

# Evidence of hand hygiene as the building block for infection prevention and control

An extract from the systematic literature reviews undertaken as the background for the WHO Guidelines on Core Components of Infection Prevention and Control Programmes at the National and Acute Health Care Facility Level



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# 1. Acronyms and abbreviations

AMR – antimicrobial resistance  
CAUTI - catheter-associated urinary tract infection  
CLABSI - catheter line-associated bloodstream infection  
EPIC - effective practice and organization of care  
HAI – health care-associated infection  
ICUs - intensive care units  
IPC – infection prevention and control  
LMICs - low- and middle-income countries  
MDRO - multi-drug resistant organism  
MRSA - methicilin-resistant *Staphylococcus aureus*  
SDG – sustainable development goals  
UHC – universal health coverage  
USA – United States of America  
WHO – World Health Organization

## 2. Introduction

Too many of the vulnerable people seeking care develop a health care-associated infection (HAI) resulting in harm and sometimes even death, especially in low- and middle-income countries (LMICs). This could be prevented through simple, low-cost infection prevention and control (IPC) interventions performed at critical moments, such as hand hygiene. Defects in IPC at the health facility level increase the risk of outbreaks of highly transmissible diseases that can spread within and beyond facilities, including across national borders. At the national level, defective IPC impacts on a country's ability to meet the International Health Regulations (IHR) and successfully combat antimicrobial resistance (AMR), together with the potential to adversely impact on the quality of health care delivery required to achieve the health-related United Nations Sustainable Development Goals (SDGs), including universal health coverage (UHC). Absence of or inadequate hand hygiene practices at key moments is one aspect of IPC that is considered to be a critical example of defects in the quality of care.

On the basis of scientific evidence and with input from international experts and IPC colleagues working in countries, WHO recently identified the essential elements that every country should have in place to achieve effective IPC and issued new guidelines on *Core components of IPC programmes at the national and acute health care facility level* (<http://www.who.int/gpsc/ipc-components/en/>). These guidelines include two specific recommendations on hand hygiene as part of the IPC core components. Furthermore, a substantial portion of the evidence underpinning all the recommendations comes from research on hand hygiene.

This document aims to outline the evidence on hand hygiene included in the systematic literature reviews undertaken as the background for the WHO guidelines (<http://www.who.int/gpsc/ipc-components/en/>). It serves to provide a synopsis of the available evidence evaluating hand hygiene as a main intervention (or part of a broader IPC strategy) and where significant improvement in hand hygiene compliance or alcohol-based handrub consumption, and/or a substantial decrease of HAI or multi-drug resistant organism (MDRO) infection and/or colonization rates were achieved (*Table 1*). This evidence is presented according to the eight core components outlined in the WHO guidelines.

Information provided in this document can be useful to discuss the role of hand hygiene as a building block for IPC at national and facility level. Data can be used for motivating policy makers and senior managers to take action to visibly support hand hygiene programmes or for showing health care workers the impact of hand hygiene on patient outcomes, in particular in the context of 5 May (global hand hygiene day) campaigning activities.

The following core component recommendations are specific to hand hygiene.

#### **CORE COMPONENT 6b**

**The panel recommends that a national IPC monitoring and evaluation programme should be established to assess the extent to which standards are being met and activities are being performed according to the programme's goals and objectives. *Hand hygiene monitoring with feedback should be considered as a key performance indicator at the national level.***

(Strong recommendation, moderate quality of evidence)

#### **CORE COMPONENT 8b**

***The panel recommends that materials and equipment to perform appropriate hand hygiene should be readily available at the point of care.***

(Strong recommendation, very low quality of evidence)

In addition to these specific recommendations, 51 of 116 (44%) high quality papers used as the primary evidence for six of the eight core components investigated hand hygiene as part of IPC interventions. These were: core components 2 (three studies), 3a (eight studies), 5 (30 studies), 6 (two studies), 7 (two studies), and 8b (six studies). As listed within the guidelines, all relevant secondary evidence was also scrutinized, thus lending additional support to the findings indicated by the primary level evidence.

### 3. Summary of the key messages from this review

- Hand hygiene research drives the evidence on the need for IPC guidelines, which support the reduction of HAI and AMR
- Hand hygiene statements in IPC guidelines should directly address how this action can prevent the spread of MDROs
- The evidence for a range of hand hygiene education activities drives IPC education and training in health facilities
- Education and training should emphasize hand hygiene role in preventing the spread of MDROs in clinical workflow
- There is clear evidence that hand hygiene multimodal improvement strategies are effective in improving practices and preventing microbial transmission and infections
- A hand hygiene multimodal improvement strategy should describe how actions prevent transmission of MDROs including in the context of real life clinical workflow
- Hand hygiene monitoring plays a role in driving IPC standards and is a key performance indicator (national level)
- Using hand hygiene audit data is key to improve IPC and prevent the spread of resistant organisms
- Impact of workload can influence hand hygiene practices. This can be used to influence decisions on staffing levels
- Hand hygiene equipment and products (including at the point of care) are critical to IPC practices. Without hand hygiene resources the spread of resistant organisms will occur

The next section summarizes the evidence on hand hygiene underpinning the WHO *Guidelines on core components for IPC programmes at the national and acute health care facility level*. Studies meeting the Cochrane Effective Practice and Organization of Care (EPOC) Group criteria<sup>1</sup> were considered of sufficient quality to be used as the primary evidence to support the WHO recommendations; non-EPOC studies were also considered as secondary evidence.

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<sup>1</sup> Effective practice and organisation of care (EPOC). Suggested risk of bias criteria for EPOC reviews. EPOC resources for review authors. Oslo: Norwegian Knowledge Centre for the Health Services; 2015 ([http://epoc.cochrane.org/sites/epoc.cochrane.org/files/uploads/14\\_Suggested\\_risk\\_of\\_bias\\_criteria\\_for\\_EPOC\\_reviews\\_2015\\_09\\_02.pdf](http://epoc.cochrane.org/sites/epoc.cochrane.org/files/uploads/14_Suggested_risk_of_bias_criteria_for_EPOC_reviews_2015_09_02.pdf), accessed 20 April 2017)

## 4. Summary of the evidence on hand hygiene underpinning the WHO *Guidelines on core components for IPC programmes at the national and acute health care facility level*

### Core component 2 – National and facility level IPC guidelines

#### RECOMMENDATION

The panel recommends that evidence-based guidelines should be developed and implemented for the purpose of reducing HAI and AMR. The education and training of relevant health care workers on the guideline recommendations and the monitoring of adherence with guideline recommendations should be undertaken to achieve successful implementation.

(Strong recommendation, very low quality of evidence)

Type of evidence	Description of evidence on hand hygiene supporting the recommendation	Key study findings
Primary (EPOC) (1-3)	<ul style="list-style-type: none"> <li>○ Three of six studies (50%) comprising:               <ul style="list-style-type: none"> <li>● Two non-controlled before-after (1,2)</li> <li>● One non-controlled interrupted time series (3)</li> </ul> </li> <li>○ Two from an upper-middle income country (2,3) and one high income country (1)</li> </ul>	<ul style="list-style-type: none"> <li>○ Larson and colleagues highlighted the importance of guideline implementation in the field in a survey involving 1158 health care workers across 40 hospitals in the United States of America (USA). Although health care workers were aware of the update of a national guideline on hand hygiene, the recommendations had been implemented in less than half of the hospitals visited (1).</li> <li>○ The introduction of a new guideline as part of a multimodal intervention strategy in settings without previous exposure to standardized protocols helped to improve hand hygiene and reduce rates of catheter-associated urinary tract infection (CAUTI)</li> </ul>



		(2,3) in the context of a national network in Argentina.
<b>Secondary (non-EPOC) (4)</b>	<ul style="list-style-type: none"> <li>○ One secondary study from a high income country (4) <ul style="list-style-type: none"> <li>● Non-controlled before-after study (4)</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>○ Kachare and colleagues demonstrated an 85% significant reduction in the number of CAUTIs and increased hand hygiene compliance by implementing hospital-wide catheter guidelines and specific measures aimed at early catheter removal (4).</li> </ul>

**KEY MESSAGES**

- Hand hygiene research drives the evidence on the need for IPC guidelines, which support the reduction of HAI and AMR
- Hand hygiene statements in IPC guidelines should directly address how this action can prevent the spread of MDROs

## Core component 3 - IPC education and training

### 3a. Health care facility level

#### RECOMMENDATION

**The panel recommends that IPC education should be in place for all health care workers by utilizing team- and task-based strategies that are participatory and include bedside and simulation training to reduce the risk of HAI and AMR.**

(Strong recommendation, very low quality of evidence)

Type of evidence	Description of evidence on hand hygiene supporting the recommendation	Key study findings
<b>Primary (EPOC)</b> (5-12)	<ul style="list-style-type: none"> <li>○ Eight of 15 (53%) studies comprising:               <ul style="list-style-type: none"> <li>● Two interrupted case series (5, 6)</li> <li>● Three qualitative (7-9)</li> <li>● One controlled before-after (10)</li> <li>● One non-controlled before-after (11)</li> <li>● One mixed methods (12)</li> </ul> </li> <li>○ Seven studies from high or upper-middle income countries (5, 6, 8-12) and one from a LMIC (7)</li> </ul>	<ul style="list-style-type: none"> <li>○ Johnson and colleagues showed an overall increase in hand hygiene adherence as well as an overall decrease in catheter line-associated bloodstream infection (CLABSI) rates during the same time period following the implementation of a hand hygiene action plan feeding into a multimodal strategy (5).</li> <li>○ Conversely, the introduction of a volunteer, self-directed, automated training system for hand hygiene by Kwok and colleagues did not result in any change in overall hand hygiene compliance (6).</li> <li>○ Although formal training can be effective, individual experience is perceived to be more important for IPC (8). As an example, strategies that use traditional approaches based on logic and reasoning were perceived as less likely to improve hand hygiene (9).</li> <li>○ In three studies, the use of multidisciplinary focus groups to engage frontline health care workers was crucial to identify common IPC strategies and contributed to improved hand hygiene compliance</li> </ul>

		<p>and reduced rates of HAI (7, 10, 12).</p> <ul style="list-style-type: none"> <li>○ A reduction of catheter-related bloodstream infections and increased correct hand hygiene performance were associated with bedside teaching as a prominent part of multimodal interventions (11).</li> </ul>
<b>Secondary (non-EPOC) (13-23)</b>	<ul style="list-style-type: none"> <li>○ An additional 11 studies from high or upper-middle income countries comprising: <ul style="list-style-type: none"> <li>● 11 non-controlled before-after studies (13-23)</li> </ul> </li> <li>○ All studies from high or upper-middle income countries (13-23)</li> </ul>	<ul style="list-style-type: none"> <li>○ Hands-on or in-person group training sessions as part of multimodal interventions (19, 21), including e-learning modules (13, 20), task-oriented training sessions (15) and lectures (14, 16-18), were associated with increased hand hygiene compliance (23).</li> <li>○ Dedicated teams or IPC link nurses/practitioners were also associated with decreased methicillin-resistant <i>Staphylococcus aureus</i> (MRSA) acquisition (22) and increased hand hygiene (22).</li> </ul>

**KEY MESSAGES**

- The evidence for a range of hand hygiene education activities drives IPC education and training in health facilities
- Education and training should emphasize hand hygiene role in preventing the spread of MDROs in clinical workflow

## Core component 5 - Multimodal strategies for implementing IPC activities

5a. Health care facility level

### RECOMMENDATION

**The panel recommends that IPC activities using multimodal strategies should be implemented to improve practices and reduce HAI and AMR.**

(Strong recommendation, low quality of evidence)

Type of evidence	Description of evidence on hand hygiene supporting the recommendation	Key study findings
<p><b>Primary (EPOC)</b> (3, 5, 8, 10, 12, 24-40, 42-47)</p>	<ul style="list-style-type: none"> <li>○ 28 of 44 studies (64%) comprising:               <ul style="list-style-type: none"> <li>● 10 non-controlled before-after (3, 24-32)</li> <li>● Five interrupted time series (5, 37-39, 40)</li> <li>● Four non-controlled cohort trials (33-36)</li> <li>● Three randomized controlled trials (42-44)</li> <li>● Two controlled before-after (10, 45)</li> <li>● Two mixed methods (12, 46)</li> <li>● One qualitative (8)</li> <li>● One stepped wedge trial (47)</li> </ul> </li> <li>○ 26 studies from high or upper-middle income countries (3, 5, 8, 10, 12, 24, 25-29, 31-40, 42-47) and only one from a low income country (30)</li> </ul>	<ul style="list-style-type: none"> <li>○ In 28 studies, multimodal strategies showed an improvement in hand hygiene compliance among health care workers (3, 5, 8, 10, 12, 24-40, 42-47).</li> <li>○ Leveraging leadership commitment and the use of opinion leaders and champions were critical components in some multimodal strategies (25, 28, 32, 43, 45, 47).</li> <li>○ Four studies used positive reinforcement for health care workers when correctly performing hand hygiene as one element of their strategies (37, 44) by applying principles of product marketing to encourage staff to choose their own intervention (29) and offering financial incentives to hospital units or wards for high-level hand hygiene performance (40).</li> <li>○ Accessibility to handrub, role models, a personal sense of responsibility and emotional involvement were some factors identified as barriers affecting hand hygiene compliance (8).</li> </ul>

<p><b>Secondary (non-EPOC)</b> (4, 22, 48-72)</p>	<ul style="list-style-type: none"> <li>○ An additional 27 studies comprising: <ul style="list-style-type: none"> <li>● 25 non-controlled before-after studies (4, 22, 48-70)</li> <li>● One non-controlled cohort trial (71)</li> <li>● One case-control study (72)</li> </ul> </li> <li>○ 21 studies from high or upper-middle income countries (4, 22, 48, 49, 51, 53-62, 65, 66, 69-72) and six from LMICs (50, 52, 63, 64, 67, 68)</li> </ul>	<ul style="list-style-type: none"> <li>○ In 27 studies, multimodal strategies catalysing education, system change, and surveillance and feedback were shown to help improve hand hygiene compliance (4, 22, 48-72).</li> </ul>
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<p><b>KEY MESSAGES</b></p> <ul style="list-style-type: none"> <li>● There is clear evidence that hand hygiene multimodal improvement strategies are effective in improving practices and preventing microbial transmission and infections</li> <li>● A hand hygiene multimodal improvement strategy should describe how actions prevent the transmission of MDROs in the context of real life clinical workflow</li> <li>● NOTE: many studies featured aspects of hand hygiene, but did not study this explicitly/in isolation (similar to other core components)</li> </ul>
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## Core component 5 - Multimodal strategies for implementing IPC activities

### 5b. National level

#### RECOMMENDATION

The panel recommends that IPC activities using multimodal strategies should be implemented to improve practices and reduce HAI and AMR.

(Strong recommendation, low quality of evidence)

Type of evidence	Description of evidence on hand hygiene supporting the recommendation	Key study findings
<b>Primary (EPOC)</b> (32, 44)	<ul style="list-style-type: none"><li>○ Two of 14 studies (14%), both from high income countries comprising:<ul style="list-style-type: none"><li>● One randomized controlled trial (44)</li><li>● One controlled before-after study (32)</li></ul></li></ul>	<ul style="list-style-type: none"><li>○ Implementation of national multimodal programmes on hand hygiene practices led to mixed results.</li><li>○ In one Australian study, both compliance and HAI rates were measured after the implementation of a state-wide hand hygiene campaign based on the improved provision of alcohol-based handrubs, posters and other campaign materials and identified leads. The results showed a significant impact on two out of four clinical indicators of MRSA infection, but the authors recognized that these might have been also influenced by other IPC interventions (32).</li><li>○ Conversely, in a national multimodal hand hygiene programme using targeted training and other supportive materials, improved provision of alcohol-based handrub and performance feedback to health care workers, there was an estimated average change in 'any hand hygiene compliance' in intervention hospitals compared to control hospitals (44).</li></ul>

<p><b>Secondary (non-EPOC)</b> (48, 73-77)</p>	<ul style="list-style-type: none"> <li>○ An additional six studies, all from high income countries comprising: <ul style="list-style-type: none"> <li>● Six non-controlled before-after studies (48, 73-77)</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>○ In six studies, multimodal strategies catalysing education, system change, and surveillance and feedback were shown to help improve hand hygiene compliance feedback (48, 73-77).</li> </ul>
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**KEY MESSAGES**

- There is clear evidence that hand hygiene multimodal improvement strategies are effective in improving practices and preventing infections
- A hand hygiene multimodal improvement strategy should describe how actions prevent the transmission of MDROs in the context of real life clinical workflow.
- NOTE: many studies featured aspects of hand hygiene, but did not study this explicitly/in isolation (similar to other core components).

## Core component 6 - Monitoring/audit of IPC practices and feedback and control activities

### 6a. Health care facility level

#### RECOMMENDATION

**The panel recommends that regular monitoring/audit and timely feedback of health care practices according to IPC standards should be performed to prevent and control HAI and AMR at the health care facility level. Feedback should be provided to all audited persons and relevant staff.**

(Strong recommendation, low quality of evidence)

Type of evidence	Description of evidence on hand hygiene supporting the recommendation	Key study findings
<b>Primary (EPOC)</b> (78)	<ul style="list-style-type: none"> <li>○ Only one of six studies (17%) from an upper-middle income country comprising:                             <ul style="list-style-type: none"> <li>● One non-controlled before-after study (78)</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>○ Peer assessments with anonymous feedback effectively improved universal precaution measures (78).</li> </ul>
<b>Secondary (non-EPOC)</b> (79)	<ul style="list-style-type: none"> <li>○ One additional study from a high income country comprising:                             <ul style="list-style-type: none"> <li>● One non-controlled before-after trial (79)</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>○ Armellino and colleagues demonstrated that remote video auditing and feedback (visual cues and electronic reports) were associated with a significant increase in hand hygiene compliance compared to remote video auditing alone (79).</li> </ul>

#### KEY MESSAGES

- Hand hygiene monitoring plays a role in driving IPC standards and is a key performance indicator
- Using hand hygiene audit data is key to improve IPC and to prevent the spread of resistant organisms



## Core component 6 - Monitoring/audit of IPC practices and feedback and control activities

### 6b. National level

#### RECOMMENDATION

The panel recommends that a national IPC monitoring and evaluation programme should be established to assess the extent to which standards are being met and activities are being performed according to the programme's goals and objectives. Hand hygiene monitoring with feedback should be considered as a key performance indicator at the national level.

(Strong recommendation, moderate quality of evidence)

Type of evidence	Description of evidence on hand hygiene supporting the recommendation	Key study findings
<b>Primary (EPOC)</b> (42)	<ul style="list-style-type: none"> <li>○ One randomized controlled trial (42) exploring the effectiveness of providing feedback of national hand hygiene compliance data in acute care settings for elderly patients and in intensive care units (ICUs) (42) was identified</li> <li>○ This study was from a high-income country</li> </ul>	<ul style="list-style-type: none"> <li>○ Fuller and colleagues tested a behavioural designed feedback intervention compared to routine practice. Feedback was provided to individual health care workers whose hand hygiene practices had been observed at ward meetings. The study found that the odds ratio for hand hygiene compliance was higher in both of the acute care (of the elderly) wards as a result of providing feedback on hand hygiene behaviour (42).</li> </ul>
<b>Secondary (non-EPOC)</b> (80)	<ul style="list-style-type: none"> <li>○ One additional study was retrieved [non-controlled before- after trial (308)] that supports the inclusion of hand hygiene as a key indicator for monitoring and providing timely feedback.</li> <li>○ This study was from a high-income country</li> </ul>	<ul style="list-style-type: none"> <li>○ McGuckin and colleagues investigated the impact of a 12-month multicentre collaboration assessing hand hygiene product usage in health care facilities in the USA combined with feedback about hand hygiene compliance. A significant increase in hand hygiene compliance was observed from 26% for intensive care units (ICUs) and 36% for non-ICUs to 37% and 51%, respectively (80).</li> </ul>

### KEY MESSAGES

- Hand hygiene monitoring plays a role in driving IPC standards and is a key performance indicator
- Using hand hygiene audit data to improve IPC is key to prevent the spread of resistant organisms

## Core component 7 - Workload, staffing and bed occupancy at the facility level

### RECOMMENDATION

The panel recommends that the following elements should be adhered to in order to reduce the risk of HAI and the spread of AMR: (1) bed occupancy should not exceed the standard capacity of the facility; (2) health care worker staffing levels should be adequately assigned according to patient workload.

(Strong recommendation, very low quality of evidence)

Type of evidence	Description of evidence on hand hygiene supporting the recommendation	Key findings
<b>Primary (EPOC)</b> (81, 82)	<ul style="list-style-type: none"><li>○ Two of 19 studies (10%), both from high income countries (81, 82)<ul style="list-style-type: none"><li>● One non-controlled cohort (81)</li><li>● One cross-sectional (82)</li></ul></li></ul>	<ul style="list-style-type: none"><li>○ Inadequate adherence to hand hygiene protocols was associated with low staffing levels in one study and high workload in another (81, 82).</li></ul>
<b>Secondary (non-EPOC)</b>	<ul style="list-style-type: none"><li>○ No secondary evidence was included/available.</li></ul>	<ul style="list-style-type: none"><li>○ Not applicable.</li></ul>

### KEY MESSAGES

- Impact of workload can influence hand hygiene practices. This can be used to influence decisions on staffing levels

## Core component 8 - Built environment, materials and equipment for IPC at the facility level

### 8b. Materials, equipment and ergonomics for appropriate hand hygiene

#### RECOMMENDATION

The panel recommends that materials and equipment to perform appropriate hand hygiene should be readily available at the point of care.

(Strong recommendation, very low quality of evidence)

Type of evidence	Description of evidence on hand hygiene supporting the recommendation	Key study findings
<b>Primary (EPOC)</b> (31, 41, 83-86)	<ul style="list-style-type: none"><li>○ Six of 11 studies (54%) were identified, all from high income countries, comprising:<ul style="list-style-type: none"><li>● Four non-controlled before-after (31, 84-86)</li><li>● One randomized controlled trial (83)</li><li>● One qualitative study (41)</li></ul></li></ul>	<ul style="list-style-type: none"><li>○ A determinant of hand hygiene compliance was the placement of handrub dispensers at the point of care within the context of a multimodal improvement approach (31, 83, 85, 86).</li><li>○ One additional study supplied 'pocket bottles' of alcohol-based handrub to anaesthesiologists and showed a marked increase in their hand hygiene behaviour (84).</li><li>○ In one qualitative study, a source of frustration for health care workers was when a limited access to hand hygiene facilities occurred (41).</li></ul>
<b>Secondary (non-EPOC)</b>	<ul style="list-style-type: none"><li>○ No secondary evidence was included/available.</li></ul>	<ul style="list-style-type: none"><li>○ Not applicable.</li></ul>

#### KEY MESSAGES

- Hand hygiene equipment and products (including at the point of care) are critical to IPC practices and the spread of resistant organisms will occur without hand hygiene resources

**Table 1: Available hand hygiene evidence included in the *WHO guidelines on core components of infection prevention and control programmes at the national and acute health care facility level* categorized by outcomes of interest\***

	MRSA	CAUTI/UTI	CLABSI/BSI	HAI	VAP	SSI	Hand hygiene compliance	Perceptions/themes
CC2: Guidelines		2, 4		3			1-3, 4	
CC3a: Education & training	22		5, 11, 19	20			5, 6, 10-12	7, 8, 9, 13-23
CC5a: Multimodal strategies	24, 28, 29, 32, 38, 22, 56, 71	38, 4, 55, 57, 64	5, 28, 38, 56	3, 34, 63, 65	28, 38	71	3, 5, 10, 12, 24, 25-28, 29-31, 33, 34, 35, 36, 37, 38, 39, 40, 42-46, 47, 4, 22, 48-56, 58-72	8, 58
CC5b: Multimodal strategies	32, 75, 76						44, 48, 73, 75-77	74
CC6a: Monitoring, audit & feedback							78, 79	
CC6b: Monitoring, audit & feedback							42, 80	
CC7: Workload, staffing & occupancy							81, 82	
CC8b: Materials						84	31, 83, 84-86	41

\* This includes both primary (in black) and secondary (in red) level evidence.

BSI: bloodstream infections; CAUTI: catheter-associated urinary tract infection; CC: core components; CLABSI: central line-associated bloodstream infection; HAI: health care-associated infections; MRSA: methicillin-resistant *Staphylococcus aureus*; SSI: surgical site infection; UTI: urinary tract infection; VAP: ventilator-associated pneumonia

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