker CK;Maza J;	1992	Postscaling becteremia in HIV-associated gingivitis and periodontitis	Insufficient data on bacteremia for background microbiology
Mason JC;Dollery CT;So A;Cohen J;Bloom SR;Bulpitt C;Russell-Jones R;Oakley CM;	1992	An infected prosthetic hip. Is there a role for prophylactic antibiotics?	Retrospective study
Mombelli A;Lang NP;	1992	Antimicrobial treatment of peri-implant infections	Insufficient data for analysis
Roberts GJ;Gardner P;Simmons NA;	1992	Optimum sampling time for detection of dental bacteraemia in children	Insufficient data on bacteremia for background microbiology
Schmalzried TP;Amstutz HC;Au MK;Dorey FJ;	1992	Etiology of deep sepsis in total hip arthroplasty. The significance of hematogenous and recurrent infections	Retrospective study
Armstrong RA;Whiteside LA;	1991	Results of cementless total knee arthroplasty in an older rheumatoid arthritis population	Insufficient data for analysis
Lofthus JE;Waki MY;Jolkovsky DL;Otomo-Corgel J;Newman MG;Flemmig T;Nachnani S;	1991	Bacteremia following subgingival irrigation and scaling and root planing	Insufficient data on bacteremia for background microbiology
Mathiesen EB;Lindgren JU;Blomgren GG;Reinholt FP;	1991	Corrosion of modular hip prostheses	Retrospective study

Table 57 Excluded Studies for Background Microbiology

Author(s)	Year	Title	Reason for Exclusion
Rasul AT;Tsukayama D;Gustilo RB;	1991	Effect of time of onset and depth of infection on the outcome of total knee arthroplasty infections	Retrospective study
Sanderson PJ;	1991	Infection in orthopaedic implants	Review
Swanson AB;de Groot SG;Masada K;Makino M;Pires PR;Gannon DM;Sattel AB;	1991	Constrained total elbow arthroplasty	Insufficient data for analysis
Coulter WA;Coffey A;Saunders ID;Emmerson AM;	1990	Bacteremia in children following dental extraction	Insufficient data on bacteremia for background microbiology
Kelly PJ;Fitzgerald RH;Cabanela ME;Wood MB;Cooney WP;Arnold PG;Irons GB;	1990	Results of treatment of tibial and femoral osteomyelitis in adults	Insufficient data for analysis
Mnaymneh W;Emerson RH;Borja F;Head WC;Malinin TI;	1990	Massive allografts in salvage revisions of failed total knee arthroplasties	Retrospective study
Stern SH;Insall JN;	1990	Total knee arthroplasty in obese patients	Insufficient data for analysis
Wilson MG;Kelley K;Thornhill TS;	1990	Infection as a complication of total knee-replacement arthroplasty. Risk factors and treatment in sixty-seven cases	Retrospective study
Wymenga AB;Van Dijke BJ;Van Horn JR;Slooff TJ;	1990	Prosthesis-related infection. Etiology, prophylaxis and diagnosis (a review)	Review

Table 57 Excluded Studies for Background Microbiology

Author(s)	Year	Title	Reason for Exclusion
Emery SE;Chan DP;Woodward HR;	1989	Treatment of hematogenous pyogenic vertebral osteomyelitis with anterior debridement and primary bone grafting	Insufficient data for analysis
Lian G;Cracchiolo A;Lesavoy M;	1989	Treatment of major wound necrosis following total knee arthroplasty	Retrospective study
Eskola A;Santavirta S;Konttinen YT;Tallroth K;Hoikka V;Lindholm ST;	1988	Cementless total replacement for old tuberculosis of the hip	Insufficient data for analysis
Goulet JA;Pellicci PM;Brause BD;Salvati EM;	1988	Prolonged suppression of infection in total hip arthroplasty	Retrospective study
Gustilo RB;Pasternak HS;	1988	Revision total hip arthroplasty with titanium ingrowth prosthesis and bone grafting for failed cemented femoral component loosening	Insufficient data for analysis
Kester MA;Cook SD;Harding AF;Rodriguez RP;Pipkin CS;	1988	An evaluation of the mechanical failure modalities of a rotating hinge knee prosthesis	Insufficient data for analysis
Larsson SE;Larsson S;Lundkvist S;	1988	Unicompartmental knee arthroplasty. A prospective consecutive series followed for six to 11 years	Insufficient data for analysis
Maderazo EG;Judson S;Pasternak H;	1988	Late infections of total joint prostheses. A review and recommendations for prevention	Review

Table 57 Excluded Studies for Background Microbiology

Author(s)	Year	Title	Reason for Exclusion
Madoff S;Hooper DC;	1988	Nongenitourinary infections caused by Mycoplasma hominis in adults	Retrospective study
Schutzer SF;Harris WH;	1988	Deep-wound infection after total hip replacement under contemporary aseptic conditions	Retrospective study
Bengtson S;Blomgren G;Knutson K;Wigren A;Lidgren L;	1987	Hematogenous infection after knee arthroplasty	Retrospective study
Catto BA;Jacobs MR;Shlaes DM;	1987	Streptococcus mitis. A cause of serious infection in adults	Insufficient data for analysis
Sherrer Y;Bloch D;Strober S;Fries J;	1987	Comparative toxicity of total lymphoid irradiation and immunosuppressive drug treated patients with intractable rheumatoid arthritis	Insufficient data for analysis
Stuyck J;Verbist L;Mulier JC;	1987	Treatment of chronic osteomyelitis with ciprofloxacin	Retrospective study
Unger AS;Inglis AE;Ranawat CS;Johanson NA;	1987	Total hip arthroplasty in rheumatoid arthritis. A long-term follow-up study	Insufficient data for analysis
Grogan TJ;Dorey F;Rollins J;Amstutz HC;	1986	Deep sepsis following total knee arthroplasty. Ten-year experience at the University of California at Los Angeles Medical Center	Retrospective study
Terayama K;	1986	Experience with Charnley low-friction arthroplasty in Japan	Insufficient data for analysis

Table 57 Excluded Studies for Background Microbiology

Author(s)	Year	Title	Reason for Exclusion
Fitzgerald RH;Jones DR;	1985	Hip implant infection. Treatment with resection arthroplasty and late total hip arthroplasty	Retrospective study
Josefsson K;Heimdahl A;von KL;Nord CE;	1985	Effect of phenoxymethylpenicillin and erythromycin prophylaxis on anaerobic bacteraemia after oral surgery	Insufficient data on bacteremia for background microbiology
Lachiewicz PF;Inglis AE;Insall JN;Sculco TP;Hilgartner MW;Bussel JB;	1985	Total knee arthroplasty in hemophilia	Retrospective study
Amstutz HC;Thomas BJ;Jinnah R;Kim W;Grogan T;Yale C;	1984	Treatment of primary osteoarthritis of the hip. A comparison of total joint and surface replacement arthroplasty	Retrospective study
Cluzel RA;Lopitaux R;Sirot J;Rampon S;	1984	Rifampicin in the treatment of osteoarticular infections due to staphylococci	Insufficient data for analysis
Inman RD;Gallegos KV;Brause BD;Redecha PB;Christian CL;	1984	Clinical and microbial features of prosthetic joint infection	Retrospective study
Poss R;Thornhill TS;Ewald FC;Thomas WH;Batte NJ;Sledge CB;	1984	Factors influencing the incidence and outcome of infection following total joint arthroplasty	Retrospective study
Trivedi DN;	1984	Bacteraemia due to operative procedure	Insufficient data on bacteremia for background microbiology
Glynn MK;Sheehan JM;	1983	An analysis of the causes of deep infection after hip and knee arthroplasties	Retrospective study

Table 57 Excluded Studies for Background Microbiology

Author(s)	Year	Title	Reason for Exclusion
Ritter MA;Sieber JM;	1983	A non-surgical approach to preventing hematogenous infections in total joint replacements	Retrospective study
Thomas BJ;Moreland JR;Amstutz HC;	1983	Infection after total joint arthroplasty from distal extremity sepsis	Retrospective study
Miley GB;Scheller AD;Turner RH;	1982	Medical and surgical treatment of the septic hip with one-stage revision arthroplasty	Retrospective study
Soreide O;Lillestol J;Alho A;Hvidsten K;	1982	Migration of the femoral stem in hip arthroplasties. Analysis of associations with structural, radiological and follow-up variables	Insufficient data for analysis
Stinchfield FE;Bigliani LU;Neu HC;Goss TP;Foster CR;	1980	Late hematogenous infection of total joint replacement	Retrospective study
Hughes PW;Salvati EA;Wilson PD;Blumenfeld EL;	1979	Treatment of subacute sepsis of the hip by antibiotics and joint replacement. Criteria for diagnosis with evaluation of twenty-six cases	Retrospective study
Sconyers JR;Albers DD;Kelly R;	1979	Relationship of bacteremia to toothbrushing in clinically healthy patients	Insufficient data on bacteremia for background microbiology
Mallory TH;	1978	Excision arthroplasty with delayed wound closure for the infected total hip replacement	Retrospective study

Table 57 Excluded Studies for Background Microbiology

Author(s)	Year	Title	Reason for Exclusion
Marmor L;Berkus D;	1978	Hematogenous infection of total knee implants	Retrospective study
Wampole HS;Allen AL;Gross A;	1978	The incidence of transient bacteremia during periodontal dressing change	Insufficient data on bacteremia for background microbiology
Visuri T;Antila P;Laurent LE;	1976	A comparison of dicloxacillin and ampicillin in the antibiotic prophylaxis of total hip replacement	Insufficient data for analysis
Millender LH;Nalebuff EA;Hawkins RB;Ennis R;	1975	Infection after silicone prosthetic arthroplasty in the hand	Retrospective study
Wilson PD;Aglietti P;Salvati EA;	1974	Subacute sepsis of the hip treated by antibiotics and cemented prosthesis	Retrospective study
Francis LE;DeVries J;Lang D;	1973	An oral antiseptic for the control of post-extraction bacteraemia	Insufficient data on bacteremia for background microbiology
Roberts GJ;Simmons NB;Longhurst P;Hewitt PB;	1973	Evaluation of transient bacteremia following routine periodontal procedures	Insufficient data on bacteremia for background microbiology
America Academy of Periodontology	1972	Oral irrigation and bacteremia	Insufficient data on bacteremia for background microbiology
Degling TE;	1972	Orthodontics, bacteremia, and the heart damaged patient	Insufficient data on bacteremia for background microbiology
DeVries J;Francis LE;Lang D;	1972	Control of post-extraction bacteraemias in the penicillin-hypersensitive patient	Insufficient data on bacteremia for background microbiology

Table 57 Excluded Studies for Background Microbiology

Author(s)	Year	Title	Reason for Exclusion
Wada K;Tomizawa M;Sasaki I;	1968	Study on bacteriemia in patients of pyorrhea Alveolaris caused by surgical operations	Insufficient data on bacteremia for background microbiology
Bender IB;SELTZER S;TASHMAN S;MELOFF G;	1963	Dental procedures in patients with rheumatic heart disease	Insufficient data on bacteremia for background microbiology

PUBLICATIONS EXCLUDED DURING FULL TEXT REVIEW

Table 58 Excluded Studies Identified During Full Text Review

Author(s)	Year	Title	Reason for Exclusion
Ashrafi SS;Nakib N;	2011	Need for antibiotic premedication for patients having periodontal dental procedures	Review
Castillo DM;Sanchez-Beltran MC;Castellanos JE;Sanz I;Mayorga-Fayad I;Sanz M;Lafaurie GI;	2011	Detection of specific periodontal microorganisms from bacteraemia samples after periodontal therapy using molecular-based diagnostics	Comparison of testing methods
Esteban J;Cordero-Ampuero J;	2011	Treatment of prosthetic osteoarticular infections	Review
Garg A;Guez G;	2011	Debate rages over antibiotic prophylaxis in patients with total joint replacements	Commentary
Mercuri LG;Psutka D;	2011	Perioperative, Postoperative, and Prophylactic Use of Antibiotics in Alloplastic Total Temporomandibular Joint Replacement Surgery: A Survey and Preliminary Guidelines	Survey
Swan J;Dowsey M;Babazadeh S;Mandaleson A;Choong PF;	2011	Significance of sentinel infective events in haematogenous prosthetic knee infections	Retrospective study
Zywiel MG;Johnson AJ;Stroh DA;Martin J;Marker DR;Mont MA;	2011	Prophylactic oral antibiotics reduce reinfection rates following two-stage revision total knee arthroplasty	Retrospective sudy

Table 58 Excluded Studies Identified During Full Text Review

Author(s)	Year	Title	Reason for Exclusion
Akiyama T;Miyamoto H;Fukuda K;Sano N;Katagiri N;Shobuike T;Kukita A;Yamashita Y;Taniguchi H;Goto M;	2010	Development of a novel PCR method to comprehensively analyze salivary bacterial flora and its application to patients with odontogenic infections	Not relevant to bacteremia or implant infection evidence
Akutsu Y;Matsubara H;Shuto K;Shiratori T;Uesato M;Miyazawa Y;Hoshino I;Murakami K;Usui A;Kano M;Miyauchi H;	2010	Pre-operative dental brushing can reduce the risk of postoperative pneumonia in esophageal cancer patients	Not relevant to bacteremia or implant infection evidence
de Oliveira CE;Gasparoto TH;Dionisio TJ;Porto VC;Vieira NA;Santos CF;Lara VS;	2010	Candida albicans and denture stomatitis: evaluation of its presence in the lesion, prosthesis, and blood	Not relevant to bacteremia or implant infection evidence
Ebersole JL;Stevens J;Steffen MJ;Dawson ID;Novak MJ;	2010	Systemic endotoxin levels in chronic indolent periodontal infections	Not relevant to bacteremia or implant infection evidence
Bebek B;Bago I;Skaljac G;Plecko V;Miletic I;Anic I;	2009	Antimicrobial effect of 0.2% chlorhexidine in infected root canals	Not relevant to bacteremia or implant infection evidence
Brook I;	2009	The bacteriology of salivary gland infections	Review
Herzke CA;Chen LF;Anderson DJ;Choi Y;Sexton DJ;Kaye KS;	2009	Empirical antimicrobial therapy for bloodstream infection due to methicillin-resistant Staphylococcus aureus: no better than a coin toss	Not relevant to bacteremia or implant infection evidence
Huddleston PM;Clyburn TA;Evans RP;Moucha CS;Prokuski LJ;Joseph J;Sale K;	2009	Surgical site infection prevention and control: An emerging paradigm	Review

Table 58 Excluded Studies Identified During Full Text Review

Author(s)	Year	Title	Reason for Exclusion
Kuong EE;Ng FY;Yan CH;Fang CX;Chiu PK;	2009	Antibiotic prophylaxis after total joint replacements	Review
Myburgh HP;Butow KW;	2009	Cleft soft palate reconstruction: prospective study on infection and antibiotics	Not relevant to bacteremia or implant infection evidence
Nakano K;Ooshima T;	2009	Serotype classification of Streptococcus mutans and its detection outside the oral cavity	Not applicable
Parahitiyawa NB;Jin LJ;Leung WK;Yam WC;Samaranayake LP;	2009	Microbiology of odontogenic bacteremia: beyond endocarditis	Review
Anirudhan D;Bakhshi S;Xess I;Broor S;Arya LS;	2008	Etiology and outcome of oral mucosal lesions in children on chemotherapy for acute lymphoblastic leukemia	Not relevant to bacteremia or implant infection evidence
Bahrani-Mougeot FK;Paster BJ;Coleman S;Ashar J;Knost S;Sautter RL;Lockhart PB;	2008	Identification of oral bacteria in blood cultures by conventional versus molecular methods	Not relevant to bacteremia or implant infection evidence
Bahrani-Mougeot FK;Thornhill M;Sasser H;Marriott I;Brennan MT;Papagerakis S;Coleman S;Fox PC;Lockhart PB;	2008	Systemic host immuno-inflammatory response to dental extractions and periodontitis	Not relevant to bacteremia or implant infection evidence
Cogulu D;Uzel A;Oncag O;Eronat C;	2008	PCR-based identification of selected pathogens associated with endodontic infections in deciduous and permanent teeth	Not relevant to bacteremia or implant infection evidence

Table 58 Excluded Studies Identified During Full Text Review

Author(s)	Year	Title	Reason for Exclusion
Jones DJ;Munro CL;	2008	Oral care and the risk of bloodstream infections in mechanically ventilated adults: A review	Review
Lalani T;Chu VH;Grussemeyer CA;Reed SD;Bolognesi MP;Friedman JY;Griffiths RI;Crosslin DR;Kanafani ZA;Kaye KS;Ralph CG;Fowler VG;	2008	Clinical outcomes and costs among patients with Staphylococcus aureus bacteremia and orthopedic device infections	Cost analysis
Lee MK;Ide M;Coward PY;Wilson RF;	2008	Effect of ultrasonic debridement using a chlorhexidine irrigant on circulating levels of lipopolysaccharides and interleukin-6	Not relevant to bacteremia or implant infection evidence
Montefusco V;Gay F;Spina F;Miceli R;Maniezzo M;Teresa AM;Farina L;Piva S;Palumbo A;Boccadoro M;Corradini P;	2008	Antibiotic prophylaxis before dental procedures may reduce the incidence of osteonecrosis of the jaw in patients with multiple myeloma treated with bisphosphonates	Retrospective study
Sassone LM;Fidel RA;Faveri M;Guerra R;Figueiredo L;Fidel SR;Feres M;	2008	A microbiological profile of symptomatic teeth with primary endodontic infections	Not relevant to bacteremia or implant infection evidence
Tosello A;Chevaux JM;Montal S;Foti B;	2008	Assessment of oral status and oro-pharyngeal candidosis in elderly in short-term hospital care	Not relevant to bacteremia or implant infection evidence
Uckay I;Pittet D;Bernard L;Lew D;Perrier A;Peter R;	2008	Antibiotic prophylaxis before invasive dental procedures in patients with arthroplasties of the hip and knee	Review

Table 58 Excluded Studies Identified During Full Text Review

Author(s)	Year	Title	Reason for Exclusion
Wright TI;Baddour LM;Berbari EF;Roenigk RK;Phillips PK;Jacobs MA;Otley CC;	2008	Antibiotic prophylaxis in dermatologic surgery: advisory statement 2008	Advisory Statement
Yilmaz S;Oren H;Demircioglu F;Irken G;	2008	Assessment of febrile neutropenia episodes in children with acute leukemia treated with BFM protocols	Retrospective study
Kuriyama T;Williams DW;Yanagisawa M;Iwahara K;Shimizu C;Nakagawa K;Yamamoto E;Karasawa T;	2007	Antimicrobial susceptibility of 800 anaerobic isolates from patients with dentoalveolar infection to 13 oral antibiotics	Not relevant to bacteremia or implant infection evidence
Faveri M;Feres M;Shibli JA;Hayacibara RF;Hayacibara MM;de Figueiredo LC;	2006	Microbiota of the dorsum of the tongue after plaque accumulation: An experimental study in humans	Not relevant to bacteremia or implant infection evidence
Flynn TR;Shanti RM;Hayes C;	2006	Severe odontogenic infections, part 2: prospective outcomes study	Not relevant to bacteremia or implant infection evidence
Flynn TR;Shanti RM;Levi MH;Adamo AK;Kraut RA;Trieger N;	2006	Severe odontogenic infections, part 1: prospective report	Not relevant to bacteremia or implant infection evidence
Khemaleelakul S;Baumgartner JC;Pruksakom S;	2006	Autoaggregation and coaggregation of bacteria associated with acute endodontic infections	Not relevant to bacteremia or implant infection evidence
Marculescu CE;Berbari EF;Hanssen AD;Steckelberg JM;Harmsen SW;Mandrekar JN;Osmon DR;	2006	Outcome of prosthetic joint infections treated with debridement and retention of components	Retrospective study

Table 58 Excluded Studies Identified During Full Text Review

Author(s)	Year	Title	Reason for Exclusion
Rocas IN;Baumgartner JC;Xia T;Siqueira JF;	2006	Prevalence of selected bacterial named species and uncultivated phylotypes in endodontic abscesses from two geographic locations	Not relevant to bacteremia or implant infection evidence
Saito D;Leonardo RT;Rodrigues JL;Tsai SM;Hofling JF;Goncalves RB;	2006	Identification of bacteria in endodontic infections by sequence analysis of 16S rDNA clone libraries	Not relevant to bacteremia or implant infection evidence
Sakamoto M;Rocas IN;Siqueira JF;Benno Y;	2006	Molecular analysis of bacteria in asymptomatic and symptomatic endodontic infections	Not relevant to bacteremia or implant infection evidence
Sakr MR;El-Aiady AA;Ragab SH;Gomaa HE;El Din HG;	2006	Fungal and bacterial infection in malnourished children and its relation to severity of the disease	Not relevant to bacteremia or implant infection evidence
Sixou JL;Aubry-Leuliette A;De Medeiros-Battista O;Lejeune S;Jolivet-Gougeon A;Solhi-Pinsard H;Gandemer V;Barbosa-Rogier M;Bonnaure-Mallet M;	2006	Capnocytophaga in the dental plaque of immunocompromised children with cancer	Not relevant to bacteremia or implant infection evidence
Not available	2005	Antibacterial prophylaxis for dental, GI, and GU procedures	Review
Chakraborty P;Chattopadhyay UK;	2005	A study on the polymicrobial etiology of root canal infections in anterior non-vital teeth in a government hospital in Kolkata, India	Not relevant to bacteremia or implant infection evidence

Table 58 Excluded Studies Identified During Full Text Review

Author(s)	Year	Title	Reason for Exclusion
Chu FC;Tsang CS;Chow TW;Samaranayake LP;	2005	Identification of cultivable microorganisms from primary endodontic infections with exposed and unexposed pulp space	Not relevant to bacteremia or implant infection evidence
Ferrari PH;Cai S;Bombana AC;	2005	Effect of endodontic procedures on enterococci, enteric bacteria and yeasts in primary endodontic infections	Not relevant to bacteremia or implant infection evidence
Huang ST;Lee HC;Lee NY;Liu KH;Ko WC;	2005	Clinical characteristics of invasive Haemophilus aphrophilus infections	Retrospective study
Iwai T;Inoue Y;Umeda M;Huang Y;Kurihara N;Koike M;Ishikawa I;	2005	Oral bacteria in the occluded arteries of patients with Buerger disease	Not relevant to bacteremia or implant infection evidence
Nowak E;Niepsuj K;Nolewajka-Lasak I;Rheinbaben FV;	2005	The effectiveness of preoperative rinsing with skinsept oral on reducing the bacterial flora and eradicating Helicobacter pylori in the oral cavity	Not relevant to bacteremia or implant infection evidence
Shariff G;Brennan MT;Louise KM;Fox PC;Weinrib D;Burgess P;Lockhart PB;	2004	Relationship between oral bacteria and hemodialysis access infection	Not relevant to bacteremia or implant infection evidence
Apisarnthanarak A;Mayfield JL;Garison T;McLendon PM;DiPersio JF;Fraser VJ;Polish LB;	2003	Risk factors for Stenotrophomonas maltophilia bacteremia in oncology patients: a case-control study	Not relevant to bacteremia or implant infection evidence
Candoni A;Fili C;Trevisan R;Silvestri F;Fanin R;	2003	Fusobacterium nucleatum: a rare cause of bacteremia in neutropenic patients with leukemia and lymphoma	Not relevant to bacteremia or implant infection evidence

Table 58 Excluded Studies Identified During Full Text Review

Author(s)	Year	Title	Reason for Exclusion
Krcmery V;Gogova M;Ondrusova A;Buckova E;Doczeova A;Mrazova M;Hricak V;Fischer V;Marks P;Kovacik J;Schramekova E;Vitekova D;Sedlak T;Duris I;Samudovsky J;Semanova M;Kovac M;Duris T;Herman O;Cernoskova M;Sefara J;Kojsova M;Baranikova D;Ayazi M;Neuschlova D	2003	Etiology and Risk Factors of 339 Cases of Infective Endocarditis: Report from a 10-year National Prospective Survey in the Slovak Republic	Not applicable
Listgarten MA;Loomer PM;	2003	Microbial identification in the management of periodontal diseases. A systematic review	Review
Seymour RA;Whitworth JM;Martin M;	2003	Antibiotic prophylaxis for patients with joint prostheses: still a dilemma for dental practitioners (Brief record)	Retrospective study
Brook I;	2002	Aerobic and anaerobic microbiology of suppurative sialadenitis	Not relevant to bacteremia or implant infection evidence
Fouad AF;Barry J;Caimano M;Clawson M;Zhu Q;Carver R;Hazlett K;Radolf JD;	2002	PCR-based identification of bacteria associated with endodontic infections	Not relevant to bacteremia or implant infection evidence
Geerts SO;Nys M;De MP;Charpentier J;Albert A;Legrand V;Rompen EH;	2002	Systemic release of endotoxins induced by gentle mastication: association with periodontitis severity	Not relevant to bacteremia or implant infection evidence
Kucukkaya M;Kabukcuoglu Y;Tezer M;Kuzgun U;	2002	Management of childhood chronic tibial osteomyelitis with the Ilizarov method	Not relevant to bacteremia or implant infection evidence

Table 58 Excluded Studies Identified During Full Text Review

Author(s)	Year	Title	Reason for Exclusion
Munson MA;Pitt-Ford T;Chong B;Weightman A;Wade WG;	2002	Molecular and cultural analysis of the microflora associated with endodontic infections	Not relevant to bacteremia or implant infection evidence
Peters LB;Wesselink PR;van Winkelhoff AJ;	2002	Combinations of bacterial species in endodontic infections	Not relevant to bacteremia or implant infection evidence
Reebye UN;Ollerhead TR;Hughes CV;Cottrell DA;	2002	The microbial composition of mandibular third molar pericoronal infections	Not relevant to bacteremia or implant infection evidence
Roberts G;Holzel H;	2002	Intravenous antibiotic regimens and prophylaxis of odontogenic bacteraemia	Retrospective study
Sunde PT;Olsen I;Debelian GJ;Tronstad L;	2002	Microbiota of periapical lesions refractory to endodontic therapy	Not applicable
Tada A;Watanabe T;Yokoe H;Hanada N;Tanzawa H;	2002	Oral bacteria influenced by the functional status of the elderly people and the type and quality of facilities for the bedridden	Not relevant to bacteremia or implant infection evidence
van SD;Kaandorp C;Krijnen P;	2002	Cost-effectiveness of antibiotic prophylaxis for bacterial arthritis	Cost analysis
Fernandes-Naglik L;Downes J;Shirlaw P;Wilson R;Challacombe SJ;Kemp GK;Wade WG;	2001	The clinical and microbiological effects of a novel acidified sodium chlorite mouthrinse on oral bacterial mucosal infections	Not relevant to bacteremia or implant infection evidence

Table 58 Excluded Studies Identified During Full Text Review

Author(s)	Year	Title	Reason for Exclusion
Fujiwara T;Nakano K;Kawaguchi M;Ooshima T;Sobue S;Kawabata S;Nakagawa I;Hamada S;	2001	Biochemical and genetic characterization of serologically untypable Streptococcus mutans strains isolated from patients with bacteremia	Not relevant to bacteremia or implant infection evidence
Glass RT;Bullard JW;Hadley CS;Mix EW;Conrad RS;	2001	Partial spectrum of microorganisms found in dentures and possible disease implications	Not relevant to bacteremia or implant infection evidence
Krijnen P;Kaandorp CJ;Steyerberg EW;van SD;Moens HJ;Habbema JD;	2001	Antibiotic prophylaxis for haematogenous bacterial arthritis in patients with joint disease: a cost effectiveness analysis	Cost analysis
Lana MA;Ribeiro-Sobrinho AP;Stehling R;Garcia GD;Silva BK;Hamdan JS;Nicoli JR;Carvalho MA;Farias LM;	2001	Microorganisms isolated from root canals presenting necrotic pulp and their drug susceptibility in vitro	Not relevant to bacteremia or implant infection evidence
Peciuliene V;Reynaud AH;Balciuniene I;Haapasalo M;	2001	Isolation of yeasts and enteric bacteria in root-filled teeth with chronic apical periodontitis	Not relevant to bacteremia or implant infection evidence
Pitten FA;Kramer A;	2001	Efficacy of cetylpyridinium chloride used as oropharyngeal antiseptic	Not relevant to bacteremia or implant infection evidence
Wrobel CJ;Chappell ET;Taylor W;	2001	Clinical presentation, radiological findings, and treatment results of coccidioidomycosis involving the spine: report on 23 cases	Retrospective study

Table 58 Excluded Studies Identified During Full Text Review

Author(s)	Year	Title	Reason for Exclusion
Kuriyama T;Karasawa T;Nakagawa K;Saiki Y;Yamamoto E;Nakamura S;	2000	Bacteriologic features and antimicrobial susceptibility in isolates from orofacial odontogenic infections	Not relevant to bacteremia or implant infection evidence
Labarca JA;Leber AL;Kern VL;Territo MC;Brankovic LE;Bruckner DA;Pegues DA;	2000	Outbreak of Stenotrophomonas maltophilia bacteremia in allogenic bone marrow transplant patients: role of severe neutropenia and mucositis	n<10
Lucht U;	2000	The Danish Hip Arthroplasty Register	Review
Monsenego P;	2000	Presence of microorganisms on the fitting denture complete surface: study 'in vivo'	Not relevant to bacteremia or implant infection evidence
Mullally BH;Dace B;Shelburne CE;Wolff LF;Coulter WA;	2000	Prevalence of periodontal pathogens in localized and generalized forms of early-onset periodontitis	Not relevant to bacteremia or implant infection evidence
Osaki T;Yoneda K;Yamamoto T;Ueta E;Kimura T;	2000	Candidiasis may induce glossodynia without objective manifestation	Not relevant to bacteremia or implant infection evidence
Peltroche-Llacsahuanga H;Reichhart E;Schmitt W;Lutticken R;Haase G;	2000	Investigation of infectious organisms causing pericoronitis of the mandibular third molar	Not relevant to bacteremia or implant infection evidence
Rupf S;Kannengiesser S;Merte K;Pfister W;Sigusch B;Eschrich K;	2000	Comparison of profiles of key periodontal pathogens in periodontium and endodontium	Not relevant to bacteremia or implant infection evidence

Table 58 Excluded Studies Identified During Full Text Review

Author(s)	Year	Title	Reason for Exclusion
Siqueira JF;Rocas IN;Souto R;de UM;Colombo AP;	2000	Checkerboard DNA-DNA hybridization analysis of endodontic infections	Not relevant to bacteremia or implant infection evidence
Sunde PT;Olsen I;Lind PO;Tronstad L;	2000	Extraradicular infection: a methodological study	Not relevant to bacteremia or implant infection evidence
Sunde PT;Tronstad L;Eribe ER;Lind PO;Olsen I;	2000	Assessment of periradicular microbiota by DNA-DNA hybridization	Not relevant to bacteremia or implant infection evidence
Bentley KC;Head TW;Aiello GA;	1999	Antibiotic prophylaxis in orthognathic surgery: a 1-day versus 5-day regimen	Not relevant to bacteremia or implant infection evidence
Hall G;Heimdahl A;Nord CE;	1999	Bacteremia after oral surgery and antibiotic prophylaxis for endocarditis	Review
LaPorte DM;Waldman BJ;Mont MA;Hungerford DS;	1999	Infections associated with dental procedures in total hip arthroplasty	Retrospective study
Lockhart PB;Durack DT;	1999	Oral microflora as a cause of endocarditis and other distant site infections	Review
Nicolatou-Galitis O;Bakiri M;Belegrati M;Nikolatos G;Spyropoulos C;Fisfis M;Kalmantis T;Velegraki A;	1999	Oropharyngeal candidiasis in patients with hematological immunosuppression. A pilot study	Not relevant to bacteremia or implant infection evidence
Reit C;Molander A;Dahlen G;	1999	The diagnostic accuracy of microbiologic root canal sampling and the influence of antimicrobial dressings	Not relevant to bacteremia or implant infection evidence
Amir J;Yagupsky P;	1998	Invasive Kingella kingae infection associated with stomatitis in children	Not relevant to bacteremia or implant infection evidence

Table 58 Excluded Studies Identified During Full Text Review

Author(s)	Year	Title	Reason for Exclusion
Pinero J;	1998	Nd:YAG-assisted periodontal curettage to prevent bacteria before cardiovascular surgery	Not relevant to bacteremia or implant infection evidence
Segreti J;Nelson JA;Trenholme GM;	1998	Prolonged suppressive antibiotic therapy for infected orthopedic prostheses	Retrospective study
Chaudhry R;Kalra N;Talwar V;Thakur R;	1997	Anaerobic flora in endodontic infections	Not relevant to bacteremia or implant infection evidence
Drucker DB;Gomes BP;Lilley JD;	1997	Role of anaerobic species in endodontic infection	Not relevant to bacteremia or implant infection evidence
Jacobson J;Patel B;Asher G;Woolliscroft JO;Schaberg D;	1997	Oral staphylococcus in older subjects with rheumatoid arthritis	Not relevant to bacteremia or implant infection evidence
Kulak Y;Arikan A;Kazazoglu E;	1997	Existence of Candida albicans and microorganisms in denture stomatitis patients	Not relevant to bacteremia or implant infection evidence
Moritz A;Gutknecht N;Schoop U;Goharkhay K;Doertbudak O;Sperr W;	1997	Irradiation of infected root canals with a diode laser in vivo: results of microbiological examinations	Not relevant to bacteremia or implant infection evidence
Waldman BJ;Mont MA;Hungerford DS;	1997	Total knee arthroplasty infections associated with dental procedures	Retrospective study
Bollen CM;Vandekerckhove BN;Papaioannou W;Van EJ;Quirynen M;	1996	Full- versus partial-mouth disinfection in the treatment of periodontal infections. A pilot study: long-term microbiological observations	Not relevant to bacteremia or implant infection evidence

Table 58 Excluded Studies Identified During Full Text Review

Author(s)	Year	Title	Reason for Exclusion
Deacon JM;Pagliaro AJ;Zelicof SB;Horowitz HW;	1996	Prophylactic use of antibiotics for procedures after total joint replacement	Review
Debelian GJ;Olsen I;Tronstad L;	1996	Electrophoresis of whole-cell soluble proteins of microorganisms isolated from bacteremias in endodontic therapy	Not relevant to bacteremia or implant infection evidence
Rajasuo A;Jousimies-Somer H;Savolainen S;Leppanen J;Murtomaa H;Meurman JH;	1996	Bacteriologic findings in tonsillitis and pericoronitis	Not relevant to bacteremia or implant infection evidence
Yoneyama T;Hashimoto K;Fukuda H;Ishida M;Arai H;Sekizawa K;Yamaya M;Sasaki H;	1996	Oral hygiene reduces respiratory infections in elderly bed-bound nursing home patients	Not relevant to bacteremia or implant infection evidence
Quirynen M;Bollen CM;Vandekerckhove BN;Dekeyser C;Papaioannou W;Eyssen H;	1995	Full- vs. partial-mouth disinfection in the treatment of periodontal infections: short-term clinical and microbiological observations	Not relevant to bacteremia or implant infection evidence
Richard P;Amador D;Moreau P;Milpied N;Felice MP;Daeschler T;Harousseau JL;Richet H;	1995	Viridans streptococcal bacteraemia in patients with neutropenia	Not relevant to bacteremia or implant infection evidence
Bartzokas CA;Johnson R;Jane M;Martin MV;Pearce PK;Saw Y;	1994	Relation between mouth and haematogenous infection in total joint replacements	n<10

Table 58 Excluded Studies Identified During Full Text Review

Author(s)	Year	Title	Reason for Exclusion
Sjostrom K;Ou J;Whitney C;Johnson B;Darveau R;Engel D;Page RC;	1994	Effect of treatment on titer, function, and antigen recognition of serum antibodies to Actinobacillus actinomycetemcomitans in patients with rapidly progressive periodontitis	Not relevant to bacteremia or implant infection evidence
Brook I;Frazier EH;	1993	Anaerobic osteomyelitis and arthritis in a military hospital: a 10-year experience	Not relevant to bacteremia or implant infection evidence
Donnelly JP;Muus P;Horrevorts AM;Sauerwein RW;de Pauw BE;	1993	Failure of clindamycin to influence the course of severe oromucositis associated with streptococcal bacteraemia in allogeneic bone marrow transplant recipients	Not relevant to bacteremia or implant infection evidence
Helovuo H;Hakkarainen K;Paunio K;	1993	Changes in the prevalence of subgingival enteric rods, staphylococci and yeasts after treatment with penicillin and erythromycin	Not relevant to bacteremia or implant infection evidence
Holan G;Kadari A;Engelhard D;Chosack A;	1993	Temperature elevation in children following dental treatment under general anesthesia with or without prophylactic antibiotics	Not relevant to bacteremia or implant infection evidence
Lo Bue AM;Sammartino R;Chisari G;Gismondo MR;Nicoletti G;	1993	Efficacy of azithromycin compared with spiramycin in the treatment of odontogenic infections	Not relevant to bacteremia or implant infection evidence

Table 58 Excluded Studies Identified During Full Text Review

Author(s)	Year	Title	Reason for Exclusion
O'Sullivan EA;Duggal MS;Bailey CC;Curzon ME;Hart P;	1993	Changes in the oral microflora during cytotoxic chemotherapy in children being treated for acute leukemia	Not relevant to bacteremia or implant infection evidence
Ueta E;Osaki T;Yoneda K;Yamamoto T;	1993	Prevalence of diabetes mellitus in odontogenic infections and oral candidiasis: an analysis of neutrophil suppression	Not relevant to bacteremia or implant infection evidence
Bergmann OJ;Ellegaard B;Dahl M;Ellegaard J;	1992	Gingival status during chemical plaque control with or without prior mechanical plaque removal in patients with acute myeloid leukaemia	Not relevant to bacteremia or implant infection evidence
Epstein JB;Vickars L;Spinelli J;Reece D;	1992	Efficacy of chlorhexidine and nystatin rinses in prevention of oral complications in leukemia and bone marrow transplantation	Not relevant to bacteremia or implant infection evidence
Hashioka K;Yamasaki M;Nakane A;Horiba N;Nakamura H;	1992	The relationship between clinical symptoms and anaerobic bacteria from infected root canals	Not relevant to bacteremia or implant infection evidence
Norden C;Nelson JD;Mader JT;Calandra GB;	1992	Evaluation of new anti-infective drugs for the treatment of infections of prosthetic hip joints. Infectious Diseases Society of America and the Food and Drug Administration	Review
Ufomata D;Akerele JO;	1992	Bacteriological investigation of infected root canals in Benin City, Nigeria	Not relevant to bacteremia or implant infection evidence

Table 58 Excluded Studies Identified During Full Text Review

Author(s)	Year	Title	Reason for Exclusion
Baumgartner JC;Falkler WA;	1991	Bacteria in the apical 5 mm of infected root canals	Not relevant to bacteremia or implant infection evidence
Bergmann OJ;	1991	Alterations in oral microflora and pathogenesis of acute oral infections during remission-induction therapy in patients with acute myeloid leukaemia	Not relevant to bacteremia or implant infection evidence
Hirai K;Tagami A;Okuda K;	1991	Isolation and classification of anaerobic bacteria from pulp cavities of nonvital teeth in man	Not relevant to bacteremia or implant infection evidence
Jacobson JJ;Schweitzer SO;Kowalski CJ;	1991	Chemoprophylaxis of prosthetic joint patients during dental treatment: a decision-utility analysis	Decision utiltiy analysis
Thyne GM;Ferguson JW;	1991	Antibiotic prophylaxis during dental treatment in patients with prosthetic joints	Review
Bell SM;Gatus BJ;Shepherd BD;	1990	Antibiotic prophylaxis for the prevention of late infections of prosthetic joints	Retrospective study
Jacobson JJ;Schweitzer S;DePorter DJ;Lee JJ;	1990	Antibiotic prophylaxis for dental patients with joint prostheses? A decision analysis	Decision utiltiy analysis
Peterson DE;Minah GE;Reynolds MA;Weikel DS;Overholser CD;DePaola LG;Wade JC;Suzuki JB;	1990	Effect of granulocytopenia on oral microbial relationships in patients with acute leukemia	Not relevant to bacteremia or implant infection evidence

Table 58 Excluded Studies Identified During Full Text Review

Author(s)	Year	Title	Reason for Exclusion
Wilkins J;Patzakis MJ;	1990	Peripheral teflon catheters. Potential source for bacterial contamination of orthopedic implants?	Irrelevant study population
Bergmann OJ;	1989	Oral infections and fever in immunocompromised patients with haematologic malignancies	Not relevant to bacteremia or implant infection evidence
Brown AT;Sims RE;Raybould TP;Lillich TT;Henslee PJ;Ferretti GA;	1989	Oral gram-negative bacilli in bone marrow transplant patients given chlorhexidine rinses	Not relevant to bacteremia or implant infection evidence
Daoud A;Saighi-Bouaouina A;	1989	Treatment of sequestra, pseudarthroses, and defects in the long bones of children who have chronic hematogenous osteomyelitis	Retrospective study
Etemadzadeh H;Meurmann JH;Murtomaa H;Torkko H;Lappi L;Roos M;	1989	Effect on plaque growth and salivary micro-organisms of amine fluoride-stannous fluoride and chlorhexidine-containing mouthrinses	Not relevant to bacteremia or implant infection evidence
Gerlach KL;Schaal KP;Walz C;Pape HD;	1989	Treatment of severe odontogenic infections with amoxicillin/clavulanic acid	Not relevant to bacteremia or implant infection evidence
Heimdahl A;Mattsson T;Dahllof G;Lonnquist B;Ringden O;	1989	The oral cavity as a port of entry for early infections in patients treated with bone marrow transplantation	Not relevant to bacteremia or implant infection evidence

Table 58 Excluded Studies Identified During Full Text Review

Author(s)	Year	Title	Reason for Exclusion
Lindqvist C;Soderholm AL;Slatis P;	1989	Dental X-ray status of patients admitted for total hip replacement	Not relevant to bacteremia or implant infection evidence
Lo Bue AM;Chisari G;Fiorenza G;Ferlito S;Gismondo MR;	1989	The activity of ofloxacin compared to spiramycin in oral surgery	Not relevant to bacteremia or implant infection evidence
Steele MT;Sainsbury CR;Robinson WA;Salomone JA;Elenbaas RM;	1989	Prophylactic penicillin for intraoral wounds	Not relevant to bacteremia or implant infection evidence
Tsevat J;Durand-Zaleski I;Pauker SG;	1989	Cost-effectiveness of antibiotic prophylaxis for dental procedures in patients with artificial joints	Cost analysis
Weikel DS;Peterson DE;Rubinstein LE;Metzger-Samuels C;Overholser CD;	1989	Incidence of fever following invasive oral interventions in the myelosuppressed cancer patient	Not relevant to bacteremia or implant infection evidence
Appelbaum PC;Spangler SK;Strauss M;	1988	Reduction of oral flora with ciprofloxacin in healthy volunteers	Not relevant to bacteremia or implant infection evidence
Bergmann OJ;	1988	Oral infections and septicemia in immunocompromised patients with hematologic malignancies	Not relevant to bacteremia or implant infection evidence
Cioffi GA;Terezhalmy GT;Taybos GM;	1988	Total joint replacement: a consideration for antimicrobial prophylaxis	Review
De LM;	1988	Clinical and microbiological effects of in vivo miocamycin therapy on oral infections and in surgical prophylaxis	Not relevant to bacteremia or implant infection evidence

Table 58 Excluded Studies Identified During Full Text Review

Author(s)	Year	Title	Reason for Exclusion
Ferretti GA;Ash RC;Brown AT;Parr MD;Romond EH;Lillich TT;	1988	Control of oral mucositis and candidiasis in marrow transplantation: a prospective, double-blind trial of chlorhexidine digluconate oral rinse	Not relevant to bacteremia or implant infection evidence
Jacobson JJ;Schweitzer S;DePorter DJ;Lee JJ;	1988	Chemoprophylaxis of dental patients with prosthetic joints: a simulation model	Simulation model
Ranta H;Haapasalo M;Ranta K;Kontiainen S;Kerosuo E;Valtonen V;Suuronen R;Hovi T;	1988	Bacteriology of odontogenic apical periodontitis and effect of penicillin treatment	Not relevant to bacteremia or implant infection evidence
Rosen S;Ogg-Bell K;Heller A;Weisenstein P;Beck FM;	1988	Use of an organic iodine compound to decrease oral microflora in the implant patient	Not relevant to bacteremia or implant infection evidence
Dumbach J;Spitzer W;	1987	Short-term antibiotic prophylaxis in elective oral and maxillofacial surgery with mezlocillin and oxacillin	Not relevant to bacteremia or implant infection evidence
Ebersole JL;Taubman MA;Smith DJ;Frey DE;Haffajee AD;Socransky SS;	1987	Human serum antibody responses to oral microorganisms. IV. Correlation with homologous infection	Not relevant to bacteremia or implant infection evidence
Foster RJ;Collins FJ;Bach AW;	1987	Concurrent oral surgery and orthopaedic treatment in the multiply injured patient: is there an increased incidence of orthopaedic sepsis?	Irrelevant study population

Table 58 Excluded Studies Identified During Full Text Review

Author(s)	Year	Title	Reason for Exclusion
Jacobson JJ;Matthews LS;	1987	Bacteria isolated from late prosthetic joint infections: dental treatment and chemoprophylaxis	Retrospective study
Kerver AJH;Rommes JH;Mevissen-Verhage EAE;	1987	Colonization and infection in surgical intensive care patients - A prospective study	Not relevant to bacteremia or implant infection evidence
Komiyama K;Habbick BF;Martin T;Tumber SK;	1987	Characterization by pyocine typing and serotyping of oral and sputum strains of Pseudomonas aeruginosa isolated from cystic fibrosis patients	Not relevant to bacteremia or implant infection evidence
Maniloff G;Greenwald R;Laskin R;Singer C;	1987	Delayed postbacteremic prosthetic joint infection	n<10
Quayle AA;Russell C;Hearn B;	1987	Organisms isolated from severe odontogenic soft tissue infections: Their sensitivities to cefotetan and seven other antibiotics, and implications for therapy and prophylaxis	Not relevant to bacteremia or implant infection evidence
Fong IW;Ledbetter WH;Vandenbroucke AC;Simbul M;Rahm V;	1986	Ciprofloxacin concentrations in bone and muscle after oral dosing	Not applicable
Jacobson JJ;Millard HD;Plezia R;Blankenship JR;	1986	Dental treatment and late prosthetic joint infections	Retrospective study
Santosh S;Saini OP;Manjit C;Uma S;	1986	Bacteriological status of closed root canals of non-vital teeth	Not relevant to bacteremia or implant infection evidence

Table 58 Excluded Studies Identified During Full Text Review

Author(s)	Year	Title	Reason for Exclusion
Wittmann DH;Kotthaus E;	1986	Further methodological improvement in antibiotic bone concentration measurements: penetration of ofloxacin into bone and cartilage	Not relevant to bacteremia or implant infection evidence
Heimdahl A;von KL;Satoh T;Nord CE;	1985	Clinical appearance of orofacial infections of odontogenic origin in relation to microbiological findings	Not relevant to bacteremia or implant infection evidence
Kovatch AL;Wald ER;Albo VC;	1985	Oral trimethoprim sulfamethoxazole for prevention of bacterial infection during the induction phase of cancer chemotherapy in children	Not relevant to bacteremia or implant infection evidence
Mangini P;Cicchetti M;Bottaro L;	1985	A multicenter, randomized parallel double-blind study comparing three antibiotics, cephemic-cofosfolactamine, fosfomycin and cephalexin, in the treatment of systemic infections	Not relevant to bacteremia or implant infection evidence
McGowan DA;Hendrey ML;	1985	Is antibiotic prophylaxis required for dental patients with joint replacements?	Retrospective study
Woodman AJ;Vidic J;Newman HN;Marsh PD;	1985	Effect of repeated high dose prophylaxis with amoxycillin on the resident oral flora of adult volunteers	Not relevant to bacteremia or implant infection evidence
Cannon PD;Black HJ;Kitson K;Ward CS;	1984	Serum amoxycillin levels following oral loading dose prior to outpatient general anaesthesia for dental extractions	Not relevant to bacteremia or implant infection evidence

Table 58 Excluded Studies Identified During Full Text Review

Author(s)	Year	Title	Reason for Exclusion
Newman MG;	1984	Anaerobic oral and dental infection	Review
Terezhalmy GT;Hall EH;	1984	The asplenic patient: a consideration for antimicrobial prophylaxis	Review
Crawford I;Russell C;	1983	Streptococci isolated from the bloodstream and gingival crevice of man	Not relevant to bacteremia or implant infection evidence
Hunt DE;Meyer RA;	1983	Continued evolution of the microbiology of oral infections	Not relevant to bacteremia or implant infection evidence
Southall PJ;Mahy NJ;Davies RM;Speller DC;	1983	Resistance in oral streptococci after repeated two-dose amoxycillin prophylaxis	Not relevant to bacteremia or implant infection evidence
von KL;Nord CE;	1983	Ornidazole compared to phenoxymethylpenicillin in the treatment of orofacial infections	Not relevant to bacteremia or implant infection evidence
Erasmus M;Lichter D;Rock R;Rumbak A;Rumbak J;	1982	An investigation to determine the frequency of resistance of plaque bacteria to certain antimicrobial drugs	Not relevant to bacteremia or implant infection evidence
Greenberg MS;Cohen SG;McKitrick JC;Cassileth PA;	1982	The oral flor as a source of septicemia in patients with acute leukemia	Not relevant to bacteremia or implant infection evidence
Stobberinoh EE;Eggink CO;	1982	The value of the bacteriological culture in endodontics. II. The bacteriological flora of endodontic specimens	Not relevant to bacteremia or implant infection evidence

Table 58 Excluded Studies Identified During Full Text Review

Author(s)	Year	Title	Reason for Exclusion
Bystrom A;Sundqvist G;	1981	Bacteriologic evaluation of the efficacy of mechanical root canal instrumentation in endodontic therapy	Not relevant to bacteremia or implant infection evidence
Newman KA;Schimpff SC;Young VM;Wiernik PH;	1981	Lessons learned from surveillance cultures in patients with acute nonlymphocytic leukemia. Usefulness for epidemiologic, preventive and therapeutic research	Not relevant to bacteremia or implant infection evidence
von KL;Nord CE;Nordenram A;	1981	Anaerobic bacteria in dentoalveolar infections	Not relevant to bacteremia or implant infection evidence
Jacobsen PL;Murray W;	1980	Prophylactic coverage of dental patients with artificial joints: a retrospective analysis of thirty-three infections in hip prostheses	Retrospective study
Kannangara DW;Thadepalli H;McQuirter JL;	1980	Bacteriology and treatment of dental infections	Not relevant to bacteremia or implant infection evidence
Krekmanov L;Hallander HO;	1980	Relationship between bacterial contamination and alveolitis after third molar surgery	Not relevant to bacteremia or implant infection evidence
Carlsson AK;Lidgren L;Lindberg L;	1977	Prophylactic antibiotics against early and late deep infections after total hip replacements	Retrospective study
Sabiston CB;Grigsby WR;	1977	The microbiology of dentalpyogenic infections	Not relevant to bacteremia or implant infection evidence

Table 58 Excluded Studies Identified During Full Text Review

Author(s)	Year	Title	Reason for Exclusion
Altonen M;SAXEN L;Kosunen T;Ainamo J;	1976	Effect of two antimicrobial rinses and oral prophylaxis on preoperative degerming of saliva	Not relevant to bacteremia or implant infection evidence
Billick SB;Borchardt KA;Poenisch P;	1976	Asymptomatic orophyarngeal flora in patients admitted to hospital	Not relevant to bacteremia or implant infection evidence
Williams BL;Pantalone RM;Sherris JC;	1976	Subgingival microflora and periodontitis	Not relevant to bacteremia or implant infection evidence
Gabrielson ML;Stroh E;	1975	Antibiotic efficacy in odontogenic infections	Not relevant to bacteremia or implant infection evidence
Mejare B;	1975	Streptococcus faecalis and Streptococcus faecium in infected dental root canals at filling and their susceptibility to azidocillin and some comparable antibiotics	Not relevant to bacteremia or implant infection evidence
Murray PR;Washington JA;	1975	Microscopic and baceriologic analysis of expectorated sputum	Not relevant to bacteremia or implant infection evidence
Sabiston CB;Gold WA;	1974	Anaerobic bacteria in oral infections	Not relevant to bacteremia or implant infection evidence
Sims W;	1974	The clinical bacteriology of purulent oral infections	Not relevant to bacteremia or implant infection evidence
Turner JE;Mincer HH;	1974	Prevalence and antibiotic susceptibility of microorganisms isolated from oral infectious disease	Not relevant to bacteremia or implant infection evidence

Table 58 Excluded Studies Identified During Full Text Review

Author(s)	Year	Title	Reason for Exclusion
Stone HH;Geheber CE;Kolb LD;Kitchens WR;	1973	Alimentary tract colonization by Candida albicans	Not relevant to bacteremia or implant infection evidence
Khairat O;	1967	Bacteroides corrodens isolated from bacteriaemias	Duplicate publication
Diener J;Schwartz SM;Shelanski M;Steinberg G;	1964	Bacteremia and oral sepsis with particular reference to the possible reduction of systemic disease originating from the oral cavity	Not relevant to bacteremia or implant infection evidence
Garrod LP;WATERWORTH PM;	1962	The risks of dental extraction during penicillin treatment	Not relevant to bacteremia or implant infection evidence

APPENDIX IV
MEDICAL LIBRARIAN SEARCH STRATEGY
PUBMED/MEDLINE STRATEGY:

#1
Dentistry[mh] OR Mouth[mh] OR "Dental Care"[mh] OR "Mouth Diseases/therapy"[mh] OR "Mouth Neoplasms/therapy"[mh] OR "Dental implants"[mh] OR "Dental Prosthesis"[mh] OR "Nonodontogenic Cysts"[mh] OR "Odontogenic Cysts"[mh] OR "Dental Health Surveys"[mh] OR "oral bacteria" OR "dental caries" OR ((oral[titl] OR dental[titl]) NOT medline[sb]) OR "Teeth Extraction"[ot] OR Tooth[ot] OR Dentistry[ot] OR Endodontics[ot] OR jsubsetd

#2
flossing[tiab] OR toothbrush*[tiab] OR brushing[tiab] OR dental[tiab] OR oral[tiab] OR periodont*[tiab] OR endodont*[tiab] OR gingiv*[tiab] OR mouth[tiab] OR hematogenous[tiab]

#3
"Bacterial Infections"[mh:noexp] OR Bacteremia[mh] OR Fungemia[mh] OR bacteremia[tiab] OR bacteraemia[tiab] OR fungemia[tiab] OR fungaemia[tiab] OR (Septicemia[mh:noexp] AND 1966[mhda]:1991[mhda]) OR Bacteremia[ot] OR "Streptococcal Infections"[ot] OR Septicemia[ot]

#4
"Anti-bacterial agents"[pa] OR "Anti-bacterial agents"[mh] OR "Antifungal Agents"[mh] OR "Anti-Infective Agents, Local"[mh] OR "Anti-Infective Agents"[mh:noexp] OR (Premedication[mh] AND 1973[mhda]:1995[mhda]) OR "Antibiotic Prophylaxis"[mh] OR ("Postoperative Complications"[mh] AND " Anti-bacterial agents/therapeutic use"[mh] AND 1968[mhda]:1975[mhda]) OR (antibiotic*[tiab] AND prophyla*[tiab]) OR "Prosthesis-Related Infections"[mh] OR Infection Control[mh] OR (Infection[mh:noexp] AND 1966[mhda]:1991[mhda])

#5
"Prostheses and Implants"[mh:noexp] OR "Bone Nails"[mh] OR "Bone Plates"[mh] OR "Bone Screws"[mh] OR "Internal Fixators"[mh] OR "Joint Prosthesis"[mh] OR Arthroplasty[mh] OR arthroplasty[tiab] OR ((joint[tiab] OR knee[tiab] OR hip[tiab]) AND (artificial[tiab] OR replacement[tiab] OR prosthe*[tiab])) OR (("Tissue Scaffolds"[mh] OR instrumentation[tiab] OR rod[tiab] OR rods[tiab] OR allograft*[tiab] OR "bone glass" OR (bone[tiab] AND void[tiab] AND filler*[tiab])) AND "Orthopedic Procedures"[mh]) OR "Bone Transplantation"[mh] OR ("Prosthesis Implantation"[mh] OR (silastic[tiab] AND (implant*[tiab] OR prosthes*[tiab])) AND ("Musculoskeletal System"[mh] OR Extremities[mh]))

#6
#1 AND #3

#7
#5 AND (#4 OR #3) AND (#2 OR #1)

#8
#6 OR #7

#9
English[lang]

#10
(animal[mh] NOT human[mh]) OR cadaver[mh] OR cadaver*[titl] OR ((comment[pt] OR editorial[pt] OR letter[pt] OR "historical article"[pt]) NOT "clinical trial"[pt]) OR addresses[pt] OR news[pt] OR "newspaper article"[pt] OR pmcbook

#11
#8 AND #9 NOT #10

Results sorted by study type

#12
Medline[tw] OR systematic review[tiab] OR Meta-analysis[pt]

#13
"Clinical Trial"[pt] OR (clinical[tiab] AND trial[tiab]) OR random*[tw] OR "Therapeutic use"[sh]

#14
#11 AND #12

#15
#11 AND #13 NOT #12

#16
#11 NOT (#13 OR #12)

EMBASE SEARCH STRATEGY

#1
Dentistry/exp OR Mouth/exp OR 'Dental Care'/exp OR 'mouth disease'/dm_dt,dm_su,dm_th,dm_rh,dm_dm OR 'mouth tumor'/dm_dt,dm_su,dm_th,dm_rh,dm_dm OR 'odontogenic cyst'/de OR 'odontogenic keratocyst'/de OR 'odontogenic tumor'/de

#2
flossing:ti,ab OR toothbrush*:ti,ab OR dental:ti,ab OR peridont*:ti,ab OR endodont*:ti,ab OR gingiv*:ti,ab OR mouth:ti,ab OR hematogenous:ti,ab OR 'oral bacteria'

#3
'Bacterial Infection'/de OR Bacteremia/exp OR Fungemia/exp OR bacteremia:ti,ab OR bacteraemia:ti,ab OR fungemia:ti,ab OR fungaemia:ti,ab

#4
'Antiinfective Agent'/exp OR 'Antibiotic Prophylaxis'/de OR 'antibiotic prophylaxis' OR 'Prosthesis Infection'/de OR Infection/de

#5
'Joint Prosthesis'/exp OR 'Bone Nail'/de OR 'Bone Plate'/de OR 'Bone Screw'/de OR 'Internal Fixator'/de OR 'Pedicle Screw'/de OR 'Bone Graft'/exp OR 'tissue scaffold'/de OR 'bone void filler' OR ('silicone prosthesis'/de AND 'musculoskeletal system'/exp)

#6
#1 AND #3

#7
#5 AND (#4 OR #3) AND (#2 OR #1)

#8
#6 OR #7

#9
English:la AND [humans]/lim AND [embase]/lim

#10
cadaver/de OR 'in vitro study'/exp OR 'abstract report'/de OR book/de OR editorial/de OR note/de OR (letter/de NOT 'types of study'/exp)

#11
#8 AND #9 NOT #10

Results sorted by study type

#12
'meta analysis':ti,ab,de OR 'systematic review':ti,ab,de OR medline:ti,ab,de

#13
random*:ti,ab,de OR 'clinical trial':ti,ab,de OR 'health care quality'/exp

#14
#11 AND #12

#15
(#11 AND #13) NOT #12

#16
#11 NOT (#12 OR #13)

COCHRANE LIBRARY STRATEGY

(dental OR periodont* OR gingiv* OR mouth) AND (bacteremia OR bacteraemia OR fungemia OR fungaemia)

SUPPLEMENTAL SEARCH

PUBMED/MEDLINE

#1

"Prostheses and Implants"[mh:noexp] OR "Bone Nails"[mh] OR "Bone Plates"[mh] OR "Bone Screws"[mh] OR "Internal Fixators"[mh] OR "Joint Prosthesis"[mh] OR Arthroplasty[mh] OR arthroplasty[tiab] OR ((joint[tiab] OR knee[tiab] OR hip[tiab]) AND (artificial[tiab] OR replacement[tiab] OR prosthe*[tiab])) OR (("Tissue Scaffolds"[mh] OR instrumentation[tiab] OR rod[tiab] OR rods[tiab] OR allograft*[tiab] OR "bone glass" OR (bone[tiab] AND void[tiab] AND filler*[tiab])) AND "Orthopedic Procedures"[mh]) OR "Bone Transplantation"[mh] OR ("Prosthesis Implantation"[mh] OR (silastic[tiab] AND (implant*[tiab] OR prosthes*[tiab])) AND ("Musculoskeletal System"[mh] OR Extremities[mh]))

#2

Bacteremia[mh] OR Fungemia[mh] OR bacteremia[tiab] OR bacteraemia[tiab] OR fungemia[tiab] OR fungaemia[tiab] OR hematogenous[tiab] OR haematogenous[tiab] OR "late infection" OR (late[titl] AND infection[titl])

#3

#1 AND #2

#4

"1960"[PDat]:"2011"[PDat] AND English[lang]

#5

(animal[mh] NOT human[mh]) OR cadaver[mh] OR cadaver*[titl] OR ((comment[pt] OR editorial[pt] OR letter[pt] OR "historical article"[pt]) NOT "clinical trial"[pt]) OR case reports[pt] OR addresses[pt] OR news[pt] OR "newspaper article"[pt] OR pmcbook

#6

#3 AND #4 NOT #5

#7

Medline[tw] OR systematic review[tiab] OR Meta-analysis[pt]

#8 *(removed "therapeutic use"[sh] from published filter search string)*

"Clinical Trial"[pt] OR (clinical[tiab] AND trial[tiab]) OR random*[tw]

#9 *(added keywords for joint registries)*

cohort studies[mh] OR cohort* OR (epidemiologic methods[mh:noexp] AND 1966[pdat]:1989[pdat]) OR case-control studies[mh] OR ((case OR cases) AND (control OR

controls OR controlled)) OR ((case OR cases) AND series*) OR registr* OR register*

#10
Microbiological Techniques[mh]

#11
#6 AND #7

#12
#6 AND #8 NOT #7

#13
#6 AND #9 NOT (#7 OR #8)

#14
#6 AND #10 NOT (#7 OR #8 OR #9)

#15
#6 NOT (#7 OR #8 OR #9 OR #10)

EMBASE

#1
Arthroplasty/exp OR 'Joint Prosthesis'/exp OR 'Bone Nail'/de OR 'Bone Plate'/de OR 'Bone Screw'/de OR 'Internal Fixator'/de OR 'Pedicle Screw'/de OR 'Bone Graft'/exp OR 'tissue scaffold'/de OR 'bone void filler' OR ('silicone prosthesis'/de AND 'musculoskeletal system'/exp)

#2
Bacteremia/exp OR Fungemia/exp OR bacteremia:ti,ab OR bacteraemia:ti,ab OR fungemia:ti,ab OR fungaemia:ti,ab

#3
#1 AND #2

#4
English:la AND [humans]/lim AND [embase]/lim

#5
cadaver/de OR 'in vitro study'/exp OR 'abstract report'/de OR book/de OR editorial/de OR note/de OR (letter/de NOT 'types of study'/exp)

#6
#3 AND #4 NOT #5

Results sorted by study type

#7
'meta analysis':ti,ab,de OR 'systematic review':ti,ab,de OR medline:ti,ab,de

#8
random*:ti,ab,de OR 'clinical trial':ti,ab,de OR 'health care quality'/exp

#9
'cohort analysis'/exp OR 'longitudinal study'/exp OR 'prospective study'/exp OR 'follow up'/exp OR cohort* OR 'case control study'/exp OR (case* AND control*)

#10
'microbiological examination'/exp

#11
#6 AND #7

#12
#6 AND #8 NOT #7

#13
#6 AND #9 NOT (#7 OR #8)

#14
#6 AND #10 NOT (#7 OR #8 OR #9)

#15
#6 NOT (#7 OR #8 OR #9 OR #10)

APPENDIX V
EVALUATING QUALITY AND APPLICABILITY
STUDIES OF INTERVENTIONS
QUALITY

We judged quality using questions specified before this topic was selected and a computer program determined the final quality rating. We separately evaluated the quality of evidence for each outcome reported by each study. This follows the suggestion of the GRADE working group. We evaluated quality using a domain-based approach using a scheme to allow for evaluation of intervention studies of all designs. The domains we used are whether:

- The study was prospective (with prospective studies, it is possible to have an *a priori* hypothesis to test; this is not possible with retrospective studies.)
- The study was of low statistical power
- The assignment of patients to groups was unbiased
- There was blinding to mitigate against a placebo effect
- The patient groups were comparable at the beginning of the study
- The intervention was delivered in such a way that any observed effects could reasonably be attributed to that intervention
- Whether the instruments used to measure outcomes were valid
- Whether there was evidence of investigator bias

Each quality domain is addressed by one or more questions that are answered "Yes," "No," or "Unclear." These questions and the domains that each address are shown below.

To arrive at the quality of the evidence for a given outcome, all domains except the "Statistical Power" domain are termed as "flawed" if one or more questions addressing any given domain are answered "No" for a given outcome, or if there are two or more "Unclear" answers to the questions addressing that domain. The "Statistical Power" domain is considered flawed if a given study did not enroll enough patients to detect a standardized difference between means of 0.2.

Domain flaws lead to corresponding reductions in the quality of the evidence. The manner in which we conducted these reductions is shown in the table below. For example, the evidence reported in a randomized controlled trial (RCT) for any given outcome is rated as "High" quality if zero or one domain is flawed. If two or three domains are flawed for the evidence addressing this outcome, the quality of evidence is reduced to "Moderate," and if four or five domains are flawed, the quality of evidence is reduced to "Low." The quality of evidence is reduced to "Very Low" if six or more domains are flawed.

Some flaws are so serious that we automatically term the evidence as being of "Very Low" quality, regardless of a study's domain scores. These serious design flaws are:

- Non-consecutive enrollment of patients in a case series
- Case series that gave patients the treatment of interest AND another treatment
- Measuring the outcome of interest one way in some patients and measuring it in another way in other patients
- Low statistical power

Quality Questions and Domains for Four Designs of Studies of Interventions

Domain	Question:	Parallel, Contemporary Controls	Crossover Trials	Historical Controls	Case Series
Group Assignment	Stochastic	Yes	Yes	No	No
Group Assignment	Quasi-random Assignment	No	No	No	na*
Group Assignment	Matched Groups	No	No	Yes	No
Group Assignment	Consecutive Enrollment	na	na	na	Yes
Prospective	Prospective	Yes	Yes	Yes	Yes
Blinding	Blinded Patients	Yes	Yes	No	No
Blinding	Blinded Assessors	Yes	Yes	No	No
Blinding	Blinding Verified	Yes	Yes	No	No
Group Comparability	Allocation Concealment	Yes	Yes	No	No
Group Comparability	>80% Follow-up	Yes	Yes	No	Yes
Group Comparability	<20% Completion Difference	Yes	Yes	No	No
Group Comparability	Similar Baseline Outcome Values	Yes	na	Yes	No
Group Comparability	Comparable Pt. Characteristics	Yes	na	Yes	No
Group Comparability	Same Control Group Results	na	Yes	na	na
Group Comparability	Same Experimental Group Results	na	Yes	na	na
Treatment Integrity	Same Centers	Yes	Yes	Yes	No
Treatment Integrity	Same Treatment Duration in and across All Groups	Yes	Yes	Yes	No
Treatment Integrity	Same Concomitant Treatment to All Groups (controlled studies only)	Yes	Yes	Yes	na
Treatment Integrity	No Confounding Treatment (case series only)	na	na	na	Yes
Measurement	Same Instruments	Yes	Yes	Yes	Yes
Measurement	Valid Instrument	Yes	Yes	Yes	Yes
Bias	Article & Abstract Agree	Yes	Yes	Yes	Yes
Bias	All Outcomes Reported	Yes	Yes	Yes	Yes
Bias	A Priori Analysis	Yes	Yes	Yes	Yes
Statistical Power	Statistically Significant	High	High	High	High
Statistical Power	Number of patients in analysis	See below for further information			

*"na" means "not asked"

Relationship between Quality and Domain Scores for Studies of Interventions

Number of Flawed Domains	Strength of Evidence
0-1	High
2-3	Moderate
4-5	Low
>5	Very Low

APPLICABILITY

We rated the applicability (also called "generalizability" or "external validity") of the evidence for each outcome reported by each study. As with quality, a computer program that used predetermined questions about specific applicability domains determined applicability ratings. We rated applicability as either "High", "Moderate", or "Low" depending on how many domains are flawed. As with quality, a domain is "flawed" if one or more questions addressing that domain is answered "No: or if two or more are answered "Unclear." We characterized a domain as "flawed" if one or more questions addressing any given domain are answered "No" for a

given outcome, or if there are two or more “Unclear” answers to the questions addressing that domain

Our questions and domains about applicability are those of the PRECIS instrument. The instrument was originally designed to evaluate the applicability of randomized controlled trials, but it can also be used for studies of other design. The questions in this instrument fall into four domains. These domains and their corresponding questions are shown below. The applicability of a study is rated as “High” if it has no flawed domains, as “Low” if all domains are flawed, and as “Moderate” in all other cases as shown in the table below.

Applicability Questions and Domains for Studies of Interventions

Question	Domain
All Types of Patients Enrolled	Participants
Flexible Instructions to Practitioners	Interventions and Expertise
Full Range of Expt'l Practitioners	Interventions and Expertise
Usual Practice Control	Interventions and Expertise
Full Range of Control Practitioners	Interventions and Expertise
No Formal Follow-up	Interventions and Expertise
Usual and Meaningful Outcome	Interventions and Expertise
Compliance Not Measured	Compliance and Adherence
No Measure of Practitioner Adherence	Compliance and Adherence
All Patients in Analysis	Analysis

Relationship between Applicability and Domain Scores for Interventions

Number of Flawed Domains	Applicability
0	High
1, 2, 3	Moderate
4	Low

STUDIES OF INCIDENCE AND PREVALENCE

QUALITY

Our appraisal of studies of incidence and prevalence is a domain-based approach conducted using *a priori* questions and scored by a computer program. The four domains we employed are:

- Outcome (whether the study is measuring the incidence/prevalence of a clinically meaningful event)
- Measurement (whether the study measured the disease/disorder/condition in a way that would lead to accurate estimates of incidence or prevalence)
- Participants (whether those who were studied were representative of the population of interest)
- Investigator Bias (whether author biases could have prejudiced the results)

Quality Questions and Domains for Studies of Incidence and Prevalence

Question	Domain	Incidence	Prevalence
Outcome Could Occur >1 Time in a Participant	None*	Yes	Yes
Study of Proportions or Number of Episodes	None	Yes	Yes
Only First Episode Counted	Measurement	Yes	Yes
Standard Methods for Collecting Outcomes Data	Outcome	Yes	Yes
Consistent Outcome Definitions	Outcome	Yes	Yes
Data Obtained from People or Records	None	Yes	Yes
Free from Response Bias	Measurement	Yes	Yes
Free from Information Bias	Measurement	Yes	Yes
Valid Instrument	Measurement	Yes	Yes
Valid Database Entries	Measurement	Yes	Yes
Study of In-Hospital Events	None	Yes	Yes
Use of Medical Records/Administrative Databases	Measurement	Yes	Yes
Appropriately Timed Outcome	Measurement	Yes	No
Chronic or Acute Disease	None	No	Yes
Study of Point Prevalence	None	No	Yes
Can Estimate Be Affected by Disease Severity	None	Yes	Yes
Correction for Disease Severity	Measurement	Yes	Yes
Population or Sample Data	None	Yes	Yes
Random Selection of Participants	Participants	Yes	Yes
>80% of Patients in Analysis	Participants	Yes	Yes
Free of Financial Conflicts of Interest	Bias	Yes	Yes
A Priori Analysis	Bias	Yes	Yes
Consistent Abstract, Results, Discussion	Bias	Yes	Yes

*An entry of "None" means that the question is not used in determining quality but, rather, is used for other purposes. A "Yes" entry in the above table means that a question is asked, a "No" entry means that it is not asked.

We characterized a study that has no flaws in any of its domains as being of "High" quality, a study that has one flawed domain as being of "Moderate" quality, a study with two flawed domains as being of "Low" quality, and a study with three or more flawed domains as being of "Very Low" quality. We characterized a domain as "flawed" if one or more questions addressing any given domain are answered "No" for a given screening/diagnostic/test, or if there are two or more "Unclear" answers to the questions addressing that domain.

We considered some design flaws as so serious that their presence automatically guarantees that a study is characterized as being of "Very Low" quality regardless of its domain scores. These flaws are:

- The outcome of interest could have occurred more than once in a person during the course of the study, and more than the first episode of the outcome was counted in the incidence/prevalence estimate
- The study was a study of the proportion (or number) of people who have a disease, and the study was not a study of point prevalence.

Relationship between Quality and Domain Scores for Studies of Incidence and Prevalence

Number of Flawed Domains	Quality
0	High
1	Moderate
2	Low
≥3	Very Low

APPLICABILITY

We separately evaluated the applicability of prevalence and incidence studies, and did so using a domain-based approach that involves predetermined questions and computer scoring. The domains we used for the applicability of prognostics are:

- Participants (i.e. whether the participants in the study were like those seen in the population of interest)
- Analysis (i.e., whether participants were appropriately included and excluded from the analysis)
- Outcome (i.e., whether the incidence/prevalence estimates being made were of a clinically meaningful outcome)

Applicability Questions and Domains for Studies of Incidence and Prevalence

Question	Domain
Full Spectrum of Patients	Patients
All Patients in Analysis	Patients
No Stepwise Analysis	Analysis
Unambiguous Coding Scheme	Analysis
Model Validated	Analysis
Clinically Meaningful Outcome	Outcome

We characterized a domain as "flawed" if one or more questions addressing any given domain are answered "No" for a given screening/diagnostic/test, or if there are two or more "Unclear" answers to the questions addressing that domain. We characterized the applicability of a screening/diagnostic test as "High" if none of its domains are flawed, "Low" if all of its domains are flawed, and "Moderate" in all other cases.

Relationship between Applicability and Domain Scores for Studies of Incidence and Prevalence

Number of Flawed Domains	Applicability
0	High
1,2	Moderate
3	Low

STUDIES OF PROGNOSTICS

QUALITY

Our appraisal of studies of prognostics is a domain-based approach conducted using *a priori* questions, and scored by a computer program. The five domains we employed are:

- Prospective (A variable is specified as a potential prognostic variable *a priori*. This is not possible with retrospective studies.)
- Power (Whether the study had sufficient statistical power to detect a prognostic variable as statistically significant)
- Analysis (Whether the statistical analyses used to determine that a variable was rigorous to provide sound results)
- Model (Whether the final statistical model used to evaluate a prognostic variable accounted for enough variance to be statistically significant)
- Whether there was evidence of investigator bias

Quality Questions and Domains for Studies of Prognostics

Question	Domain
Prospective	Prospective
At Least 10 Patients per Important Variable	Power
At Least 10 Events*	Power
All Important Variables Screened for Entry Into Model	Analysis
Interactions Tested	Analysis
Collinearity Absent	Analysis
Primary Analysis (not subgroup or post hoc)	Analysis
Statistically Significant Fit	Model
Article and Abstract Agree	Investigator Bias
Results Reported for All Variables Studies	Investigator Bias
Blinded Data Analysts**	Investigator Bias

*Asked only if the variable predicted by the prognostic is dichotomous.

**Asked only if the prognostic variable is derived from a study that attempts to predict which patients respond best to a treatment.

We separately determined a quality score for each prognostic reported by a study. We characterized the evidence relevant to that prognostic variable as being of "High" quality if there are no flaws in any of the relevant domains, as being of "Moderate" quality if one of the relevant domains is flawed, as "Low" quality if there are two flawed domains, and as "Very Low" quality if three or more relevant domains are flawed. We characterized a domain as "flawed" if one or more questions addressing any given domain are answered "No" for a given prognostic variable, or if there are two or more "Unclear" answers to the questions addressing that domain.

Relationship between Quality and Domain Scores for Studies of Prognostics

Number of Flawed Domains	Quality
0	High
1	Moderate
2	Low
≥3	Very Low

APPLICABILITY

We separately evaluated the applicability of each prognostic variable reported in a study, and did so using a domain-based approach that involves predetermined questions and computer scoring. The domains we used for the applicability of prognostics are:

- Patients (i.e. whether the patients in the study and in the analysis were like those seen in actual clinical practice)
- Analysis (i.e., whether the analysis was not conducted in a way that was likely to describe variation among patients that might be unique to the dataset the authors used)
- Outcome (i.e., whether the prognostic was a predictor of a clinically meaningful outcome)

Applicability Questions and Domains for Studies of Prognostics

Question	Domain
Full Spectrum of Patients	Patients
All Patients in Analysis	Patients
No Stepwise Analysis	Analysis
Unambiguous Coding Scheme	Analysis
Model Validated	Analysis
Clinically Meaningful Outcome	Outcome

We characterized the evidence relevant to that prognostic as being of "High" applicability if there are no flaws in any of the relevant domains, as being of "Low" applicability if all three domains are flawed, and as of "Moderate" applicability in all other cases. We characterized a domain as "flawed" if one or more questions addressing any given domain are answered "No" for a given prognostic variable, or if there are two or more "Unclear" answers to the questions addressing that domain.

Relationship between Domain Scores and Applicability for Studies of Prognostics

Number of Flawed Domains	Applicability
0	High
1,2	Moderate
3	Low

APPENDIX VI
RULES FOR OPINION BASED CONSENSUS RECOMMENDATIONS

A guideline can contain recommendations that are backed by little or no data. Under such circumstances, work groups often issue opinion-based recommendations. Although doing so is sometimes acceptable in an evidence-based guideline (expert opinion is a form of evidence), it is also important to avoid constructing a guideline that liberally uses expert opinion; research shows that expert opinion is often incorrect.

Opinion-based recommendations are developed only if they address a vitally important aspect of patient care. For example, constructing an opinion-based recommendation in favor of taking a history and physical is warranted. Constructing an opinion-based recommendation in favor of a specific modification of a surgical technique is seldom warranted. To ensure that an opinion-based recommendation is absolutely necessary, the AAOS has adopted rules to guide the content of the rationales that underpin such recommendations. These rules are based on those outlined by the US Preventive Services Task Force (USPSTF).[27] Specifically, rationales based on expert opinion must:

- Not contain references to or citations from articles not included in the systematic review that underpins the recommendation.

- Not contain the AAOS guideline language "We Recommend", "We suggest" or "The practitioner might".

- Contain an explanation of the potential preventable burden of disease. This involves considering both the incidence and/or prevalence of the disease, disorder, or condition and considering the associated burden of suffering. To paraphrase the USPSTF, when evidence is insufficient, provision of a treatment (or diagnostic) for a serious condition might be viewed more favorably than provision of a treatment (or diagnostic) for a condition that does not cause as much suffering. The AAOS (like the USPSTF) understand that evaluating the "burden of suffering" is subjective and involves judgment. This evaluation should be informed by patient values and concerns. The considerations outlined in this bullet make it difficult to recommend new technologies. It is not appropriate for a guideline to recommend widespread use of a technology backed by little data and for which there is limited experience.

- Address potential harms. In general, "When the evidence is insufficient, an intervention with a large potential for harm (such as major surgery) might be viewed less favorably than an intervention with a small potential for harm (such as advice to watch less television)."[27]

- Address apparent discrepancies in the logic of different recommendations. Accordingly, if there are no relevant data for several recommendations and the work group chooses to issue an opinion-based recommendation in some cases but chooses not to make a recommendation in other cases, the rationales for the opinion-based recommendations must explain why this difference exists. Information garnered from the previous bullet points will be helpful in this regard.

- Consider current practice. The USPSTF specifically states that clinicians justifiably fear that not doing something that is done on a widespread basis will lead to litigation.[27] The consequences of not providing a service that is neither widely available nor widely used are less serious than the consequences of not providing a treatment accepted by the medical profession and thus expected by patients. Discussions of available treatments and procedures rely on mutual communication between the patient's guardian and physician, and on weighing the potential risks and benefits for a given patient. The patient's "expectation of treatment" must be tempered by the treating physician's guidance about the reasonable outcomes that the patient can expect.

- Justify, why a more costly device, drug, or procedure is being recommended over a less costly one whenever such an opinion-based recommendation is made.

Work group members write the rationales for opinion based recommendations on the first day of the final work group meeting. When the work group re-convenes on the second day of its meeting, it will vote on the rationales. The typical voting rules will apply. If the work group cannot adopt a rationale after three votes, the rationale and the opinion-based recommendation will be withdrawn, and a "recommendation" stating that the group can neither recommend for or against the recommendation in question will appear in the guideline.

Discussions of opinion-based rationales may cause some members to change their minds about whether to issue an opinion-based recommendation. Accordingly, at any time during the discussion of the rationale for an opinion-based recommendation, any member of the work group can make a motion to withdraw that recommendation and have the guideline state that the work group can neither recommend for or against the recommendation in question.

CHECKLIST FOR VOTING ON CONSENSUS RECOMMENDATIONS

1. When voting on the rationale, please consider the following:

2. Does the recommendation affect a substantial number of patients or address treatment (or diagnosis) of a condition that causes death and/or considerable suffering?

3. Does the recommendation address the potential harms that will be incurred if it is implemented and, if these harms are serious, does the recommendation justify;

    a. why the potential benefits outweigh the potential harms and/or

    b. why an alternative course of treatment (or diagnostic workup) that involves less serious or fewer harms is not being recommended?

4. Does the rationale explain why the work group chose to make a recommendation in the face of minimal evidence while, in other instances, it chose to make no recommendation in the face of a similar amount of evidence?

5. Does the rationale explain that the recommendation is consistent with current practice?

6. If relevant, does the rationale justify why a more costly device, drug, or procedure is being recommended over a less costly one?

APPENDIX VII
VOTING WITH THE NOMINAL GROUP TECHNIQUE

Voting on guideline recommendations will be conducted using a modification of the nominal group technique (NGT), a method previously used in guideline development.[28] Briefly each member of the guideline Work Group ranks his or her agreement with a guideline recommendation on a scale ranging from 1 to 9 (where 1 is "extremely inappropriate" and 9 is "extremely appropriate"). Consensus is obtained if the number of individuals who do not rate a measure as 7, 8, or 9 is statistically non-significant (as determined using the binomial distribution). Because the number of Work Group members who are allowed to dissent with the recommendation depends on statistical significance, the number of permissible dissenters varies with the size of the work group. The number of permissible dissenters for several work group sizes is given in the table below:

Group Size	Number of Permissible Dissenters
< 4	group size not allowed
4-5	0
6-8	1
9-11	1
12-14	2
15-16	3
17-19	4
20-22	5
23-24	6
25-27	7
28-29	8
30-32	9
33-34	10
35-36	11

The NGT is conducted by first having members vote on a given recommendation without discussion. If the number of dissenters is "permissible", the recommendation is adopted without further discussion. If the number of dissenters not permissible, there is further discussion to see whether the disagreement(s) can be resolved. Three rounds of voting are held to attempt to resolve disagreements. If disagreements are not resolved after three voting rounds, no recommendation is adopted.

APPENDIX VIII
STRUCTURED PEER REVIEW FORM

Review of any AAOS confidential draft allows us to improve the overall guideline but <u>does not imply endorsement</u> by any given individual or any specialty society who participates in our review processes. The AAOS review process may result in changes to the documents; therefore, endorsement cannot occur until the AAOS Board of Directors officially approves the final guideline. The ADA will also employ a formal approval process.

Please note that if you return a review:

- **Your review comments will be published on the AAOS website, and may be published on the ADA website, with our explanation of why we did or did not change the draft document in response to your comments.**
- **Your conflicts of interest disclosures will be published on the AAOS website, and may be published on the ADA website, with your review comments.**

Reviewer Information:
Name of Reviewer:

Address:

City: State: Zip Code:

Phone: Fax: E-mail:

Specialty Area/Discipline:

Work setting: Credentials:

<u>May we list you as a Peer Reviewer in the final Guidelines?</u> ☐ Yes ☐ No
PLEASE READ: If you do not wish to be listed, your name will be removed for identification purposes. However, your review comments, our responses and your COI will still be available for public review on our website with the posted Guideline if you complete this review.

Are you reviewing this guideline as a representative of a professional society? ☐ Yes ☐ No

If yes, may we list your society as a reviewer of this guideline? ☐ Yes ☐ No

Society Name:
(Listing the specialty society as a reviewing society does not imply or otherwise indicate endorsement of this guideline.)

Conflicts of Interest (COI): All Reviewers must declare their conflicts of interest.
If the boxes below are not checked and/or the reviewer does not attach his/her conflicts of interest, the reviewer's comments will not be addressed by the AAOS nor will the reviewer's name or society be listed as a reviewer of this GL. If a committee reviews the guideline, only the chairperson or lead of the review must declare their relevant COI.

☐ **I have declared my conflicts of interest on page 2 of this form.**

☐ **I have declared my conflicts of interest in the AAOS database; my customer # is _____**

☐ **I understand that the AAOS will post my declared conflicts of interest with my comments concerning review of this guideline on the AAOS website.**

REVIEWER CONFLICT OF INTEREST - The Orthopaedic Disclosure Program
Each item below requires an answer. Please report information for the last 12-months.

Do you or a member of your immediate family receive royalties for any pharmaceutical, biomaterial or orthopaedic product or device? If YES, please identify product or device:	☐ Yes ☐ No
Within the past twelve months, have you or a member of your immediate family served on the speakers bureau or have you been paid an honorarium to present by any pharmaceutical, biomaterial or orthopaedic product or device company? If YES, please identify company:	☐ Yes ☐ No
Are you or a member of your immediate family a PAID EMPLOYEE for any pharmaceutical, biomaterial or orthopaedic device or equipment company, or supplier? If YES, please identify company or supplier:	☐ Yes ☐ No
Are you or a member of your immediate family a PAID CONSULTANT for any pharmaceutical, biomaterial or orthopaedic device or equipment company, or supplier? If YES, please identify company or supplier:	☐ Yes ☐ No
Are you or a member of your immediate family an UNPAID CONSULTANT for any pharmaceutical, biomaterial or orthopaedic device or equipment company, or supplier? If YES, please identify company or supplier:	☐ Yes ☐ No
Do you or a member of your immediate family own stock or stock options in any pharmaceutical, biomaterial or orthopaedic device or equipment company, or supplier (excluding mutual funds) If YES, please identify company or supplier:	☐ Yes ☐ No
Do you or a member of your immediate family receive research or institutional support as a principal investigator from any pharmaceutical, biomaterial or orthopaedic device or equipment company, or supplier? If YES, please identify company or supplier:	☐ Yes ☐ No
Do you or a member of your immediate family receive any other financial or material support from any pharmaceutical, biomaterial or orthopaedic device and equipment company or supplier? If YES, please identify company or supplier:	☐ Yes ☐ No
Do you or a member of your immediate family receive any royalties, financial or material support from any medical and/or orthopaedic publishers? If YES, please identify publisher:	☐ Yes ☐ No
Do you or a member of your immediate family serve on the editorial or governing board of any medical and/or orthopaedic publication? If YES, please identify:	☐ Yes ☐ No
Do you or a member of your immediate family serve on the Board of Directors or a committee of any medical and/or orthopaedic professional society? If YES, please identify:	☐ Yes ☐ No

Structured Peer Review Form Instructions

Please read and review this Draft Clinical Practice Guideline with particular focus on your area of expertise. Your responses will be used to assess the validity, clarity and accuracy of the interpretation of the evidence. If applicable, **please specify the draft page and line numbers in your comments**. Please feel free to also comment on the overall structure and content of the document. If you need more space than is provided, please attach additional pages.

Please complete and return this form electronically in **WORD format** to boyer@aaos.org; please contact Kevin Boyer at (847) 384-4328 if you have any questions. Thank you in advance for your time in completing this form and giving us your feedback. We value your input and greatly appreciate your efforts. Please return the completed form in **WORD format** by end of day **March 15, 2012**.

Please indicate your level of agreement with each of the following statements by placing an "X" in the appropriate box.

	Disagree	Somewhat Disagree	Somewhat Agree	Agree
1. The recommendations are clearly stated	☐	☐	☐	☐
2. There is an explicit link between the recommendations and the supporting evidence	☐	☐	☐	☐
3. Given the nature of the topic and the data, all clinically important outcomes are considered	☐	☐	☐	☐
4. The guideline's target audience is clearly described	☐	☐	☐	☐
5. The patients to whom this guideline is meant to apply are specifically described	☐	☐	☐	☐
6. The criteria used to select articles for inclusion are appropriate	☐	☐	☐	☐
7. The reasons why some studies were excluded are clearly described	☐	☐	☐	☐
8. All important studies that met the article inclusion criteria are included	☐	☐	☐	☐
9. The validity of the studies is appropriately appraised	☐	☐	☐	☐
10. The methods are described in such a way as to be reproducible.	☐	☐	☐	☐
11. The statistical methods are appropriate to the material and the objectives of this guideline	☐	☐	☐	☐
12. Important parameters (e.g., setting, study population, study design) that could affect study results are systematically addressed	☐	☐	☐	☐
13. Health benefits, side effects, and risks are adequately addressed	☐	☐	☐	☐
14. The writing style is appropriate for health care professionals.	☐	☐	☐	☐
15. The grades assigned to each recommendation are appropriate	☐	☐	☐	☐

COMMENTS

PLEASE RETURN ALL COMMENTS IN WORD FORMAT

Please provide a brief explanation of both your positive and negative answers in the preceding section. If applicable, please specify the draft page and line numbers in your comments. Please feel free to also comment on the overall structure and content of the Guideline

---

OVERALL ASSESSMENT

Would you recommend these guidelines for use in clinical practice? (Check one)

☐ Strongly recommend

☐ Recommend (with provisions or alterations)

☐ Would not recommend

☐ Unsure

Note: Your answer to this question does not constitute an endorsement of this guideline. We ask this question as a means of monitoring the clinical relevance of our guideline.

APPENDIX IX
PEER REVIEW

Participation in the AAOS-ADA peer review process does not constitute an endorsement of this guideline by the participating organization.

Peer review of the draft guideline is completed by external organizations with an interest in the guideline. Outside peer reviewers are solicited for each AAOS guideline and consist of experts in the guideline's topic area. These experts represent professional societies other than AAOS and are nominated by the guideline work group prior to beginning work on the guideline. For this guideline, twenty-one outside peer review organizations were invited to review the draft guideline and all supporting documentation. Nine societies participated in the review of this guideline draft and seven explicitly consented to be listed as a peer review organization in this appendix. Two organizations did not give explicit consent that the organization name could be listed in this publication.

The organizations that reviewed the document and consented to be listed as a peer review organization are listed below:

American Academy of Family Physicians (AAFP)
American Association of Hip and Knee Surgeons (AAHKS)
American Association of Oral and Maxillofacial Surgeons (AOMS)
American Academy of Oral Pathology (AAOP)
American Academy of Pediatric Dentistry (AAPD)
American Association of Public Health Dentistry (AAPHD)
American Dental Association (ADA)
American Dental Hygienists' Association (ADHA)
Canadian Dental Association (CDA)
Infectious Disease Society of America (IDSA)
Lumbar Spine Research Society (LSRS)
North American Spine Society (NASS)
College of American Pathologists (CAP)
American Academy of Periodontology (AAP)
American College of Prosthodontists (ACP)
Society of Infectious Disease Pharmacists (SIDP)

Individuals who participated in the peer review of this document and gave their consent to be listed as reviewers of this document are:

Robert Rich, Jr. MD
Brian J. McGrory, MD
Louis G. Mercuri, DDS, MS
Sook-Bin Woo, DMD
A. Charles Post, DDS
Paul A. Moore, DMD, PhD, MPH
Paul S. Farsai, DMD, MPH
Denise Bowers, RDH, PhD
Charles Shuler, DMD, PhD

Susan Sutherland, DDS, MSc
John S. Kirkpatrick, MD, MS
Charles A. Reitman, MD
James M. Horton, MD
Tushar Patel, MD
Jamie Baisden, MD, FACS
John Steele, MD, PhD
Frank Scannaapieco, DMD, PhD
Mijin Choi, DDS, MS, FACP
Erika J. Ernst PharmD, BCPS

Participation in the AAOS-ADA guideline peer review process does not constitute an endorsement of the guideline by the participating organizations or the individuals listed above nor does it in any way imply the reviewer supports this document.

PUBLIC COMMENTARY

A period of public commentary follows the peer review of the draft guideline. If significant non-editorial changes are made to the document as a result of public commentary, these changes are also documented and forwarded to the AAOS and ADA bodies that approve the final guideline.

Public commentators who gave explicit consent to be listed in this document include the following:

Arlen D. Hanssen, MD
Thomas K. Fehring, MD
Laura MB Gehrig, MD
Marc M. DeHart, MD

Participation in the AAOS-ADA guideline public commentary review process does not constitute an endorsement of the guideline by the participating organizations or the individual listed nor does it in any way imply the reviewer supports this document.

APPENDIX X
AAOS BODIES THAT APPROVED THIS CLINICAL PRACTICE GUIDELINE

Guidelines Oversight Committee

The AAOS Guidelines Oversight Committee (GOC) consists of sixteen AAOS members. The overall purpose of this Committee is to oversee the development of the clinical practice guidelines, performance measures, health technology assessments and utilization guidelines.

Evidence Based Practice Committee

The AAOS Evidence Based Practice Committee (EBPC) consists of ten AAOS members. This Committee provides review, planning, and oversight for all activities related to quality improvement in orthopaedic practice, including, but not limited to evidence-based guidelines, performance measures, and outcomes..

Council on Research and Quality

To enhance the mission of the AAOS, the Council on Research and Quality promotes the most ethically and scientifically sound basic, clinical, and translational research possible to ensure the future care for patients with musculoskeletal disorders. The Council also serves as the primary resource to educate its members, the public, and public policy makers regarding evidenced-based medical practice, orthopaedic devices and biologics regulatory pathways and standards development, patient safety, occupational health, technology assessment, and other related areas of importance.

Board of Directors

The 16 member AAOS Board of Directors manages the affairs of the AAOS, sets policy, and determines and continually reassesses the Strategic Plan.

ADA BODIES THAT APPROVED THIS CLINICAL PRACTICE GUIDELINE

Council on Scientific Affairs

The Council on Scientific Affairs (CSA) consists of seventeen ADA members. The CSA serves the public, the dental profession and other health professions as the primary source of timely, relevant and emerging information on the science of dentistry and promotion of oral health.

The CSA provides recommendations to the ADA’s policymaking bodies on scientific issues. The Council also promotes, reviews, evaluates, and conducts studies on scientific matters.

DOCUMENTATION OF APPROVAL

AAOS-ADA Work Group Draft Completed:	February 12, 2012
Peer Review Completed:	March 15, 2012
Public Commentary Completed:	August 27, 2012
AAOS Guidelines Oversight Committee:	September 22, 2012
AAOS Evidence Based Practice Committee:	September 22, 2012
AAOS Council on Research and Quality:	October 26, 2012
AAOS Board of Directors:	December 7, 2012
ADA Council on Scientific Affairs	November 13, 2012

APPENDIX XI
SUPPLEMENTAL EVIDENCE TABLES
Table 59 Antibiotic Prophylaxis Network Meta-Analysis Consistency Check

Comparison	MC Mean	MC SD	Direct Ln OR	Direct SD (Ln OR)	Omega	SD Omega	Z	p
Placebo vs:								
Amoxicillin	-2.638	0.465	-2.375	0.420	-1.174	0	0.000	1.00
Penicillin	-1.738	0.695	-1.266	0.486	-0.451	0	0.000	1.00
Erythromycin	-0.852	0.664	-0.669	0.512	-0.267	0	0.000	1.00
Clindamycin	-1.453	0.650	-2.112	0.462	0.672	0	0.000	1.00
Josamycin	-0.187	1.114	0.228	0.677	-0.243	0	0.000	1.00
Moxifloxacin	-2.676	0.961	-2.957	0.765	0.485	0	0.000	1.00
IV Tetracycline	-4.123	1.144	-4.075	0.635	-0.022	0	0.000	1.00
IM Teicoplanin	-2.312	1.343	-2.674	1.570	-1.347	3.030	0.444	0.66
Topical Amoxicillin	-1.118	1.217	-2.064	1.174	12.797	0	0.000	1.00
Antiseptic Rinse	-1.424	1.048	-0.989	0.494	-0.124	0	0.000	1.00
Amoxicillin vs:								
Penicillin	0.900	0.731	-0.003	0.600	1.862	0	0.000	1.00
Clindamycin	1.185	0.725	1.892	0.467	-0.503	0	0.000	1.00
Moxifloxacin	-0.038	0.959	0.421	0.377	-0.084	0	0.000	1.00
IM Teicoplanin	0.327	1.299	0.811	0.913	-0.472	0	0.000	1.00
Topical Amoxicillin	1.521	1.215	2.436	1.170	-11.541	0	0.000	1.00
Penicillin vs:								
Antiseptic Rinse	0.314	1.06	-0.161	0.568	0.191	0	0.000	1.00
Erythromycin vs:								
Clindamycin	-0.601	0.696	-0.357	0.568	-0.484	0	0.000	1.00
Josamycin	0.665	1.113	0.228	0.677	0.257	0	0.000	1.00
IV Tetracycline	-3.271	1.148	-2.996	0.670	-0.142	0	0.000	1.00
Clindamycin vs:								
Moxifloxacin	-1.223	0.994	-1.470	0.465	0.069	0	0.000	1.00

Table 60 Topical Antimicrobial Prophylaxis Network Meta-Analysis Consistency Check

	MC Mean	MC SD	Direct Ln OR	Direct SD (Ln OR)	Omega	SD Omega	Z	p
No Treatment vs:								
Saline Rinse	-0.04	0.45	-0.25	0.58	-0.54	0.93	0.58	0.56
Chlorhexidine Rinse	-1.77	0.52	-1.52	0.51	-13.16	0.00	0.00	1.00
Povidone-Iodine Rinse	-1.94	0.53	-1.47	0.68	1.24	1.09	1.14	0.26
Chloramine T Rinse/Brush	-1.84	0.90	-1.74	0.61	-0.09	0.00	0.00	1.00
Lugol's Solution Rinse	-0.30	1.00	-0.27	0.74	-0.03	0.00	0.00	1.00
Hydrogen Peroxide Rinse	-1.10	0.56	-0.97	0.35	-0.08	0.00	0.00	1.00
Sodium Perborate-Ascorbic Acid Rinse	-1.75	0.71	-1.56	0.42	-0.10	0.00	0.00	1.00
Phenolated Rinse	-1.53	0.51	-1.65	0.53	-1.76	2.05	0.86	0.39
Saline Rinse vs:								
Chlorhexidine Rinse	-1.73	0.60	-2.49	0.76	-1.96	1.22	1.60	0.11
Povidone-Iodine Rinse	-1.90	0.60	-1.79	0.72	0.36	1.31	0.28	0.78
Sodium Perborate-Ascorbic Acid Rinse	-1.71	0.74	-1.92	0.55	0.27	0.00	0.00	1.00
Phenolated Rinse	-1.49	0.59	-1.37	0.40	-0.10	0.00	0.00	1.00
Chlorhexidine Rinse vs:								
Povidone-Iodine Rinse	-0.17	0.45	-0.21	0.43	0.30	0.00	0.00	1.00
Hydrogen Peroxide Rinse	0.67	0.64	0.41	0.64	22.85	0.00	0.00	1.00
Placebo Rinse	0.85	0.53	0.47	0.40	0.51	0.00	0.00	1.00
Povidone-Iodine Rinse vs:								
Hydrogen Peroxide Rinse	0.84	0.65	0.62	0.65	17.68	0.00	0.00	1.00
Placebo Rinse	1.03	0.51	1.12	0.35	-0.09	0.00	0.00	1.00
Operative Field Isolation	-0.89	0.79	-0.87	0.47	-0.02	0.00	0.00	1.00
Isolation + Iodine Rinse	-1.02	0.79	-0.98	0.48	-0.02	0.00	0.00	1.00
Isolation + Chlorhexidine Rinse	-2.20	0.87	-2.10	0.58	-0.08	0.00	0.00	1.00
Chloramine T Rinse/Brush vs:								
Lugol's Solution Rinse	1.54	0.87	1.47	0.57	0.06	0.00	0.00	1.00
Operative Field Isolation vs:								
Isolation + Iodine Rinse	-0.12	0.79	-0.12	0.49	0.00	0.00	0.00	1.00
Isolation + Chlorhexidine Rinse	-1.31	0.87	-1.23	0.59	-0.06	0.00	0.00	1.00
Isolation + Iodine Rinse vs:								
Isolation + Chlorhexidine Rinse	-1.18	0.87	-1.11	0.59	-0.06	0.00	0.00	1.00

Table 61 Goodness-of-fit Statistics

	Data Points	Residual Deviance
Antibiotic Prophylaxis Network	43	43.03
Topical Antimicrobial Prophylaxis Network	33	31.31

Table 62 Antibiotic and Topical Antimicrobial Prophylaxis Network Meta-Analysis Consistency Check

	MC Mean	MC SD	Direct Ln OR	Direct SD (Ln OR)	Direct Var	Omega	SD Omega	Z	p
Placebo Pill/No Treatment vs:									
Amoxicillin	-2.56	0.37	-2.38	0.42	0.18	0.81	0.89	0.91	0.36
Penicillin	-1.68	0.57	-1.27	0.49	0.24	-1.09	0.00	0.00	1.00
Erythromycin	-0.85	0.53	-0.67	0.51	0.26	-3.21	0.00	0.00	1.00
Clindamycin	-1.44	0.51	-2.11	0.46	0.21	2.82	0.00	0.00	1.00
Josamycin	-0.18	0.91	0.23	0.68	0.46	-0.50	0.00	0.00	1.00
Moxifloxacin	-2.61	0.74	-2.96	0.77	0.59	-5.85	3.13	1.87	0.06
IV Tetracycline	-4.13	0.95	-4.07	0.63	0.40	-0.04	0.00	0.00	1.00
IM Teicoplanin	-2.16	1.16	-2.67	1.57	2.47	-1.12	2.32	0.48	0.63
Topical Amoxicillin	-1.07	1.02	-2.06	1.17	1.38	-4.14	2.40	1.72	0.08
Chlorhexidine or Povidone-Iodine Rinse	-1.38	0.83	-0.99	0.49	0.24	-0.22	0.00	0.00	1.00
Saline Rinse	-0.01	0.50	-0.80	0.36	0.13	0.80	0.00	0.00	1.00
Chlorhexidine Rinse	-1.78	0.57	-1.52	0.51	0.26	-1.16	0.00	0.00	1.00
Povidone-Iodine Rinse	-1.93	0.59	-1.47	0.68	0.46	1.83	1.35	1.36	0.17
Chloramine T Rinse/Brush	-1.84	0.96	-1.74	0.61	0.38	-0.07	0.00	0.00	1.00
Lugol's Solution Rinse	-0.29	1.06	-0.27	0.74	0.55	-0.01	0.00	0.00	1.00
Hydrogen Peroxide Rinse	-1.11	0.62	-0.97	0.35	0.12	-0.06	0.00	0.00	1.00
Phenolated Rinse	-1.52	0.57	-1.65	0.53	0.28	0.85	0.00	0.00	1.00
Sodium Perborate-Ascorbic Acid Rinse	-1.76	0.79	-1.56	0.42	0.17	-0.08	0.00	0.00	1.00
Amoxicillin vs:									
Penicillin	0.88	0.60	0.00	0.60	0.36	507.16	0.00	0.00	1.00
Clindamycin	1.12	0.57	1.89	0.47	0.22	-1.55	0.00	0.00	1.00
Moxifloxacin	-0.05	0.73	0.42	0.38	0.14	-0.17	0.00	0.00	1.00
IM Teicoplanin	0.39	1.12	0.81	0.91	0.83	-0.81	0.00	0.00	1.00
Topical Amoxicillin	1.48	1.02	2.44	1.17	1.37	4.03	2.41	1.68	0.09

	MC Mean	MC SD	Direct Ln OR	Direct SD (Ln OR)	Direct Var	Omega	SD Omega	Z	p
Penicillin vs:									
Chlorhexidine or Povidone-Iodine Rinse	0.30	0.85	-0.16	0.57	0.32	0.37	0.00	0.00	1.00
Erythromycin vs:									
Clindamycin	-0.59	0.56	-0.36	0.57	0.32	11.20	3.94	2.84	0.00
Josamycin	0.67	0.91	0.23	0.68	0.46	0.55	0.00	0.00	1.00
IV Tetracycline	-3.28	0.96	-3.00	0.67	0.45	-0.27	0.00	0.00	1.00
Clindamycin vs:									
Moxifloxacin	-1.17	0.77	-1.47	0.46	0.22	0.17	0.00	0.00	1.00
Saline Rinse vs:									
Chlorhexidine Rinse	-1.77	0.65	-2.49	0.76	0.58	-2.66	1.47	1.81	0.07
Povidone-Iodine Rinse	-1.92	0.66	-1.79	0.72	0.52	0.79	1.80	0.44	0.66
Phenolated Rinse	-1.51	0.66	-1.37	0.40	0.16	-0.08	0.00	0.00	1.00
Sodium Perborate-Ascorbic Acid Rinse	-1.75	0.82	-1.92	0.55	0.30	0.14	0.00	0.00	1.00
Chlorhexidine Rinse vs:									
Povidone-Iodine Rinse	-0.15	0.49	-0.21	0.43	0.18	0.19	0.00	0.00	1.00
Hydrogen Peroxide Rinse	0.67	0.70	0.41	0.64	0.41	1.25	0.00	0.00	1.00
Placebo Rinse	0.88	0.58	0.47	0.40	0.16	0.37	0.00	0.00	1.00
Povidone-Iodine Rinse vs:									
Hydrogen Peroxide Rinse	0.82	0.71	0.62	0.65	0.42	0.91	0.00	0.00	1.00
Placebo Rinse	1.03	0.56	1.12	0.35	0.13	-0.07	0.00	0.00	1.00
Operative Field Isolation	-0.90	0.87	-0.87	0.47	0.22	-0.01	0.00	0.00	1.00
Isolation + Iodine Rinse	-1.02	0.87	-0.98	0.48	0.23	-0.01	0.00	0.00	1.00
Isolation + Chlorhexidine Rinse	-2.20	0.94	-2.10	0.58	0.34	-0.06	0.00	0.00	1.00
Chloramine T Rinse/Brush vs:									
Lugol's Solution Rinse	1.55	0.94	1.47	0.57	0.33	0.05	0.00	0.00	1.00
Operative Field Isolation vs:									
Isolation + Iodine Rinse	-0.12	0.88	-0.12	0.49	0.24	0.00	0.00	0.00	1.00
Isolation + Chlorhexidine Rinse	-1.31	0.95	-1.23	0.59	0.35	-0.05	0.00	0.00	1.00

	MC Mean	MC SD	Direct Ln OR	Direct SD (Ln OR)	Direct Var	Omega	SD Omega	Z	p
Isolation + Iodine Rinse vs:									
Isolation + Chlorhexidine Rinse	-1.18	0.95	-1.11	0.59	0.35	-0.04	0.00	0.00	1.00

Table 63 Bacteremia Incidence Study Details

Study	Procedure	N	n	Rate	LowerCI	UpperCI	SD
Bhanji 2002	brushing	47	29	0.617021	0.474266	0.742093	0.068325
Forner 2006	brushing	60	2	0.033333	0.009189	0.113638	0.026646
Lockhart 2008	brushing	88	28	0.318182	0.230226	0.421348	0.048756
Sconyers 1973	brushing	30	5	0.166667	0.073365	0.335644	0.066909
Sconyers 1979	brushing	50	0	0	0	0.071348	0.018202
Forner 2006	chewing	60	4	0.066667	0.026229	0.159254	0.033936
Murphy 2006	chewing	21	0	0	0	0.154639	0.03945
Pineiro 2010	dental implants	30	2	0.066667	0.018477	0.213235	0.049684
Cherry 2007	prophylaxis	60	11	0.333333	0.218739	0.544864	0.05922
De Leo 1974	prophylaxis	39	11	0.282051	0.165435	0.437753	0.06947
Forner 2006	prophylaxis	19	21	0.35	0.241678	0.476374	0.100626
Forner 2006	prophylaxis	20	15	0.75	0.531299	0.888138	0.091032
Heimdahl 1990	prophylaxis	20	14	0.7	0.481027	0.854523	0.095281
Baumgartner 1976	endodontics	30	1	0.033333	0.005909	0.166704	0.04102
Baumgartner 1977	endodontics	12	7	0.583333	0.319511	0.80674	0.124295
Bender 1963	endodontics	98	15	0.153061	0.095007	0.237289	0.036297
Heimdahl 1990	endodontics	20	4	0.2	0.080658	0.416017	0.085552
Savarrio 2004	endodontics	30	9	0.3	0.166647	0.478758	0.079621
Bender 1963	extraction	33	17	0.515152	0.352184	0.67496	0.082342
Casolari 1989	extraction	56	38	0.678571	0.548226	0.78599	0.060655
Heimdahl 1990	extraction	20	20	1	0.838875	1	0.041105
Khairat 1966	extraction	100	64	0.64	0.542354	0.727288	0.047178
Rahn 1994	injection	40	21	0.525	0.374974	0.670645	0.075428
American Academy of Periodontology 1972	interdental cleaner	60	17	0.283333	0.185068	0.407673	0.056788
Berger 1974	interdental cleaner	30	8	0.266667	0.141827	0.44448	0.077209
Crasta 2009	interdental cleaner	59	24	0.40678	0.29089	0.534066	0.062036

Study	Procedure	N	n	Rate	LowerCI	UpperCI	SD
Felix 1971	interdental cleaner	30	15	0.5	0.331541	0.668459	0.08595
Lineberger 1973	interdental cleaner	30	8	0.266667	0.141827	0.44448	0.077209
Ramadan 1975	interdental cleaner	50	9	0.18	0.097702	0.307961	0.053638
Romans 1971	interdental cleaner	30	2	0.066667			0.049684
Wank 1976	interdental cleaner	21	6	0.285714	0.138139	0.499564	0.092202
Ali 1992	intubation	36	0	0.111111	0.044066	0.253148	0.053338
Berry 1973	intubation	50	4	0.08	0.03155	0.188382	0.040009
Dinner 1987	intubation	54	3	0.055556	0.019073	0.151072	0.033674
Hansen 1989	intubation	19	1	0.052632	0.009352	0.246387	0.060469
Oncag 2005	intubation	74	9	0.121622	0.065323	0.215266	0.038251
Valdes 2008	intubation	110	13	0.118182	0.070381	0.19175	0.030962
Enabulele 2008	oral surgery	50	16	0.32	0.207582	0.458103	0.063909
Heimdahl 1990	oral surgery	20	11	0.55	0.342085	0.741802	0.10197
Josefsson 1985	oral surgery	20	11	0.55	0.342085	0.741802	0.10197
Takai 2005	oral surgery	57	33	0.578947	0.449801	0.698124	0.063349
Erverdi 1999	orthodontics	40	3	0.075	0.025836	0.198642	0.044084
Gürel 2009	orthodontics	25	8	0.32	0.172052	0.515897	0.087717
Bender 1963	periodontics scaling root planing	15	8	0.533333	0.30117	0.751905	0.114985
Casolari 1989	periodontics scaling root planing	42	12	0.285714	0.17167	0.435672	0.067349
Lafaurie 2007	periodontics scaling root planing	42	34	0.809524	0.666992	0.90018	0.059488
Lofthus 1991	periodontics scaling root planing	10	3	0.3	0.107791	0.603222	0.126387
Lucartorto 1992	periodontics scaling root planing	41	13	0.317073	0.195646	0.469842	0.069949
Morozumi 2010	periodontics scaling root planing	10	9	0.9	0.59585	0.982124	0.098541
Waki 1990	periodontics scaling root planing	15	2	0.133333	0.037361	0.37882	0.087108
Bender 1963	periodontics gingivectomy	12	10	0.833333	0.551969	0.953035	0.102314
Lineberger 1973	periodontics gingivectomy	10	6	0.6	0.312674	0.83182	0.132437

Study	Procedure	N	n	Rate	LowerCI	UpperCI	SD
Rogosa 1960	periodontics gingivectomy	13	12	0.923077	0.66686	0.98629	0.081489
Wada 1968	periodontics gingivectomy	77	20	0.25974	0.174892	0.367422	0.049116
Daly 1997	periodontics probing	30	13	0.433333	0.273775	0.608027	0.08527
Daly 2001	periodontics probing	40	10	0.25	0.141871	0.40194	0.066345
Oncag 2006	restorative	23	3	0.130435	0.045377	0.321275	0.070383
Brown 1998	suture	24	2	0.083333	0.023159	0.258488	0.060034
King 1988	suture	20	1	0.05	0.008881	0.236131	0.057973
Wampole 1978	suture	20	5	0.25	0.111862	0.468701	0.091032

Table 64 Bacteremia Prevalence Study Details

Study	Procedure	N	n	Rate	LowerCI	UpperCI	SD
Lucas 2000	brushing	52	20	0.384615	0.264705	0.520401	0.06523
Silver 1979	brushing	36	3	0.083333	0.028749	0.218267	0.048347
Degling 1972	chewing	40	0	0	0	0.087622	0.022353
Trivedi 1984	chewing	20	2	0.1	0.027866	0.301034	0.069687
Marzoni 1983	cleft palate	14	6	0.428571	0.213808	0.674094	0.117421
Lucas 1999	prophylaxis	103	33	0.320388	0.238131	0.415562	0.045264
Trivedi 1984	prophylaxis	40	22	0.55	0.398291	0.692947	0.075169
Winslow 1960	prophylaxis	72	17	0.236111	0.152967	0.345988	0.049241
Debelian 1995	endodontics	26	11	0.423077	0.255444	0.610514	0.09058
Barbosa 2010	extraction	210	149	0.709524	0.644796	0.766723	0.031104
Coulter 1990	extraction	32	20	0.625	0.452544	0.770661	0.081154
Crawford 1973	extraction	25	23	0.92	0.750339	0.97778	0.058022
DeVries 1972	extraction	100	49	0.49	0.39422	0.58652	0.049057
Khairat 1966	extraction	100	64	0.64	0.542354	0.727288	0.047178
Maskell 1986	extraction	10	10	1	0.722467	1	0.070801
Peterson 1976	extraction	80	39	0.4875	0.381079	0.595067	0.05459
Roberts 1992	extraction	229	84	0.366812	0.307068	0.430951	0.031603
Roberts 1987 (	extraction	47	18	0.382979	0.257907	0.525734	0.068325
Shanson 1987	extraction	40	13	0.325	0.200845	0.479823	0.071169
Shanson 1978	extraction	20	14	0.7	0.481027	0.854523	0.095281
Tomas 2007	extraction	53	51	0.962264	0.872457	0.98959	0.029881
Trivedi 1984	extraction	40	35	0.875	0.738879	0.945405	0.052686
Roberts 1998	injection	93	49	0.526882	0.42637	0.625261	0.050738
Roberts 1997	intubation	31	3	0.096774	0.033465	0.248999	0.054984
Martin 1964	oral surgery extraction	50	27	0.54	0.403989	0.670303	0.067939
Rajasuo 2004	oral surgery extraction	16	14	0.875	0.639772	0.965023	0.082974
Roberts 1998	oral surgery extraction	103	51	0.495146	0.400516	0.590125	0.04837
Tomas 2008	oral surgery extraction	100	67	0.67	0.573053	0.754369	0.046255

Study	Procedure	N	n	Rate	LowerCI	UpperCI	SD
Roberts 1997	oral surgery flap elevation	51	20	0.392157	0.270273	0.529148	0.066041
Roberts 1998	oral surgery flap elevation	51	22	0.431373	0.305012	0.567347	0.066923
Rajasuo 2004	oral surgery plate removal	10	6	0.6	0.312674	0.83182	0.132437
Burden 2004	orthodontics	30	4	0.133333	0.053097	0.296813	0.062174
Degling 1972	orthodontics	10	0	0	0	0.277533	0.070801
Kinane 2005	periodontics probing	30	5	0.166667	0.073365	0.335644	0.066909

Table 65 Results of Bacteremia Incidence Random Effects Meta-Analysis

Procedure Group	n studies	Pooled Incidence of Bacteremia*	95% Confidence Interval	I^2
Brushing	5	21.8%	5.2 – 38.4%	96.3%
Chewing	2	3.6%	0 – 10.1%	39.1%
Prophylaxis	5	47.7%	29.0 – 66.4%	85.8%
Endodontics	5	22.1%	8.8 – 35.5%	83.4%
Extraction	4	71.4%	49.4 – 93.4%	94.1%
Interdental Cleaners	8	27.5%	17.8% - 37.1%	77.2%
Intubation	6	9.3%	6.1% - 12.5%	0.0%
Oral Surgery - Extraction	4	49.2%	35.2 – 63.3%	68.9%
Orthodontics	2	18.6%	0 - 42.5%	83.9%
Periodontics – Scaling/Root Planing	7	46.9%	24.4 – 69.4%	92.6%
Periodontics – Gingivectomy	4	65.1%	27.6 – 100%	95.2%
Periodontics – Probing	2	33.4%	15.5 - 51.3%	65.3%
Sialography	2	10.6%	0 – 33.4%	88.5%
Suture	3	10.8%	0.7 – 21%	43.4%

Table 66 Results of Bacteremia Prevalence Random Effects Meta-Analysis

Procedure Group	n	Pooled	95%	I^2

	studies	Incidence of Bacteremia*	Confidence Interval	
Brushing	2	23.1%	0 – 52.6%	92.7%
Chewing	2	2.8%	0 – 11.6%	46.4%
Prophylaxis	3	35.9%	20.5 – 51.3%	83.6%
Extraction	13	65.3%	51.8 – 78.8%	96.1%
Oral Surgery – Extraction	4	63.7%	49.3 – 78.0%	83.9%
Oral Surgery – Flap Elevation	2	41.2%	31.9 – 50.4%	0.0%
Orthodontics	2	7.1%	0 - 20.1%	50.1%
Restorative – Drilling	2	14.7%	1.4 – 28.0%	84.5%
Restorative – Rubber Dam and Matrix Band & Wedge	2	45.6%	18.2 – 73.0%	93.9%

Table 67 Antibiotic Prophylaxis Studies Not Included in Recommendation 1 Network Meta-analysis

Procedure	Study	N	Strength	Outcome (specific type)	Active Antibiotic (%, n/N)	Control (%, n/N)	Results
Dental Prophylaxis	Baltch 1982	56	Low	Bacteremia	Penicillin G (10.7%, 3/28)	No Treatment (60.7%, 17/28)	Favors Penicillin G
Intubation	Lockhart 2004	100	High	Bacteremia	Amoxicillin (4%, 2/49)	Placebo (18%, 9/51)	Favors Amoxicillin
Oral Surgery	Goker 1992	100	Moderate	Bacteremia	Ofloxacin (40%,10/25) Clindamycin (40%, 10/25) Sultamicillin (36%, 9/25)	Placebo (44%, 11/25)	No difference
Oral Surgery	Josefsson 1985	60	Moderate	Bacteremia	Penicillin (50%, 10/20) Erythromycin (55%, 11/20)	No treatment (55%, 11/20)	No difference
Oral Surgery	Katoh 1992	62	Moderate	Bacteremia	IV Cefuroxime (4%, 1/24) IV Ceftriaxone (0%, 0/21) IV Clindamycin (6%, 1/17)	N/A	No difference
Oral Surgery	Martin 1964	127	Moderate	Bacteremia	600mg penicillin (16%, 8/50) 300mg penicillin (19%, 5/27)	No treatment (54%, 27/50)	Favors Penicillin
Periodontology	Appleman 1982	31	Moderate	Bacteremia	Cephalexin (36%, 10/28)	Placebo (44%, 11/25)	No difference
Periodontology	Gutverg 1962	163	Moderate	Bacteremia	Mysteclin plus dental prophylaxis (10%, 5/52) Mysteclin (5%, 3/57) Azithromycin (20%, 2/10)	No Treatment (36%, 24/67)	Favors Mysteclin
Periodontology	Morozumi 2010	30	High	Bacteremia	Essential Oil Antiseptic (70%, 7/10)	No Treatment (90%, 9/10)	Favors Azithromycin
Restorative	Brennan 2007	100	Moderate	Bacteremia	Amoxicillin (6%, 3/49)	Placebo (20%, 10/51)	Favors Amoxicillin

Table 68 Topical Antimicrobial Prophylaxis Studies Excluded from Recommendation 2 Network Meta-Analysis

Procedure	Study	N	Strength	Outcome (specific type)	Active Treatment (%, n/N) or (mean, SD)	Control (%, n/N) or (mean, SD)	Results
Brushing	Madsen 1974	29	Low	Bacteremia	Chlorhexidine (24%, 7/29)	No Treatment (34%, 10/29)	No difference
Chewing	Fine 2010	22	Moderate	Bacteremia (Aerobic CFU/ml)	Essential Oil Rinse (8.0, 11.12)	Placebo (35.1, 36.29)	Favors Rinse
Chewing	Fine 2010	22	Moderate	Bacteremia (Anaerobic CFU/ml)	Essential Oil Rinse (6.0, 7.92)	Placebo (30.3, 34.74)	Favors Rinse
Dental Implant	Pineiro 2010	50	Moderate	Bacteremia	Chlorhexidine (0%, 0/20)	No Treatment (7%, 2/30)	No difference
Dental Prophylaxis	Cherry 2007	60	Moderate	Bacteremia	Povidone-Iodine (10%, 3/30)	Saline (30%, 9/30)	Favors Povidone-Iodine
Dental Prophylaxis	Fine 1996	18	Moderate	Bacteremia (Aerobic CFU/ml)	Essential Oil Rinse (4.67, 2.14)	Placebo (38.72, 17.82)	Favors Rinse
Dental Prophylaxis	Fine 1997	18	Moderate	Bacteremia (Anaerobic CFU/ml)	Essential Oil Rinse (1.61, 1.54)	Placebo (14.89, 7.86)	Favors Rinse
Injection	Rahn 1995	120	Moderate	Bacteremia	Chlorhexidine (45%, 18/40) Povidone-Iodine (28%, 11/40)	Water (53%, 21/40)	Favors Povidone-Iodine
Inter-dental Cleaning	Madsen 1974	29	Low	Bacteremia	Chlorhexidine (24%, 7/29)	No Treatment (34%, 10/29)	No difference
Intubation	Fourrier 2005	228	High	Bacteremia	Antiseptic Rinse (18%, 20/114)	Placebo (18%, 21/114)	No difference
Oral surgery	Huffman 1974	25	Low	Bacteremia	Cetylpyridinium Chloride (83%, 10/12)	Saline (70%, 9/13)	No difference
Orthodontistry	Erverdi 2001	150	Low	Bacteremia	Chlorhexidine (3%, 2/80)	No Treatment (7%, 5/70)	No difference
Periodontology	Brenman 1974	52	Moderate	Bacteremia	Povidone-Iodine (23%, 6/26)	Placebo (58%, 15/26)	Favors Povidone-Iodine

Procedure	Study	N	Strength	Outcome (specific type)	Active Treatment (%, n/N) or (mean, SD)	Control (%, n/N) or (mean, SD)	Results
Periodontology	Lofthus 1991	30	Moderate	Bacteremia	Chlorhexidine (20%, 2/10) Water (40%, 4/10) Azithromycin (20%, 2/10)	No Treatment (30%, 3/10)	No difference
Periodontology	Morozumi 2010	30	High	Bacteremia	Essential Oil Antiseptic (70%, 7/10)	No Treatment (90%, 9/10)	Favors Azithromycin
Periodontology	Waki 1990	54	Moderate	Bacteremia	Chlorhexidine (27%, 4/15) Water (15%, 2/13)	No Treatment (13%, 2/15)	No difference
Suture	Brown 1998	55	Moderate	Bacteremia	Chlorhexidine (15%, 4/27)	No Treatment (9%, 2/22)	No difference

APPENDIX XII
QUALITY AND APPLICABILITY TABLES FOR INCLUDED STUDIES

Table 69 APPRAISE Table of Prognostic Studies for Recommendation 1, Direct Evidence

●: Domain free of flaws

○: Domain flaws present

Study	Prospective	Power	Analysis	Investigator Bias	Model	*Quality*	Patients	Analysis	Outcomes	*Applicability*
Berbari 2010	●	●	○	●	●	Moderate	●	○	●	Moderate

Table 70 APPRAISE Table of Treatment Studies for Recommendation 1, Dental Prophylaxis

●: Domain free of flaws

○: Domain flaws present

Study	Outcome	Hypothesis	Group Assignment	Blinding	Group Comparability	Treatment Integrity	Measurement	Investigator Bias	*Quality*	Participants	Intervention and Expertise	Compliance and Adherence	Analysis	*Applicability*
Baltch 1982	Bacteremia	●	○	○	○	●	●	○	Low	●	○	●	●	Moderate

Table 71 APPRAISE Table of Treatment Studies for Recommendation 1, Intubation

●: Domain free of flaws

○: Domain flaws present

Study	Outcome	Hypothesis	Group Assignment	Blinding	Group Comparability	Treatment Integrity	Measurement	Investigator Bias	*Quality*	Participants	Intervention and Expertise	Compliance and Adherence	Analysis	*Applicability*
Lockhart 2004	Bacteremia	●	●	●	●	●	●	●	High	●	○	●	●	Moderate

Table 72 APPRAISE Table of Treatment Studies for Recommendation 1, Oral Surgery

●: Domain free of flaws

○: Domain flaws present

Study	Outcome	Hypothesis	Group Assignment	Blinding	Group Comparability	Treatment Integrity	Measurement	Investigator Bias	*Quality*	Participants	Intervention and Expertise	Compliance and Adherence	Analysis	*Applicability*
Goker 1992	Bacteremia	●	○	●	○	●	●	○	Moderate	●	○	●	●	Moderate
Josefsson 1985	Bacteremia	●	○	●	○	●	●	○	Moderate	●	○	●	●	Moderate
Katoh 1992	Bacteremia	●	○	●	○	●	●	○	Moderate	●	○	●	●	Moderate
Martin 1964	Bacteremia	●	○	●	○	●	●	○	Moderate	●	○	●	●	Moderate

Table 73 APPRAISE Table of Treatment Studies for Recommendation 1, Periodontology

●: Domain free of flaws

○: Domain flaws present

Study	Outcome	Hypothesis	Group Assignment	Blinding	Group Comparability	Treatment Integrity	Measurement	Investigator Bias	*Quality*	Participants	Intervention and Expertise	Compliance and Adherence	Analysis	*Applicability*
Appleman 1981	Bacteremia	●	○	●	○	●	●	○	Moderate	●	○	●	●	Moderate
Gutverg 1962	Bacteremia	●	○	○	○	●	●	●	Moderate	●	○	●	●	Moderate
Morozumi 2010	Bacteremia	●	●	○	●	●	●	●	High	●	○	●	●	Moderate

Table 74 APPRAISE Table of Treatment Studies for Recommendation 1, Restorative Procedure

●: Domain free of flaws

○: Domain flaws present

Study	Outcome	Hypothesis	Group Assignment	Blinding	Group Comparability	Treatment Integrity	Measurement	Investigator Bias	*Quality*	Participants	Intervention and Expertise	Compliance and Adherence	Analysis	*Applicability*
Brennan 2007	Bacteremia	●	○	●	○	●	●	○	Moderate	●	○	●	●	Moderate

Table 75 APPRAISE Table of Treatment Studies for Recommendation 1, Extraction

●: Domain free of flaws

○: Domain flaws present

Study	Outcome	Hypothesis	Group Assignment	Blinding	Group Comparability	Treatment Integrity	Measurement	Investigator Bias	*Quality*	Participants	Intervention and Expertise	Compliance and Adherence	Analysis	*Applicability*
Aitken 1995	Bacteremia	●	○	●	○	●	●	○	Moderate	●	○	●	○	Moderate
Cannell 1991	Bacteremia	●	○	●	○	●	●	○	Moderate	●	○	●	○	Moderate

●: Domain free of flaws

○: Domain flaws present

Study	Outcome	Hypothesis	Group Assignment	Blinding	Group Comparability	Treatment Integrity	Measurement	Investigator Bias	*Quality*	Participants	Intervention and Expertise	Compliance and Adherence	Analysis	*Applicability*
Casolari 1989	Bacteremia	●	○	○	○	●	●	●	Moderate	●	○	○	○	Moderate
Coulter 1990	Bacteremia	●	○	●	○	●	●	○	Moderate	●	○	●	○	Moderate
DeVries 1972	Bacteremia	●	○	●	○	○	●	○	Low	●	○	●	○	Moderate
Dios 2006	Bacteremia	●	○	●	○	●	●	●	Moderate	●	○	●	●	Moderate
Hall 1993	Bacteremia	●	○	●	○	●	●	○	Moderate	●	○	●	○	Moderate
Hall 1996	Bacteremia	●	○	●	○	●	●	●	Moderate	●	○	●	○	Moderate
Hall 1996	Bacteremia	●	○	●	○	●	●	●	Moderate	●	○	●	○	Moderate
Head 1984	Bacteremia	●	○	●	○	●	●	○	Moderate	●	○	●	○	Moderate
Jokinen 1970	Bacteremia	●	○	○	○	●	●	●	Moderate	●	○	○	○	Moderate
Khairat 1966	Bacteremia	●	○	●	○	●	●	○	Moderate	●	○	●	○	Moderate

●: Domain free of flaws

○: Domain flaws present

Study	Outcome	Hypothesis	Group Assignment	Blinding	Group Comparability	Treatment Integrity	Measurement	Investigator Bias	*Quality*	Participants	Intervention and Expertise	Compliance and Adherence	Analysis	*Applicability*
Lockhart 2004	Bacteremia	●	●	●	●	●	●	●	High	●	●	●	●	Moderate
Lockhart 2008	Bacteremia	●	●	●	●	●	●	●	High	●	●	●	●	Moderate
Maskell 1986	Bacteremia	●	○	●	○	●	●	○	Moderate	●	○	●	○	Moderate
Roberts 1987	Bacteremia	●	○	○	●	●	●	○	Moderate	●	○	○	●	Moderate
Shanson 1978	Bacteremia	●	○	●	○	●	●	○	Moderate	●	○	●	○	Moderate
Shanson 1985	Bacteremia	●	○	●	○	●	●	○	Moderate	●	○	●	○	Moderate
Shanson 1987	Bacteremia	●	○	●	○	●	●	○	Moderate	●	○	●	○	Moderate
Vergis 2001	Bacteremia	●	○	●	○	●	●	○	Moderate	●	○	●	○	Moderate
Wahlmann 1999	Bacteremia	●	○	○	○	●	●	○	Low	●	○	○	○	Moderate

Table 76 APPRAISE Table of Treatment Studies for Recommendation 2, Brushing

●: Domain free of flaws

○: Domain flaws present

Study	Outcome	Hypothesis	Group Assignment	Blinding	Group Comparability	Treatment Integrity	Measurement	Investigator Bias	*Quality*	Participants	Intervention and Expertise	Compliance and Adherence	Analysis	*Applicability*
Madsen 1974	Bacteremia	●	○	○	○	●	●	○	low	●	○	●	●	Moderate

Table 77 APPRAISE Table of Treatment Studies for Recommendation 2, Chewing

●: Domain free of flaws

○: Domain flaws present

Study	Outcome	Hypothesis	Group Assignment	Blinding	Group Comparability	Treatment Integrity	Measurement	Investigator Bias	*Quality*	Participants	Intervention and Expertise	Compliance and Adherence	Analysis	*Applicability*
Fine 2010	Bacteremia	●	○	●	●	●	●	○	Moderate	●	○	●	●	Moderate

Table 78 APPRAISE Table of Treatment Studies for Recommendation 2, Dental Implant

●: Domain free of flaws

○: Domain flaws present

Study	Outcome	Hypothesis	Group Assignment	Blinding	Group Comparability	Treatment Integrity	Measurement	Investigator Bias	*Quality*	Participants	Intervention and Expertise	Compliance and Adherence	Analysis	*Applicability*
Pineiro 2010	Bacteremia	●	○	○	○	●	●	●	Moderate	●	○	●	●	Moderate

Table 79 APPRAISE Table of Treatment Studies for Recommendation 2, Dental Prophylaxis

●: Domain free of flaws

○: Domain flaws present

Study	Outcome	Hypothesis	Group Assignment	Blinding	Group Comparability	Treatment Integrity	Measurement	Investigator Bias	*Quality*	Participants	Intervention and Expertise	Compliance and Adherence	Analysis	*Applicability*
Cherry 2007	Bacteremia	●	○	○	○	●	●	●	Moderate	●	○	●	●	Moderate
Fine 1996	Bacteremia	●	●	●	○	●	●	○	Moderate	●	○	●	●	Moderate

Table 80 APPRAISE Table of Treatment Studies for Recommendation 2, Injection

●: Domain free of flaws

○: Domain flaws present

Study	Outcome	Hypothesis	Group Assignment	Blinding	Group Comparability	Treatment Integrity	Measurement	Investigator Bias	*Quality*	Participants	Intervention and Expertise	Compliance and Adherence	Analysis	*Applicability*
Rahn 1995	Bacteremia	●	○	●	○	●	●	○	Moderate	●	○	●	●	Moderate

Table 81 APPRAISE Table of Treatment Studies for Recommendation 2, Inter-detal Cleaning

●: Domain free of flaws

○: Domain flaws present

Study	Outcome	Hypothesis	Group Assignment	Blinding	Group Comparability	Treatment Integrity	Measurement	Investigator Bias	*Quality*	Participants	Intervention and Expertise	Compliance and Adherence	Analysis	*Applicability*
Madsen 1974	Bacteremia	●	○	○	○	●	●	○	low	●	○	●	●	Moderate

Table 82 APPRAISE Table of Treatment Studies for Recommendation 2, Intubation

●: Domain free of flaws

○: Domain flaws present

Study	Outcome	Hypothesis	Group Assignment	Blinding	Group Comparability	Treatment Integrity	Measurement	Investigator Bias	*Quality*	Participants	Intervention and Expertise	Compliance and Adherence	Analysis	*Applicability*
Fourrier 2005	Bacteremia	●	●	●	●	●	●	●	High	●	○	●	●	Moderate

Table 83 APPRAISE Table of Treatment Studies for Recommendation 2, Oral Surgery

●: Domain free of flaws

○: Domain flaws present

Study	Outcome	Hypothesis	Group Assignment	Blinding	Group Comparability	Treatment Integrity	Measurement	Investigator Bias	*Quality*	Participants	Intervention and Expertise	Compliance and Adherence	Analysis	*Applicability*
Huffman 1974	Bacteremia	●	○	○	○	●	●	○	Low	●	○	●	●	Moderate

Table 84 APPRAISE Table of Treatment Studies for Recommendation 2, Orthodontistry

●: Domain free of flaws

○: Domain flaws present

Study	Outcome	Hypothesis	Group Assignment	Blinding	Group Comparability	Treatment Integrity	Measurement	Investigator Bias	*Quality*	Participants	Intervention and Expertise	Compliance and Adherence	Analysis	*Applicability*
Erverdi 2001	Bacteremia	●	○	○	○	●	●	○	Low	●	○	●	●	Moderate

Table 85 APPRAISE Table of Treatment Studies for Recommendation 2, Periodontology

●: Domain free of flaws

○: Domain flaws present

Study	Outcome	Hypothesis	Group Assignment	Blinding	Group Comparability	Treatment Integrity	Measurement	Investigator Bias	*Quality*	Participants	Intervention and Expertise	Compliance and Adherence	Analysis	*Applicability*
Brenman 1974	Bacteremia	●	○	●	○	●	●	○	Moderate	●	○	●	●	Moderate
Lofthus 1991	Bacteremia	●	○	○	○	●	●	●	Moderate	●	○	●	●	Moderate
Morozumi 2010	Bacteremia	●	●	○	●	●	●	●	High	●	○	●	●	Moderate
Waki 1990	Bacteremia	●	○	●	○	●	●	●	Moderate	●	○	●	●	Moderate

Table 86 APPRAISE Table of Treatment Studies for Recommendation 2, Suture

●: Domain free of flaws

○: Domain flaws present

Study	Outcome	Hypothesis	Group Assignment	Blinding	Group Comparability	Treatment Integrity	Measurement	Investigator Bias	*Quality*	Participants	Intervention and Expertise	Compliance and Adherence	Analysis	*Applicability*
Brown 1998	Bacteremia	●	○	●	○	●	●	●	Moderate	●	○	●	●	Moderate

Table 87 APPRAISE Table of Treatment Studies for Recommendation 2, Tooth Extraction

●: Domain free of flaws

○: Domain flaws present

Study	Outcome	Hypothesis	Group Assignment	Blinding	Group Comparability	Treatment Integrity	Measurement	Investigator Bias	*Quality*	Participants	Intervention and Expertise	Compliance and Adherence	Analysis	*Applicability*
Casolari 1989	Bacteremia	●	○	○	○	●	●	●	Moderate	●	○	●	●	Moderate
Cutcher 1971	Bacteremia	●	○	○	○	●	●	○	Low	●	○	●	●	Moderate

●: Domain free of flaws

○: Domain flaws present

Study	Outcome	Hypothesis	Group Assignment	Blinding	Group Comparability	Treatment Integrity	Measurement	Investigator Bias	*Quality*	Participants	Intervention and Expertise	Compliance and Adherence	Analysis	*Applicability*
Francis 1973	Bacteremia	●	○	○	○	●	●	○	Low	●	○	●	●	Moderate
Jokinen 1970	Bacteremia	●	○	○	○	●	●	●	Moderate	●	○	●	●	Moderate
Jones 1970	Bacteremia	●	○	○	○	●	●	○	Low	●	○	●	●	Moderate
Lockhart 1996	Bacteremia	●	●	●	●	●	●	○	High	●	○	●	●	Moderate
MacFarlane 1984	Bacteremia	●	○	●	○	●	●	○	Moderate	●	○	●	●	Moderate
Nasif 1977	Bacteremia	●	○	○	○	●	●	○	Low	●	○	●	●	Moderate
Rahn 1995	Bacteremia	●	○	●	○	●	●	○	Moderate	●	○	●	●	Moderate
Scopp 1971	Bacteremia	●	○	●	○	●	●	○	Moderate	●	○	●	●	Moderate
Sweet 1978	Bacteremia	●	○	●	○	●	●	○	Moderate	●	○	●	●	Moderate
Tomas 2007	Bacteremia	●	○	○	●	●	●	●	Moderate	●	○	●	●	Moderate

●: Domain free of flaws

○: Domain flaws present

Study	Outcome	Hypothesis	Group Assignment	Blinding	Group Comparability	Treatment Integrity	Measurement	Investigator Bias	*Quality*	Participants	Intervention and Expertise	Compliance and Adherence	Analysis	*Applicability*
Yamalik 1992	Bacteremia	●	○	○	○	●	●	○	Low	●	○	●	●	Moderate

Table 88 APPRAISE Table of Prognostic Studies for Recommendation 3, Brushing

●: Domain free of flaws

○: Domain flaws present

Study	Prospective	Power	Analysis	Investigator Bias	Model	*Quality*	Patients	Analysis	Outcomes	*Applicability*
Ashare 2009	●	●	○	○	●	Low	●	○	○	Moderate
Bhanji 2002	●	●	○	○	●	Low	●	○	○	Moderate
Forner 2006	●	●	○	○	●	Low	●	○	○	Moderate
Lockhart 2009	●	●	○	○	●	Low	●	○	○	Moderate
Silver 1977	●	●	○	○	●	Low	●	○	○	Moderate

Table 89 APPRAISE Table of Prognostic Studies for Recommendation 3, Chewing

●: Domain free of flaws

○: Domain flaws present

Study	Prospective	Power	Analysis	Investigator Bias	Model	*Quality*	Patients	Analysis	Outcomes	*Applicability*
Forner 2006	●	○	○	○	●	Very Low	●	○	○	Moderate

Table 90 APPRAISE Table of Prognostic Studies for Recommendation 3, Dental Prophylaxis

●: Domain free of flaws

○: Domain flaws present

Study	Prospective	Power	Analysis	Investigator Bias	Model	*Quality*	Patients	Analysis	Outcomes	*Applicability*
Cherry 2007	●	○	○	●	●	Low	●	○	○	Moderate
De Leo 1974	●	●	○	○	●	Low	●	○	○	Moderate
Forner 2006	●	●	○	○	●	Low	●	○	○	Moderate
Trivedi 1984	●	●	○	○	●	Low	●	○	○	Moderate

Table 91 APPRAISE Table of Prognostic Studies for Recommendation 3, Inter-dental Cleaning

●: Domain free of flaws

○: Domain flaws present

Study	Prospective	Power	Analysis	Investigator Bias	Model	*Quality*	Patients	Analysis	Outcomes	*Applicability*
Crasta 2009	●	●	○	○	●	Low	●	○	○	Moderate
Lineberger 1973	●	●	○	○	●	Low	●	○	○	Moderate

Table 92 APPRAISE Table of Prognostic Studies for Recommendation 3, Intubation

●: Domain free of flaws

○: Domain flaws present

Study	Prospective	Power	Analysis	Investigator Bias	Model	*Quality*	Patients	Analysis	Outcomes	*Applicability*
Valdes 2008	●	●	○	○	●	Low	●	○	○	Moderate

Table 93 APPRAISE Table of Prognostic Studies for Recommendation 3, Oral Surgery

●: Domain free of flaws

○: Domain flaws present

Study	Prospective	Power	Analysis	Investigator Bias	Model	*Quality*	Patients	Analysis	Outcomes	*Applicability*
Enabulele 2008	●	●	○	○	●	Low	●	○	○	Moderate
Roberts 1998	●	●	○	○	●	Low	●	○	○	Moderate
Takai 2005	●	●	○	○	●	Low	●	○	○	Moderate
Tomas 2008	●	●	○	○	●	Low	●	○	○	Moderate

Table 94 APPRAISE Table of Prognostic Studies for Recommendation 3, Periodontology

●: Domain free of flaws

○: Domain flaws present

Study	Prospective	Power	Analysis	Investigator Bias	Model	*Quality*	Patients	Analysis	Outcomes	*Applicability*
Daly 1997	●	○	○	○	●	Low	●	○	○	Moderate
Daly 2001	●	●	○	○	●	Low	●	○	○	Moderate

Table 95 APPRAISE Table of Prognostic Studies for Recommendation 3, Restorative Procedure

●: Domain free of flaws

○: Domain flaws present

Study	Prospective	Power	Analysis	Investigator Bias	Model	*Quality*	Patients	Analysis	Outcomes	*Applicability*
Brennan 2007	●	●	○	○	○	Very Low	●	○	○	Moderate

Table 96 APPRAISE Table of Prognostic Studies for Recommendation 3, Tooth Extraction

●: Domain free of flaws

○: Domain flaws present

Study	Prospective	Power	Analysis	Investigator Bias	Model	*Quality*	Patients	Analysis	Outcomes	*Applicability*
Barbosa 2010	●	●	○	○	●	Moderate	●	○	○	Moderate
Coulter 1990	●	●	○	○	●	Moderate	●	○	○	Moderate
Enabulele 2008	●	●	○	○	●	Moderate	●	○	○	Moderate
Lockhart 1996	●	●	○	○	●	Moderate	●	○	○	Moderate
Lockhart 2009	●	●	○	○	●	Moderate	●	○	○	Moderate
Okabe 1995	●	●	○	○	●	Moderate	●	○	○	Moderate
Roberts 1998	●	●	○	○	●	Moderate	●	○	○	Moderate
Wahlmann 1999	●	●	○	○	●	Moderate	●	○	○	Moderate

Table 97 APPRAISE Table of Incidence/Prevalence Studies for Control/Baseline, Brushing

●: Domain free of flaws

○: Domain flaws present

Study	Outcome	Incidence /Prevalence	Outcome	Measurement	Participants	Investigator Bias	*Quality*	Analysis	Outcomes	Participants	*Applicability*
Bhanji 2002	Bacteremia	I	●	●	●	●	High	●	○	○	Moderate
Forner 2006	Bacteremia	I	●	●	●	●	High	●	○	○	Moderate
Lockhart 2008	Bacteremia	I	●	●	●	●	High	●	○	○	Moderate
Lucas 2000	Bacteremia	P	●	●	●	○	Moderate	●	○	○	Moderate
Sconyers 1979	Bacteremia	I	●	●	●	●	High	●	○	○	Moderate
Sconyers 1973	Bacteremia	I	●	●	●	●	High	●	○	○	Moderate
Silver 1979	Bacteremia	P	●	●	●	●	High	●	○	○	Moderate

Table 98 APPRAISE Table of Incidence/Prevalence Studies for Control/Baseline, Brushing

●: Domain free of flaws

○: Domain flaws present

Study	Outcome	Incidence /Prevalence	Outcome	Measurement	Participants	Investigator Bias	*Quality*	Analysis	Outcomes	Participants	*Applicability*
Degling 1972	Bacteremia	P	●	●	●	●	High	●	○	○	Moderate
Forner 2006	Bacteremia	I	●	●	●	●	High	●	○	○	Moderate
Murphy 2006	Bacteremia	I	●	●	●	●	High	●	○	○	Moderate
Trivedi 1984	Bacteremia	P	●	●	●	○	Moderate	●	○	○	Moderate

Table 99 APPRAISE Table of Incidence/Prevalence Studies for Control/Baseline, Cleft Palate

●: Domain free of flaws

○: Domain flaws present

Study	Outcome	Incidence /Prevalence	Outcome	Measurement	Participants	Investigator Bias	*Quality*	Analysis	Outcomes	Participants	*Applicability*
Marzoni 1983	Bacteremia	P	●	●	○	○	Low	●	○	○	Moderate

Table 100 APPRAISE Table of Incidence/Prevalence Studies for Control/Baseline, Dental Implant

●: Domain free of flaws

○: Domain flaws present

Study	Outcome	Incidence /Prevalence	Outcome	Measurement	Participants	Investigator Bias	*Quality*	Analysis	Outcomes	Participants	*Applicability*
Pineiro 2010	Bacteremia	I	●	●	●	●	High	●	○	○	Moderate

Table 101 APPRAISE Table of Incidence/Prevalence Studies for Control/Baseline, Dental Prophylaxis

●: Domain free of flaws

○: Domain flaws present

Study	Outcome	Incidence /Prevalence	Outcome	Measurement	Participants	Investigator Bias	*Quality*	Analysis	Outcomes	Participants	*Applicability*
Cherry 2007	Bacteremia	I	●	●	●	●	High	●	○	○	Moderate
De Leo 1974	Bacteremia	I	●	●	●	●	High	●	○	○	Moderate
Forner 2006	Bacteremia	I	●	●	●	●	High	●	○	○	Moderate
Forner 2006	Bacteremia	I	●	●	●	●	High	●	○	○	Moderate
Heimdahl 1990	Bacteremia	I	●	●	●	●	High	●	○	○	Moderate
Lucas 1999	Bacteremia	P	●	●	●	○	Moderate	●	○	○	Moderate
Trivedi 1984	Bacteremia	P	●	●	●	○	Moderate	●	○	○	Moderate
Winslow 1960	Bacteremia	P	●	●	●	○	Moderate	●	○	○	Moderate

Table 102 APPRAISE Table of Incidence/Prevalence Studies for Control/Baseline, Endodontic

●: Domain free of flaws

○: Domain flaws present

Study	Outcome	Incidence /Prevalence	Outcome	Measurement	Participants	Investigator Bias	*Quality*	Analysis	Outcomes	Participants	*Applicability*
Baumgartner 1977	Bacteremia	I	●	●	●	●	High	●	○	○	Moderate
Baumgartner 1976	Bacteremia	I	●	●	●	●	High	●	○	○	Moderate
Bender 1963	Bacteremia	I	●	●	●	●	High	●	○	○	Moderate
Debelian 1995	Bacteremia	P	●	●	●	○	Moderate	●	○	○	Moderate
Heimdahl 1990	Bacteremia	I	●	●	●	●	High	●	○	○	Moderate
Savarrio 2005	Bacteremia	I	●	●	●	●	High	●	○	○	Moderate

Table 103 APPRAISE Table of Incidence/Prevalence Studies for Control/Baseline, Injections

●: Domain free of flaws

○: Domain flaws present

Study	Outcome	Incidence /Prevalence	Outcome	Measurement	Participants	Investigator Bias	*Quality*	Analysis	Outcomes	Participants	*Applicability*
Roberts 1998	Bacteremia	P	●	●	●	○	Moderate	●	○	○	Moderate
Rahn 1995	Bacteremia	I	●	●	●	○	Moderate	●	○	○	Moderate

Table 104 APPRAISE Table of Incidence/Prevalence Studies for Control/Baseline, Inter-dental Cleaning

●: Domain free of flaws

○: Domain flaws present

Study	Outcome	Incidence /Prevalence	Outcome	Measurement	Participants	Investigator Bias	*Quality*	Analysis	Outcomes	Participants	*Applicability*
Berger 1974	Bacteremia	I	●	●	●	○	Moderate	●	○	○	Moderate
Crasta 2009	Bacteremia	I	●	●	●	●	High	●	○	○	Moderate
Felix 1971	Bacteremia	I	●	●	●	○	Moderate	●	○	○	Moderate
Lineberger 1973	Bacteremia	I	●	●	●	○	Moderate	●	○	○	Moderate
Ramadan 1975	Bacteremia	I	●	●	●	○	Moderate	●	○	○	Moderate
Romans 1971	Bacteremia	I	●	●	●	○	Moderate	●	○	○	Moderate
The American Academy of Periodontology 1972	Bacteremia	I	●	●	●	○	Moderate	●	○	○	Moderate
Wank 1976	Bacteremia	I	●	●	●	○	Moderate	●	○	○	Moderate

Table 105 APPRAISE Table of Incidence/Prevalence Studies for Control/Baseline, Intubation

●: Domain free of flaws

○: Domain flaws present

Study	Outcome	Incidence /Prevalence	Outcome	Measurement	Participants	Investigator Bias	*Quality*	Analysis	Outcomes	Participants	*Applicability*
Ali 1992	Bacteremia	I	●	●	●	○	Moderate	●	○	○	Moderate
Berry 1973	Bacteremia	I	●	●	●	○	Moderate	●	○	○	Moderate
Dinner 1987	Bacteremia	I	●	●	●	○	Moderate	●	○	○	Moderate
Hansen 1989	Bacteremia	I	●	●	●	○	Moderate	●	○	○	Moderate
Oncag 2005	Bacteremia	I	●	●	●	○	Moderate	●	○	○	Moderate
Roberts 1997	Bacteremia	P	●	●	●	○	Moderate	●	○	○	Moderate
Valdes 2008	Bacteremia	I	●	●	●	●	High	●	○	○	Moderate

Table 106 APPRAISE Table of Incidence/Prevalence Studies for Control/Baseline, Oral Surgery

●: Domain free of flaws

○: Domain flaws present

Study	Outcome	Incidence /Prevalence	Outcome	Measurement	Participants	Investigator Bias	*Quality*	Analysis	Outcomes	Participants	*Applicability*
Enabulele 2008	Bacteremia	I	●	●	●	○	Moderate	●	○	○	Moderate
Flood 1990	Bacteremia	I	●	●	●	○	Moderate	●	○	○	Moderate
Heimdahl 1990	Bacteremia	I	●	●	●	●	High	●	○	○	Moderate
Josefsson 1985	Bacteremia	I	●	●	●	○	Moderate	●	○	○	Moderate
Martin 1964	Bacteremia	P	●	●	●	○	Moderate	○	○	○	Low
Rajasuo 2004	Bacteremia	P	●	○	●	●	Moderate	●	○	○	Moderate
Rajasuo 2004	Bacteremia	P	●	○	●	●	Moderate	●	○	○	Moderate
Roberts 1997	Bacteremia	P	●	●	●	○	Moderate	●	○	○	Moderate
Roberts 1998	Bacteremia	P	●	○	●	○	Low	●	○	○	Moderate
Takai 2005	Bacteremia	I	●	●	●	○	Moderate	●	○	○	Moderate
Tomas 2008	Bacteremia	P	●	○	●	○	Low	●	○	○	Moderate

Table 107 APPRAISE Table of Incidence/Prevalence Studies for Control/Baseline, Orthodontic

●: Domain free of flaws

○: Domain flaws present

Study	Outcome	Incidence /Prevalence	Outcome	Measurement	Participants	Investigator Bias	*Quality*	Analysis	Outcomes	Participants	*Applicability*
Burden 2004	Bacteremia	P	●	●	●	●	High	●	○	○	Moderate
Degling 1972	Bacteremia	P	●	●	●	●	High	●	○	○	Moderate
Erverdi 1999	Bacteremia	P	●	●	●	○	Moderate	●	○	○	Moderate
Gürel 2009	Bacteremia	I	●	●	●	○	Moderate	●	○	○	Moderate

Table 108 APPRAISE Table of Incidence/Prevalence Studies for Control/Baseline, Periodontology

●: Domain free of flaws

○: Domain flaws present

Study	Outcome	Incidence /Prevalence	Outcome	Measurement	Participants	Investigator Bias	*Quality*	Analysis	Outcomes	Participants	*Applicability*
Bender 1963	Bacteremia	I	●	●	●	●	High	●	○	○	Moderate
Casolari 1989	Bacteremia	I	●	●	●	●	High	●	○	○	Moderate
Conner 1967	Bacteremia	P	●	●	●	●	High	●	○	○	Moderate
Daly 1997	Bacteremia	I	●	●	●	●	High	●	○	○	Moderate
Daly 2001	Bacteremia	I	●	●	○	●	Moderate	●	○	○	Moderate
Gutverg 1962	Bacteremia	P	●	●	●	●	High	●	○	○	Moderate
Kinane 2005	Bacteremia	P	●	○	●	○	Moderate	○	○	○	Low
Lafaurie 2007	Bacteremia	I	●	●	●	○	High	○	○	○	Moderate
Lineberger 1973	Bacteremia	I	●	●	○	○	Moderate	○	○	○	Moderate
Lofthus 1991	Bacteremia	I	●	●	●	○	High	○	○	○	Moderate
Lucartorto 1992	Bacteremia	I	●	●	●	○	High	○	○	○	Moderate

●: Domain free of flaws

○: Domain flaws present

Study	Outcome	Incidence /Prevalence	Outcome	Measurement	Participants	Investigator Bias	*Quality*	Analysis	Outcomes	Participants	*Applicability*
Morozumi 2010	Bacteremia	I	●	●	●	○	High	○	○	○	Moderate
Rogosa 1960	Bacteremia	I	●	●	○	○	Moderate	○	○	○	Moderate
Wada 1968	Bacteremia	I	●	●	○	○	Moderate	○	○	○	Moderate
Waki 1990	Bacteremia	I	●	●	●	○	High	○	○	○	Moderate

Table 109 APPRAISE Table of Incidence/Prevalence Studies for Control/Baseline, Restorative Procedure

●: Domain free of flaws

○: Domain flaws present

Study	Outcome	Incidence /Prevalence	Outcome	Measurement	Participants	Investigator Bias	*Quality*	Analysis	Outcomes	Participants	*Applicability*
Oncag 2006	Bacteremia	I	●	●	●	○	Moderate	●	○	○	Moderate
Roberts 2000	Bacteremia	P	●	●	●	○	Moderate	●	○	●	Moderate
Sonbol 2009	Bacteremia	P	●	●	●	○	Moderate	●	○	○	Moderate

Table 110 APPRAISE Table of Incidence/Prevalence Studies for Control/Baseline, Sialography

●: Domain free of flaws

○: Domain flaws present

Study	Outcome	Incidence /Prevalence	Outcome	Measurement	Participants	Investigator Bias	*Quality*	Analysis	Outcomes	Participants	*Applicability*
Lamey 1985	Bacteremia	I	●	●	●	○	Moderate	●	○	○	Moderate
Nixon 2009	Bacteremia	I	●	●	●	○	Moderate	●	○	○	Moderate

Table 111 APPRAISE Table of Incidence/Prevalence Studies for Control/Baseline, Suture

●: Domain free of flaws

○: Domain flaws present

Study	Outcome	Incidence /Prevalence	Outcome	Measurement	Participants	Investigator Bias	*Quality*	Analysis	Outcomes	Participants	*Applicability*
Brown 1998	Bacteremia	I	●	●	●	○	Moderate	●	○	○	Moderate
Giglio 1992	Bacteremia	P	●	●	●	○	Moderate	●	○	○	Moderate
King 1988	Bacteremia	I	●	●	●	○	Moderate	●	○	○	Moderate
Wampole 1978	Bacteremia	I	●	●	●	○	Moderate	●	○	○	Moderate

Table 112 APPRAISE Table of Incidence/Prevalence Studies for Control/Baseline, Teething

●: Domain free of flaws

○: Domain flaws present

Study	Outcome	Incidence /Prevalence	Outcome	Measurement	Participants	Investigator Bias	*Quality*	Analysis	Outcomes	Participants	*Applicability*
Soliman 1977	Bacteremia	P	●	●	●	○	Moderate	●	○	○	Moderate

Table 113 APPRAISE Table of Incidence/Prevalence Studies for Control/Baseline, Tooth Extraction

●: Domain free of flaws

○: Domain flaws present

Study	Outcome	Incidence /Prevalence	Outcome	Measurement	Participants	Investigator Bias	*Quality*	Analysis	Outcomes	Participants	*Applicability*
Barbosa 2010	Bacteremia	P	●	○	●	●	Moderate	●	○	○	Moderate
Bender 1963	Bacteremia	I	●	●	●	●	High	●	○	○	Moderate
Casolari 1989	Bacteremia	I	●	●	●	●	High	●	○	○	Moderate
Coulter 1990	Bacteremia	P	●	●	●	●	High	●	○	○	Moderate
Crawford 1974	Bacteremia	P	●	○	●	●	Moderate	●	○	○	Moderate
DeVries 1972	Bacteremia	P	●	●	●	○	Moderate	●	○	○	Moderate
Francis 1973	Bacteremia	P	●	●	●	○	Moderate	●	○	○	Moderate
Heimdahl 1990	Bacteremia	I	●	●	●	●	High	●	○	○	Moderate
Khairat 1966	Bacteremia	I	●	●	●	○	Moderate	●	○	○	Moderate
Maskell 1896	Bacteremia	P	●	●	●	○	Moderate	●	○	○	Moderate

●: Domain free of flaws

○: Domain flaws present

Study	Outcome	Incidence /Prevalence	Outcome	Measurement	Participants	Investigator Bias	*Quality*	Analysis	Outcomes	Participants	*Applicability*
Peterson 1976	Bacteremia	P	●	●	●	○	Moderate	●	○	○	Moderate
Roberts 1992	Bacteremia	P	●	●	●	○	Moderate	●	○	○	Moderate
Shanson 1978	Bacteremia	P	●	●	●	○	Moderate	●	○	○	Moderate
Shanson 1987	Bacteremia	P	●	●	●	○	Moderate	●	○	○	Moderate
Tomas 2007	Bacteremia	P	●	○	●	●	Moderate	●	○	○	Moderate
Tomas 2007	Bacteremia	P	●	○	●	●	Moderate	●	○	○	Moderate
Trivedi 1984	Bacteremia	P	●	●	●	○	Moderate	●	○	○	Moderate

APPENDIX XIII
CONFLICT OF INTEREST

All members of the AAOS work group disclosed any conflicts of interest prior to the development of the recommendations for this guideline. Conflicts of interest are disclosed with the American Academy of Orthopaedic Surgeons via a private on-line reporting database and also verbally at the recommendation approval meeting.

Disclosure Items: (n) = Respondent answered 'No' to all items indicating no conflicts. 1= Royalties from a company or supplier; 2= Speakers bureau/paid presentations for a company or supplier; 3A= Paid employee for a company or supplier; 3B= Paid consultant for a company or supplier; 3C= Unpaid consultant for a company or supplier; 4= Stock or stock options in a company or supplier; 5= Research support from a company or supplier as a PI; 6= Other financial or material support from a company or supplier; 7= Royalties, financial or material support from publishers; 8= Medical/Orthopaedic publications editorial/governing board; 9= Board member/committee appointments for a society.

William C. Watters, III, MD, Work Group Co-Chair: 1 (Stryker); 3B (Palladian; Stryker); 4 (Intrinsic Orthopedics); 8 (Official Disability Guidelines; Spine; The Spine Journal); 9 (American Board of Spine Surgery; North American Spine Society); Submitted on: 08/11/2011.

Michael P. Rethman, DDS, MS, Work Group Co-Chair: 3B (Colgate-Palmolive); 4 (Colgate-Palmolive; Pfizer); 9 (American Dental Association Foundation); Submitted on: 02/05/2013.

Elliott Abt, DDS: (n) Submitted on: 10/19/2011.

Harry C. Futrell, DMD: (n) Submitted on: 10/04/2011.

Stephen O. Glenn, DDS: 8 (Key/ Alliance of the American Dental Association); 9 (American Dental Association); Submitted on: 10/19/2011.

John Hellstein, DDS, MS: 9 (American Academy of Oral and Maxillofacial Pathology; American Board of Oral and Maxillofacial Pathology; American Dental Association Council on Scientific Affairs; Basal Cell Carcinoma Nevus Syndrome Life Support Network); Submitted on: 10/04/2011.

Mark J. Steinberg, DDS, MD: 9 (American Association of Oral and Maxillofacial Surgeons); Submitted on: 04/19/2011.

Richard Parker Evans, MD: 2 (Johnson & Johnson; Smith & Nephew)

Michael J. Goldberg, MD: 8 (Journal Children's Orthopaedics; Journal of Pediatric Orthopedics); 9 (AAOS); Submitted on: 04/27/2011.

Calin Stefan Moucha, MD: 2 (3M) 4 (Auxillium); 9 (AAOS); Submitted on: 10/02/2011.

Richard J. O'Donnell, MD: 9 (National Comprehensive Cancer Network; Northern California Chapter, Western Orthopaedic Association; Orthopaedic Surgical Osseointegration Society; Sarcoma Alliance); Submitted on: 10/04/2011.

Paul A. Anderson, MD: 1 (Pioneer; Stryker); 3B (Aesculap/B.Braun); 3C (Expanding Orthopedics; SI Bone; Spatatec; Titan Surgical); 4 (Pioneer Surgical; SI Bone; Spartec; Titan Surgical); 8 (Clinical Orthopaedics and Related Research; Journal of Bone and Joint Surgery - American; Journal of Orthopaedics and Traumatology; Journal of Spinal Disorders; Neurosurgery; Spine; Spine Arthropalsty Journal); 9 (American Academy of Orthopaedic Surgeons, American Society for Testing and Materials; North American Spine Society; Spine Arthroplasty Society; Spine Section of American Association of Neurological Surgeons/Congress of Neurological Surgeons); Submitted on: 04/07/2011.

John E. O'Toole, MD: 1 (Globus Medical); 3B (Globus Medical; Pioneer Surgical); 3C (Medtronic); Submitted on: 10/19/2011.

David J. Kolessar, MD: 4 (Zimmer); Submitted on: 04/07/2011.

Karen C. Carroll, MD, FCAP: 7 (ASM Press; McGraw-Hill); 8 (Infectious Diseases in Clinical Practice; Journal Clinical Microbiology/ASM Press); Submitted on: 10/05/2011.

Kevin Garvin, MD: 1 (Biomet); 8 (Wolters Kluwer Health - Lippincott Williams & Wilkins); 9 (AAOS; AAOS; American Orthopaedic Association; American Orthopaedic Association); Submitted on: 09/21/2011.

Douglas R. Osmon, MD: 9 (Musculoskeletal infection society); Submitted on: 10/05/2011.

Anthony Rinella, MD: (n); Submitted on: 10/05/2011.

Angela Hewlett, MD, MS: 9 (Society for Healthcare Epidemiology of America); Submitted on: 10/04/2011.

William Robert Martin, III, MD: 9 (National Board of Medical Examiners); Submitted on: 03/12/2010.

Deborah S. Cummins, PhD: (n); Submitted on 11/15/2012.

Sharon Song, PhD: (n); Submitted on 1/28/2013.

Patrick Sluka, MPH: (n); Submitted on 10/19/2011.

Kevin Boyer, MPH: (n); Submitted on 03/05/2012.

Anne Woznica, MLIS: (n); Submitted on 10/03/2012.

Helen Ristic, PhD: (n); Submitted on 01/15/2013.

Nicholas Buck Hanson, MPH: (n); Submitted on 01/14/2013.

REFERENCES

(1) Kurtz S, Ong K, Lau E, Mowat F, Halpern M. Projections of primary and revision hip and knee arthroplasty in the United States from 2005 to 2030. *J Bone Joint Surg Am* 2007;89(4):780-785.

(2) Della Valle CJ, Zuckerman JD, Di Cesare PE. Periprosthetic Sepsis. *Clin Orthop* 2004;(420):26-31.

(3) Shaneyfelt TM, Centor RM. Reassessment of clinical practice guidelines: go gently into that good night. *JAMA* 2009;301(8):868-869.

(4) Institute of Medicine. Clinical Practice Guidelines We Can Trust. Washington, D.C.: National Academies Press; 2011.

(5) Institute of Medicine. Conflict of Interest in Medical Research, Education, and Practice. Washington, D.C.: National Academies Press; 2009.

(6) Hirsh J, Guyatt G. Clinical experts or methodologists to write clinical guidelines? *Lancet* 2009;374(9686):273-275.

(7) Atkins D, Eccles M, Flottorp S et al. Systems for grading the quality of evidence and the strength of recommendations I: critical appraisal of existing approaches The GRADE Working Group. *BMC Health Serv Res* 2004;4(1):38.

(8) Poolman RW, Struijs PA, Krips R, Sierevelt IN, Lutz KH, Bhandari M. Does a "Level I Evidence" rating imply high quality of reporting in orthopaedic randomised controlled trials? *BMC Med Res Methodol* 2006;6:44.

(9) *GRADE handbook for grading quality of evidence and strength of recommendation*. The GRADE Working Group; 2009.

(10) Moher D, Dulberg CS, Wells GA. Statistical power, sample size, and their reporting in randomized controlled trials. *JAMA* 1994;272(2):122-124.

(11) Institute of Medicine. Finding What Works in Health Care: Standards for Systematic Reviews. Washington, D.C.: National Academies Press; 2011.

(12) Morrison A, Moulton K, Clark M et al. English-Language Restriction When Conducting Systematic Review-based Meta-analyses: Systemataic Review of Published Studies. Ottawa: Canadian Agency for Drugs and Technologies in Health; 2009.

(13) Kastner M, Wilczynski NL, Walker-Dilks C, McKibbon KA, Haynes B. Age-specific search strategies for Medline. *J Med Internet Res* 2006;8(4):e25.

(14) Haynes RB, McKibbon KA, Wilczynski NL, Walter SD, Werre SR. Optimal search strategies for retrieving scientifically strong studies of treatment from Medline: analytical survey. *BMJ* 2005;330(7501):1179.

(15) Montori VM, Wilczynski NL, Morgan D, Haynes RB. Optimal search strategies for retrieving systematic reviews from Medline: analytical survey. *BMJ* 2005;330(7482):68.

(16) Wong SS, Wilczynski NL, Haynes RB. Comparison of top-performing search strategies for detecting clinically sound treatment studies and systematic reviews in MEDLINE and EMBASE. *J Med Libr Assoc* 2006;94(4):451-455.

(17) Kastner M, Wilczynski NL, Walker-Dilks C, McKibbon KA, Haynes B. Age-specific search strategies for Medline. *J Med Internet Res* 2006;8(4):e25.

(18) Wong SS, Wilczynski NL, Haynes RB. Optimal CINAHL search strategies for identifying therapy studies and review articles. *J Nurs Scholarsh* 2006;38(2):194-199.

(19) Treadwell JR, Tregear SJ, Reston JT, Turkelson CM. A system for rating the stability and strength of medical evidence. *BMC Med Res Methodol* 2006;6:52.

(20) Higgins J, Altman D. Assessing risk of bias in included studies. In: Higgins J, Green S, editors. *Cochrane Handbook for SYstematic Reviews of Interventions*. John Wiley & Sons; 2008. 187-241.

(21) Thorpe KE, Zwarenstein M, Oxman AD et al. A pragmatic-explanatory continuum indicator summary (PRECIS): a tool to help trial designers. *J Clin Epidemiol* 2009;62(5):464-475.

(22) Sismondo S. Pharmaceutical company funding and its consequences: a qualitative systematic review. *Contemp Clin Trials* 2008;29(2):109-113.

(23) Ezzet KA. The prevalence of corporate funding in adult lower extremity research and its correlation with reported results. *J Arthroplasty* 2003;18(7 Suppl 1):138-145.

(24) Khan SN, Mermer MJ, Myers E, Sandhu HS. The roles of funding source, clinical trial outcome, and quality of reporting in orthopedic surgery literature. *Am J Orthop (Belle Mead NJ)* 2008;37(12):E205-E212.

(25) Montori VM, Jaeschke R, Schunemann HJ et al. Users' guide to detecting misleading claims in clinical research reports. *BMJ* 2004;329(7474):1093-1096.

(26) Salanti G, Higgins JP, Ades AE, Ioannidis JP. Evaluation of networks of randomized trials. *Stat Methods Med Res* 2008;17(3):279-301.

(27) Petitti DB, Teutsch SM, Barton MB, Sawaya GF, Ockene JK, DeWitt T. Update on the methods of the U.S. Preventive Services Task Force: insufficient evidence. *Ann Intern Med* 2009;150(3):199-205.

(28) Murphy MK, Black LA, Lamping DL, McKee CM, Sanderson C.F., Askam J. Consensus development methods, and their use in clinical guideline development. *Health Technol Assess* 1998.

(29) Fleming TR, DeMets DL. Surrogate end points in clinical trials: are we being misled? *Ann Intern Med* 1996;125(7):605-613.

(30) Shaughnessy AF, Slawson DC. What happened to the valid POEMs? A survey of review articles on the treatment of type 2 diabetes. *BMJ* 2003;327(7409):266.

(31) Grimes DA, Schulz KF. Surrogate end points in clinical research: hazardous to your health. *Obstet Gynecol* 2005;105(5 Pt 1):1114-1118.

(32) Prentice RL. Surrogate endpoints in clinical trials: definition and operational criteria. *Stat Med* 1989;8(4):431-440.

(33) Stata Statistical Software: Release 10 [computer program]. College Station, TX: StatCorp LP; 2007.

(34) Hozo SP, Djulbegovic B, Hozo I. Estimating the mean and variance from the median, range, and the size of a sample. *BMC Med Res Methodol* 2005;5(1):13.

(35) Lu G, Ades AE. Combination of direct and indirect evidence in mixed treatment comparisons. *Stat Med* 2004;23(20):3105-3124.

(36) Brooks S, Gelman A. Alternative methods for monitoring convergence of iterative simulations. *Journal of Computational and Graphical Statistics* 1998;7:434-455.

(37) Dias S, Welton NJ, Caldwell DM, Ades AE. Checking consistency in mixed treatment comparison meta-analysis. *Stat Med* 2010;29(7-8):932-944.

(38) DerSimonian R., Laird N. Meta-Analysis in Clinical Trials. *Controlled Clinical Trials* 1986;7:177-188.

(39) Berbari EF, Osmon DR, Carr A et al. Dental procedures as risk factors for prosthetic hip or knee infection: a hospital-based prospective case-control study. *Clin Infect Dis* 2010;50(1):8-16.