Infection Risk from Scrubs Worn Outside Patient Care Settings

The growing trend of healthcare workers wearing scrubs outside clinical settings has led to some controversy because scrubs may become vectors for microorganism transmission that could cause infections. Also, some believe that wearing scrubs in public is unprofessional and erodes patient trust in healthcare professionals. In response to these concerns, some facilities are reviewing their dress code policies, laundering recommendations, and training initiatives regarding scrubs. This report focuses on assessing evidence to determine whether wearing scrubs outside patient care settings and returning to the care setting increases the risk of transmitting infections.

The Evidence Bar™

Evidence is inconclusive — too few data and mixed results

Evidence from 7 studies conducted in the United States or other countries is insufficient to determine whether wearing scrubs outside patient care settings increases risk of infection transmission. Findings from 1 nonrandomized comparison study and 4 surveillance studies suggest that scrub uniforms worn by staff in an intensive care unit (ICU), medical/surgical unit, or long-term care facility may harbor harmful bacteria. Limited evidence from 2 small single-center randomized controlled trials (RCTs) suggests that surgical scrub contamination risk is not increased by dressing at home or wearing scrubs to make rounds or in department offices. More studies are needed to confirm findings.

Evidence limitations: No studies evaluated whether wearing surgical or scrub uniforms outside the hospital increases healthcare-associated infections (HAIs) or community infection rates. Available evidence reports on a surrogate measure (i.e., bacterial burden). The RCTs are at high risk of bias due to their single-center focus.

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Executive Summary

Conclusions
Six studies available to assess reported bacterial burden.

─ 1 RCT found that the bacterial burden on surgical scrubs worn by labor and delivery residents was similar at the start of a shift between cohorts who dressed at home and those who dressed at the hospital.

─ 1 RCT found that the bacterial burden on surgical scrubs worn by anesthetists did not increase after visits to the surgical ward or office.

─ 1 prospective nonrandomized comparison study found that scrub uniforms worn by resident physicians for at least 24 hours had a higher bacterial burden than unworn scrubs. No scrubs harbored multidrug-resistant organisms.

─ We assessed 4 surveillance studies: 1 reported that 30% of samples on scrubs worn in the ICU were contaminated with pathogens; 1 reported the “significant presence of bacteria” on uniforms worn in a telemetry unit; 1 reported that up to 60% of uniforms worn by staff on a medical/surgical unit were colonized with potentially pathogenic bacteria; and 1 reported that samples taken from uniforms worn in 3 long-term care facilities showed high levels of methicillin-resistant Staphylococcus aureus contamination.

Evidence
Search dates: January 1, 2007, to March 5, 2018. We reviewed full text of 6 studies and the abstract of 1 published study; studies were from several countries, including the United States.

─ We included studies that assessed wearing scrubs in any patient care setting and reported on the incidence of HAIs and/or microbial burden. We review full text of studies available through open access or our library subscriptions and abstracts of other published studies.

─ 1 single-center RCT compared the bacterial burden on surgical scrubs worn by 21 labor and delivery residents who dressed at home or the hospital.

─ 1 single-center RCT compared the bacterial burden on surgical scrubs worn by 16 anesthetists in 3 settings: operating room (OR), OR and surgical wards, or OR and office.

─ 1 single-center prospective nonrandomized comparison study compared bacterial burden on scrub uniforms worn by 30 on-call residents at the end of a shift and unworn scrub uniforms.

─ 4 surveillance studies conducted in different settings (i.e., ICU, medical/surgical unit, long-term care facility) measured bacterial contamination on scrubs/uniforms worn by healthcare workers.

─ Evidence limitations: No studies evaluated whether wearing surgical or scrub uniforms outside the hospital increases healthcare-associated infections (HAIs) or community infection rates. Available evidence reports on a surrogate measure (i.e., bacterial burden). The RCTs are at high risk of bias due to their single-center focus.

Guidelines
A search of the National Guideline Clearinghouse and other web-based resources identified 4 relevant guidelines published between January 1, 2013, and March 6, 2018.

─ Guidelines published by the Association of periOperative Registered Nurses, the American College of Surgeons, and Association of Surgical Technologists all recommend that surgical scrubs not be worn outside the building. Two guidelines mention that wearing surgical scrubs outside the facility increases the risk of contamination with microorganisms in the external environment. SHEA has guidance on laundering scrubs.
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Background

Healthcare-associated Infections

HAIs (also called nosocomial infections and hospital-acquired infections) are defined as infections that patients did not have when entering care but acquired while receiving care for an illness in a healthcare facility (e.g., inpatient and ambulatory care centers, long-term care facilities, rehabilitation centers). The leading causative agents are *Clostridium difficile*, *Staphylococcus aureus*, *Klebsiella pneumoniae*, and *Escherichia coli*. Besides increasing morbidity and being the most common complication of healthcare, HAIs have been associated with extended hospital stays, increased medical costs, and increased mortality. Patients’ flora and the hospital environment have been identified as the main sources of HAIs. Infection spread is believed to occur through healthcare workers' contaminated hands and contaminated items or medical equipment. For additional information, see the article, “Multistate Point-Prevalence Survey of Health Care–Associated Infections.”

Scrubs

Surgeons, nurses, physicians, and other healthcare workers involved in patient care in healthcare facilities wear “scrubs” to identify themselves as hospital personnel to their patients and employers, to display professionalism; and to provide better protection than street clothes from unexpected exposures during the work shift.”(1) Scrubs consist of a short-sleeve shirt (i.e., scrub top) and drawstring pants (i.e., scrub trousers). Some scrubs also include a waist-length long-sleeved jacket without lapels (i.e., warm-up jacket). Scrubs are simple in design, easy to launder, and inexpensive to replace if they become damaged or stained.

Scrubs worn in the OR (i.e., surgical scrubs) are typically hospital-owned, obtained through a commercial linen service, or disposable to minimize outside contamination of ORs. Healthcare workers wearing scrubs as uniforms usually own their scrubs and launder them at home.

The growing trend of healthcare workers wearing scrubs outside the clinical setting has led to some controversy because scrubs may become “vectors for transmission of microorganisms that cause infections and illness in healthcare workers, patients, and the community.”(1) Healthcare workers wearing scrubs may bring microorganisms into the hospital or patient care setting from home, and they can also carry them out of that setting into their homes and the community.(2) In addition to having concerns about possible infection spread, some healthcare professionals feel that wearing scrubs in public is unprofessional and may have a negative impact on the trust patients have in healthcare professionals. In response to these concerns, leaders at some healthcare facilities are reviewing dress code policies, laundering recommendations, and staff training initiatives.(3)

Clinical Guidelines

A search of the National Guideline Clearinghouse and other web-based resources identified four relevant guidelines that include recommendations on wearing surgical scrubs outside the hospital setting or laundering scrubs:

- American College of Surgeons (ACS): Statement on Operating Room Attire. 2016. This statement reads:

  Many different health care providers (surgeons, anesthesiologists, CRNAs, laboratory technicians, aides, and so on) wear scrubs in the OR setting. The ACS strongly suggests that scrubs should not be worn outside the perimeter of the hospital by any health care provider. To facilitate enforcement of this guideline for OR personnel, the ACS suggests the adoption of distinctive, colored scrub suits for the operating room personnel.

  OR scrubs should not be worn in the hospital facility outside of the OR area without a clean lab coat or appropriate cover up over them.

- Association of periOperative Registered Nurses: Guidelines for Perioperative Practice: Guideline for Surgical Attire. 2018. These guidelines state:
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Health care personnel should change into street clothes whenever they go outside of the building. Surgical attire may become contaminated by contact with the external environment. Changing into clean surgical attire before entering the semi-restricted area(s) decreases the possibility of contamination with microorganisms present in the external environment.

The collective evidence does not support wearing of cover apparel to protect scrub attire from contamination, and there is evidence that lab coats worn as cover apparel can be contaminated with large numbers of pathogenic microorganisms. Researchers have found that cover apparel is not always discarded daily after use or laundered on a frequent basis.

- Society for Healthcare Epidemiology of America (SHEA). *Expert Guidance: Healthcare Personnel Attire in Non-operating Room Settings*. This guidance states:

  Optimally, any apparel worn at the bedside that comes in contact with the patient or patient environment should be laundered after daily use. Whether healthcare personnel attire for non-surgical settings should be laundered at home or professionally remains unclear. If laundered at home, a hot water wash cycle (ideally with bleach) followed by a cycle in the dryer is preferable. A combination of washing at higher temperatures and tumble drying or ironing has been associated with elimination of both pathogenic Gram-positive and Gram-negative bacteria.

- Association of Surgical Technologists (AST): *AST Standards of Practice for Surgical Attire, Surgical Scrub, Hand Hygiene and Hand Washing*, 2008. These standards state:

  Whenever leaving the healthcare facility, the surgical personnel should change into street clothes. Scrub suits worn outside the facility can come into contact with external microbes and contaminants and be transported into the facility environment.

Clinical Literature on Infection Risk from Scrubs Worn Outside the Hospital

We searched PubMed, EMBASE, Cochrane Library, and selected web-based resources for documents relevant to this topic and published between January 1, 2007, and March 5, 2018. Due to the sparsity of data on this topic, we included studies that assessed wearing scrubs in any patient care setting and reported on the incidence of HAIs and/or microbial burden. We reviewed full text of published studies available through open access or our library subscriptions and abstracts of other studies. We identified seven relevant publications and reviewed full text of six studies and the abstracts of one study. Our selected search results are listed in Table 1. The reported results of the clinical studies are summarized in Table 2.

- 1 single-center RCT compared the bacterial burden on surgical scrubs worn by labor and delivery residents dressing at home and dressing at the hospital.(4)
- 1 single-center RCT compared the bacterial burden on surgical scrubs worn by anesthetists in three settings: the OR, the OR plus surgical wards, and the OR plus office.(5)
- 1 single-center prospective comparison study compared bacterial burden on scrub uniforms worn by on-call residents at the end of a shift and unworn scrub uniforms.(6)
- 4 surveillance studies conducted in different settings (i.e., ICU, medical/surgical unit, long-term care facility) measured bacterial contamination on scrubs/uniforms worn by healthcare workers.(7-10)

Available evidence from one comparison study and four surveillance studies suggests that scrub uniforms worn by staff in various settings inside the hospital can harbor harmful bacteria. Limited evidence from single-center RCTs suggests that surgical scrub contamination risk is not increased by dressing at home or wearing scrubs to make patient rounds or in department offices. Further studies are need to confirm these findings.

Evidence limitations: No studies evaluated whether wearing surgical scrubs or scrub uniforms outside the patient care setting increases HAI or community infection rates. Available evidence reports on a surrogate measure (i.e., bacterial burden). The RCTs have limitations due to their small sample size and single-center focus.
Table 1. Overview of the Clinical Literature (January 1, 2007, through March 5, 2018)

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<tr>
<th>Publication Type</th>
<th>Number of Publications</th>
<th>References</th>
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<tr>
<td>Systematic reviews/ Technology assessments</td>
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<tr>
<td>Cost-effectiveness analyses</td>
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<tr>
<td>Randomized controlled trials</td>
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<tr>
<td>Bacterial burden on surgical scrubs at start of shift: labor and delivery residents dressing at home vs. dressing at hospital</td>
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<td>4</td>
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<tr>
<td>Bacterial burden on surgical scrubs over the course of a day: Anesthetists restricted to operating room (OR) vs. OR and surgical wards vs. OR and office</td>
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<tr>
<td>Nonrandomized controlled/ Comparison studies</td>
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<tr>
<td>Bacterial burden on scrub uniforms at the end of an on-call resident’s shift: unworn vs. worn</td>
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<td>6</td>
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<tr>
<td>Surveillance studies</td>
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<td>7-10</td>
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<tr>
<td>Case series</td>
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Table 2. Clinical Trials

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<thead>
<tr>
<th>Reference Site</th>
<th>Number of Participants</th>
<th>Study Aim Intervention</th>
<th>Results</th>
<th>Conclusions Presented in the Abstract</th>
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<tbody>
<tr>
<td>Slizewski et al. 2017(4)</td>
<td>21 resident physicians assigned to labor and delivery</td>
<td>“To quantify the effect of dressing in surgical scrubs at home versus at the hospital on the bacterial contamination at the beginning of a scheduled shift.” Randomly assigned participants each day for 4 days to 1 of 4 arms based on the site where their scrubs were laundered and where the resident dressed: home/home, home/hospital, hospital/home, and hospital/hospital</td>
<td>84 observations. “Overall, 68% of sampled scrubs demonstrated some bacterial growth. There was no difference between the home- and hospital-dressed cohorts in percentage of samples demonstrating any bacterial growth after 72 hours (60% vs 76%, P = .14), nor in median bacterial burden at the beginning of a shift (2 [interquartile range, 0-7] vs 1 [interquartile range, 1-5] CFUs, P = .62). Finally, there was no difference in total bacterial burden at the beginning of a shift between the home- and hospital-dressed cohorts when stratified by site where the scrubs were laundered.”</td>
<td>“There was no significant difference in total bacterial burden of surgical scrubs at the start of a shift between cohorts who dressed at home versus at the hospital.”</td>
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<tr>
<td>Reference Site</td>
<td>Number of Participants</td>
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<td>Hee et al. 2014(5)</td>
<td>16 anesthetists</td>
<td>“To evaluate the bacterial contamination of surgical scrub suits worn outside the operating theatre.” Randomly assigned participants on separate occasions into 1 of 3 groups: restricted to the operating theatre only; theatre and surgical wards; and theatre and departmental office.</td>
<td>“Mean bacterial counts increased significantly over the course of the working day (p = 0.036), and were lower in the chest compared to the hip (p = 0.007) and waist areas (p = 0.016). The mean (SD) bacterial counts, expressed as colony-forming units per cm(^2) at 16:00 on the day of study, were 25.2 (43.5) for those restricted to theatre and 18.5 (25.9) and 17.9 (31.0) for those allowed out to visit the ward and office, respectively (p = 0.370).”</td>
<td>“Visits to ward and office did not significantly increase bacterial contamination of scrub suits.”</td>
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<td>Krueger et al. 2012(6)</td>
<td>30 on-call resident physicians</td>
<td>“To compare the bacterial profile of worn and unworn resident scrubs.” Swabbed 30 pairs of scrubs in 10 predetermined locations before and after being worn continuously by the on-call resident.</td>
<td>“Forty-one percent (123) of unworn scrub samples yielded bacteria, compared with 89% (268) of post-call scrub samples. On unworn scrubs, the most common organisms were coagulase-negative Staphylococcus (CNS; 94), gram positive rods (GPR; 34) and Streptococcus viridians (8). On post-call scrubs, the most common bacteria were CNS (271), micrococcus (51), Staphylococcus aureus (33), and GPR (28). All S. aureus were methicillin susceptible. There were different species, pulse-field types and antibiotic resistance profiles found amongst the CNS identified. No scrubs were found to harbor multidrug-resistant (MDR) organisms.”</td>
<td>“This study found that unworn scrubs harbored normal skin flora and scrubs worn for at least 24 hours have a higher burden of bacteria than unworn scrubs but not an increased incidence of contamination with MDR organisms.”</td>
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### Surveillance Studies

<table>
<thead>
<tr>
<th>Study</th>
<th>Setting</th>
<th>Participants</th>
<th>Methodology</th>
<th>Findings</th>
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<tr>
<td>Thom et al. 2018(7)</td>
<td>University of Maryland School of Medicine and R Adams Cowely Shock Trauma Center (Baltimore, MD, USA)</td>
<td>90 critical care healthcare workers (HCWs)</td>
<td>To assess health care worker (HCW) and patient care factors associated with bacterial contamination of scrubs. Participants received 4 sets of new scrubs. Sampled each set 8 times during the 8-month study period on random days in the last 4 hours of the shift.</td>
<td>Of the 720 samples obtained, “30% of samples were contaminated with pathogenic bacteria. Multivariate analysis showed that providing care for patients with wounds (odds ratio [OR], 1.75; 95% confidence interval [CI], 1.17-2.62; P &lt; .01) or giving a bath (OR, 1.46; 95% CI, 0.96-2.22; P = .07) was associated with higher odds of scrub contamination. A second model showed the average log colony count of bacterial contamination of scrubs was higher when a bath was given (log colony count difference, 0.21; P = .05) but lower among HCWs assigned to care for at least 1 patient on contact precautions (log colony count difference, 0.28; P &lt; .01).”</td>
</tr>
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<td>Sanon and Watkins 2012(8)</td>
<td>Local hospital in Washington State (USA)</td>
<td>10 nurses working on a medical telemetry unit</td>
<td>Investigated the pathogens that nurses are potentially bringing into the public and their home when they wear work uniforms outside of the work environment.” Distributed sterilized uniforms at the beginning of their shift. Worn uniforms were collected at the end of the shifts and sent to a laboratory for analysis.</td>
<td>“The average bacteria colony growth per square inch was 1,246 and 5,795 for day and night shift, respectively. After 48 h, MRSA positives were present on 4 of the day shift and 3 of the night shift uniforms. Additional bacteria identified include: Bacillus sp., Micrococcus luteus, Staphylococcus aureus, Staphylococcus epidermidis, and Micrococcus roseus.”</td>
</tr>
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</table>

“HCW attire was frequently contaminated with bacteria. Providing care for patients with wounds or giving a bath were associated with scrub contamination by pathogenic bacteria. However, the amount of contamination was lower among HCWs who were assigned to care for patients on contact precautions.”
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<tr>
<th>Reference</th>
<th>Authors</th>
<th>Setting</th>
<th>Sample Size</th>
<th>Methodology</th>
<th>Results</th>
</tr>
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<tbody>
<tr>
<td>Wiener-Well et al. 2011(9)</td>
<td>Shaare Zedek Medical Center (Jerusalem, Israel)</td>
<td>75 nurses and 60 physicians from the medical and surgical wings</td>
<td>“Investigated the rate of potentially pathogenic bacteria present on uniforms worn by hospital staff, as well as the bacterial load of these microorganisms.” Obtained cultures from uniforms of nurses and physicians.</td>
<td>“Potentially pathogenic bacteria were isolated from at least one site of the uniforms of 85 participants (63%) and were isolated from 119 samples (50%); 21 (14%) of the samples from nurses’ gowns and 6 (6%) of the samples from physicians’ gowns (P 5 NS) included of antibiotic-resistant bacteria.”</td>
<td>“Up to 60% of hospital staff’s uniforms are colonized with potentially pathogenic bacteria, including drug-resistant organisms. It remains to be determined whether these bacteria can be transferred to patients and cause clinically relevant infection.”</td>
</tr>
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<td>Gaspard et al. 2009(10)</td>
<td>3 long-term care facilities in France</td>
<td>Nurses and care assistants</td>
<td>“Evaluated the contamination of staff clothing.” Performed sampling of uniforms in each unit for an uninterrupted period ranging from 5 to 10 days.</td>
<td>“Over 500 samples were taken from uniforms and their pockets and these samples showed a high level of MRSA contamination.”</td>
<td>“Results highlight the continued importance of hand hygiene, since staff have frequent contact with their uniforms and could potentially contaminate their hands before care.”</td>
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</table>
Selected References and Resources

References Reviewed (PubMed, EMBASE, and Cochrane Library search dates were January 1, 2007, through March 5, 2018)


Search Summaries

The following databases were used to identify the literature and related materials.


Search Strategy: attire; surgical scrubs

Results: We identified four related publications.

- AORN takes issue with ACS guidelines on scrubs outside the OR, says guidelines should be evidence-based. [Risk Management News]. 2016 Aug 31.


- Scrubs should not be worn outside the facility, and eight more guidelines on attire, from ACS. [Risk Management News]. 2016 Aug 10.

- Which SSI prevention practices are most important? [Risk Management News]. 2017 Sep 27.


Search Strategy:

- S1 “operating room attire”[tiab] OR “scrub suits”[tiab] OR scrubs[tiab] OR “surgical attire” OR uniform*[tiab]


- S3 #1 AND #2

Results: We identified 32 relevant records.
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Search Strategy:
- S1 ‘surgical attire’/de OR ‘operating room attire’ OR ‘scrub suits’ OR scrubs OR ‘surgical attire’ OR uniform*:ti,ab
- S2 remov* OR outside OR public OR wear* OR worn
- S3 #1 AND #2

Results: We identified five unique and relevant records.


Search Strategy:
- S1 “operating room attire” OR “scrub suits” OR scrubs OR “surgical attire” OR uniform*
- S2 remov* OR outside OR public OR wear* OR worn
- S3 #1 AND #2

Results: We did not identify any unique and relevant records.


Search Strategy: (“scrub suits” OR scrubs) AND (wear OR wearing) AND (outside OR public)

Results: We identified one unique record.

Guidelines and Standards [searched January 1, 2007, through March 6, 2018].

Search Strategy: “dress code”; “operating room attire”; scrubs; “surgical attire”

Results: We identified four relevant documents.
- Association of Surgical Technologists (AST). AST Standards of Practice for surgical attire, surgical scrub, hand hygiene and hand washing. [effective 2008 Apr 13].


Search Strategy: healthcare associated infection; healthcare acquired infection

Results: We identified one relevant document.
- Hospital-acquired conditions. [cited 2015 Apr 29].

Selected Web Resources. [searched March 2, 2018]
The Evidence Bar™

ECRI developed The Evidence Bar™ to provide a visualization of our judgment about the balance of benefits and harms of the technology after assessing the available published clinical evidence in light of key outcomes and comparisons of interest. The Evidence Bar™ rubric shows five possible choices for our expert judgment. After review and analysis of evidence identified through literature searches conducted by master’s level medical librarians, ECRI research analysts, extensively trained in methods of evidence assessment, weigh potential benefits and harms of a technology to arrive at their expert judgment.

| Balance of evidence unfavorable       | - |
| Balance of evidence raises concerns  | - |
| Balance of evidence inconclusive because of no available evidence, mixed results, or too few data | - |
| Balance of evidence somewhat favorable | - |
| Balance of evidence very favorable    | - |

Policy Statement

The information presented in this Clinical Evidence Assessment is highly perishable and reflects the state of the literature on this topic at the time at which searches were conducted and the Clinical Evidence Assessment was prepared. Clinical Evidence Assessments provide a guide to the published clinical literature and other information about a topic on which we received a client inquiry. The scope is customized to address the specific information needs of the requestor. The content reflects the information identified from searches of the available, published, peer-reviewed scientific literature, gray literature, and websites at the time the searches were conducted. Publications referenced in this Clinical Evidence Assessment are generally limited to the English language. Clinical Evidence Assessments are developed by a multidisciplinary staff of doctoral level research analysts, clinicians, and medical librarian information specialists. For quality assurance, all reports are subject to review within ECRI before publication. Neither ECRI nor its employees accept gifts, grants, or contributions from, or consult for medical device or pharmaceutical manufacturers. The Clinical Evidence Assessment may be based on review of abstracts of published articles as well as full text articles. Abstracts do not always accurately reflect the methods and findings of full-length articles and limit full interpretation of published data. This Clinical Evidence Assessment is not intended to provide specific guidance for the care of individual patients. ECRI implies no warranty and assumes no liability for the information contained in the Clinical Evidence Assessment.

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