

## **Consensus Recommendations on the Prevention and Management of Surgical Site Infections (SSI) in the Philippine Setting**

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Over the years, strategies in the prevention and management of surgical site infections (SSI) of patients in the Philippines have never been standardized. Several guidelines released by international foreign bodies have been found to be either conflicting or inappropriate for adaptation in the local context.

To address these issues, the Philippine College of Surgeons (PCS), in collaboration with the Philippine Hospital Infection Control Society (PHICS), Philippine Hospital Infection Control Nurses Association (PHICNA) and Operating Room Nurses Association of the Philippines, Inc. (ORNAP), initiated the development and adaptation of country-specific SSI guidelines in 2017. The new recommendations are based on the latest clinical practice guidelines released for the past five years and consensus by a panel of experts in the Philippines, through the assistance of a guideline development team engaged by PCS.

Thirty-six (36) recommendations on different aspects of care were outlined. Implementation of an SSI surveillance program was also advised for health facilities.

The new guidelines are intended to serve as the local benchmark for the prevention and management of SSI for surgeons and practitioners, taking into account their situation and experience in the Philippines. It is expected to improve the standard of care provided by health facilities and contribute to the reduction of the prevalence and incidence of SSI in the country.

**Key words:** Surgical site infection, surgical wound infection, postoperative wound infection, infection control

In the past decades, while there were international guidelines released on the prevention and management

of surgical site infections (SSI), some recommendations have been found to be inconsistent with local conditions and unadaptable for implementation in lower income countries, including the Philippines. Consequently, local experiences on infection control varied from practitioner to practitioner or between health facilities.

To address these concerns, in June 2017, the Philippine College of Surgeons (PCS), in collaboration with Philippine Hospital Infection Control Society (PHICS), Philippine Hospital Infection Control Nurses Association (PHICNA), and Operating Room Nurses Association of the Philippines, Inc. (ORNAP), initiated the development of consensus recommendations for the prevention and management of SSIs for the Philippine context. The recommendations are expected to serve as local benchmark for the prevention and management of SSI for surgeons and other health workers.

### **Methods**

Clinical practice guidelines (CPGs) published for the past five years were searched, retrieved, and reviewed by the guideline development team (i.e. consisting of an epidemiologist, biostatistician, health services administration expert, and four research assistants). The team assessed the methodological rigor and transparency

with which the guidelines were developed using the Appraisal of Guidelines for Research and Evaluation II (AGREE II) Instrument (September 2013 version). Two members of the guideline development team independently appraised each guideline document and provided ratings for items in six domains namely: scope and purpose, stakeholder involvement, rigor of development, clarity of presentation, applicability and editorial independence. Domain scores were then computed using the formula included in the AGREE II Instrument user's manual. Domain scores were used in making an overall assessment of guideline quality, using a seven-point Likert scale (i.e. 1 = lowest possible quality, 7 = highest possible quality). If the quality rating of a guideline is at least 5.0, the guideline is included in the synthesis.

Guidelines that satisfied the quality criteria were then subjected to guideline synthesis. In this stage, a matrix was developed to map recommendations for specific aspects of care alongside the guideline document. Specific aspects of care with consistent and conflicting recommendations were identified through the matrix.

For consistent recommendations, the expert panel - consisting of surgeons, internists, and nurses - decided whether to include or exclude a recommendation from

the final guidance document. The composition of the panel of experts is in Appendix 1. On the other hand, discordant recommendations were listed and arranged according to aspect of care, and were subsequently presented to the expert panel who decided - by consensus - on the specific recommendation to adapt. Consensus was defined as endorsement of a given recommendation by majority (i.e. at least fifty percent of votes plus one) of members of the expert panel. If consensus was reached for all aspects of care, succeeding rounds of consensus building were no longer done. The guideline development team synthesized proceedings of the consensus building process and included these in the guidance document. The guidance document was then routed to members of the expert panel for final comments.

## Results

The desk-based search of clinical practice guidelines (CPGs) on the prevention and management of surgical site infections published in the last five years done by the guideline development team yielded seven (7) relevant documents (Table 1). All CPGs satisfied the quality criteria, and were thus included in guideline synthesis.

**Table 1.** Clinical practice guidelines on the prevention and management of surgical site infections published in the previous five (5) years.

Year Published	Institution	Title of Guidance Document
2017	US Centers for Disease Control and Prevention (US CDC)	Guideline for the prevention of surgical site infection, 2017.
2016	World Health Organization (WHO)	Global guidelines for the prevention of surgical site infection
2016	American College of Surgeons (ACS), and Surgical Infection Society (SIS)	Surgical site infection guidelines, 2016 update
2014	Society for Healthcare Epidemiology of America (SHEA), and Infectious Diseases Society of America (IDSA)	Strategies to prevent surgical site infections in acute care hospitals: 2014 update
2013	National Institute for Health and Care Excellence (NICE)	Surgical site infection: Evidence update (2013)
		Surgical site infection: Prevention and treatment of surgical site infection clinical guideline (2008)
2012	Royal College of Surgeons in Ireland (RCSI) and Royal College of Physicians of Ireland (RCPI)	Preventing surgical site infections: Key recommendations for practice
2012	Institute for Healthcare Improvement (IHI)	How-to Guide: Prevent surgical site infections

From these CPGs, 36 recommendations on specific aspects of care were synthesized by the guideline development team, and were subjected to consensus by the panel of experts. Consensus was reached on all aspects of care during the first round of consensus building; thus, succeeding rounds of consensus building were no longer pursued.

### **Recommendation # 1: Maintaining normal body temperature (normothermia)**

Maintaining normothermia in the perioperative period is recommended for the purpose of reducing SSI risk.<sup>1,2,3,4,6,7</sup> The use of warming devices pre-operatively and intra-operatively for the purpose of maintaining normothermia is also recommended.<sup>2</sup> There is however no specific recommendation on the lower bound of temperature values for normothermia, or the ideal timing and duration of normothermia due to the lack of evidence.<sup>1</sup>

### **Recommendation # 2: Smoking cessation**

Smoking cessation is recommended for patients.<sup>3,4</sup> The ACS & SIS (2016) also recommended that patients refrain from using electronic cigarettes and marijuana prior to surgery. It is recommended that patients stop smoking within 30 days of surgery<sup>4</sup>, or within 4 to 6 weeks for procedures involving implanted devices.<sup>3</sup>

### **Recommendation # 3: Nutritional support**

The nutritional status of patients must be optimized prior to major surgery. However, delaying surgeries to administer parenteral nutrition is not recommended due to the lack of evidence of its efficacy in decreasing SSI risk.<sup>4</sup>

### **Recommendation # 4: Glucose control**

The adoption of protocols for perioperative blood glucose control is recommended since hyperglycemia is associated with increased SSI risk in the pre-operative<sup>3</sup> and post-operative periods.<sup>2,4,8,11-16</sup> It is especially recommended that early and regular monitoring of pre-

operative blood glucose levels be performed in patients with hyperglycemia with or without diabetes mellitus<sup>14,17</sup>, patients with stroke<sup>18</sup>, critically ill patients who have suffered myocardial infarction<sup>19</sup>, and patients who had a major cardiac surgery.<sup>4,8,20</sup>

### **Recommendation # 5: Maintaining adequate circulating volume**

Hemodynamic goal-directed therapy is recommended for the purpose of decreasing SSI risk.<sup>2,5</sup> Hemodynamic goal-directed therapy refers to the "titration of fluid and inotropic drugs to reach normal or supra-optimal physiological endpoints such as cardiac output and oxygen delivery".<sup>5</sup>

Blood transfusion should be avoided as much as possible since it is associated with impairment of macrophage function, which can lead to increased SSI risk. Thus, blood loss during surgery must be kept at a minimum.<sup>4</sup> However, if blood transfusion is indicated, it should not be denied from surgical patients just for the purpose of reducing SSI risk.<sup>1</sup>

### **Recommendation # 6: Supplemental oxygen / Hemoglobin saturation**

To improve oxygenation of tissues, supplemental oxygen (when indicated) should be provided together with maintenance of normothermia and adequate circulating blood volume.<sup>1,4</sup> The effectiveness of this combination of strategies has been shown in patients on general anesthesia and mechanical ventilation.<sup>4,22-24</sup> Thus, maintaining a target hemoglobin saturation of at least 95% intra-operatively and post-operatively is recommended.<sup>6,7</sup> Patients with pulmonary insufficiency are suggested to have higher target hemoglobin saturation levels.

While the administration of supplemental oxygen for patients receiving mechanical ventilation in both the intra-operative and immediate post-operative periods is recommended, there is no specific recommendation on the optimal fraction of inspired oxygen (FIO<sub>2</sub>) level<sup>4</sup>, and the duration and method of supplemental oxygen administration.<sup>1</sup> In addition, there are no specific

recommendations on the optimal FIO<sub>2</sub> levels in the following circumstances: endotracheal intubation in the intra-operative period for patients with normal pulmonary function undergoing general anesthesia; use of face mask during the perioperative period in patients with normal pulmonary function undergoing general anesthesia without endotracheal intubation or neuraxial anesthesia; and the use of face mask or nasal cannula during only the postoperative period in patients with normal pulmonary function. As of now, it still remains unclear whether the benefits of increased FIO<sub>2</sub> administration in these cases outweigh harms in the context of SSI risk reduction.<sup>1</sup>

#### **Recommendation # 7: Systemic immunosuppressive therapy**

Existing guidelines provide conflicting recommendations on the discontinuation of immunosuppressive medications for the reduction of SSI risk. For instance, while WHO prescribes the continuation of immunosuppressive therapy pre-operatively, SHEA and IDSA oppose this practice.

#### **Recommendation # 8: MRSA screening and decolonization**

Routine perioperative MRSA screening and decolonization is not recommended because of the absence of a standardized screening procedure<sup>4</sup>, and decolonization protocol.<sup>3</sup> However, MRSA screening and decolonization is still highly recommended for high-risk patients such as patients previously admitted to a hospital, patients with chronic wounds or skin lesions, patients transferred from a nursing home or long-term care facility to the hospital, patients on hemodialysis, and patients using urinary or intravenous catheters.<sup>25</sup> Patients undergoing cardiothoracic surgery, orthopedic surgery, and procedures involving implants, as well as elderly diabetic patients are also known to have increased risks of SSI due to MRSA.<sup>2,4,26</sup>

If screening and decolonization is warranted, mupirocin 2% ointment is recommended for use.<sup>2</sup> It is **not** recommended to perform routine nasal decolonization with mupirocin without prior screening, as resistance to the antimicrobial agent may

occur.<sup>4,27</sup> Furthermore, the optimal effect of the decontamination is achieved when it is performed nearer the date of the procedure.<sup>3</sup>

#### **Recommendation # 9: Bowel preparation**

Mechanical bowel preparation in combination with oral and parenteral antibiotic prophylaxis is recommended to reduce SSI risk in patients undergoing elective colorectal surgeries.<sup>2-4</sup> However, mechanical bowel preparation alone does not decrease the risk of SSI.<sup>2,4</sup> Specific regimens for parenteral and oral prophylaxis for this purpose are as indicated in the National Antibiotic Guidelines for Surgical Prophylaxis.<sup>28</sup>

#### **Recommendation # 10: Preoperative bathing or showering**

Preoperative bathing or showering is recommended.<sup>1,2,7</sup> The patient may opt to take a bath or shower inside or outside of the healthcare facility using either plain soap (at the minimum) or anti-microbial soap for this purpose.<sup>2</sup> Furthermore, there is no specific limit for the time interval between bathing and surgery.

#### **Recommendation # 11: Hair removal**

Hair removal prior to surgery is not recommended except when absolutely necessary. When needed, hair removal should be done using clippers, as this device has been identified as the best tool for hair removal because of its association with lower SSI rates.<sup>5,8,29</sup> In the absence of clippers, the use of scissors may be recommended. The use of razors in hair removal is not recommended because it is linked to increased SSI risk.<sup>6,8</sup> In addition, hair removal should not be performed inside the operating room.<sup>4,8</sup>

#### **Recommendation # 12: Surgical hand decontamination and preparation**

Before wearing sterile gloves, hand decontamination using an appropriate antimicrobial agent and water, or an alcohol-based hand rub that can withstand the growth of resident flora for long periods of time is recommended.<sup>2</sup>

SHEA and IDSA further recommends scrubbing the forearms and hands for two to five minutes, and this generally applies to most hand decontamination agents.

### **Recommendation # 13: Skin preparation**

The use of an alcohol-based antiseptic agent in skin preparation is recommended except when there are contraindications for its use, such as in procedures involving the cornea, ear, or mucosa; in which case, povidone-iodine is the recommended antiseptic agent. SHEA & IDSA, ACS & SIS, and CDC all recommend the use of an alcohol-based antiseptic agent. However, while alcohol is proven to be effective in eliminating bacteria and other disease-causing microorganisms, its effect does not stay long when singly used<sup>4</sup>; therefore, it is recommended to combine alcohol with another antiseptic agent.<sup>30</sup> RCSI & RCPI and WHO recommend using 2% chlorhexidine gluconate in 70% isopropyl alcohol solution. For patients allergic to the alcohol - chlorhexidine gluconate combination, povidone - iodine is recommended.<sup>7</sup> In the absence of alcohol and in the absence of contraindications, chlorhexidine is favored over iodine as skin preparation agent.<sup>3</sup>

### **Recommendation # 14: Surgical antibiotic prophylaxis (SAP)**

#### **14.1 Basis for administration**

Surgical antibiotic prophylaxis (SAP) should be administered only when indicated<sup>1,3</sup> and is usually based on the following: existing national or local guidelines or formulary<sup>6-8</sup>; existing clinical practice guidelines or evidence-based guidelines and standards<sup>1,4,30-32</sup>; type of surgical procedure<sup>3,4,32</sup>; and the identified SSI-causing pathogen for a procedure.<sup>3,4,32</sup>

#### **14.2 Timing of administration, and dosing**

SAP should be administered within 60 minutes prior to incision - except for vancomycin and fluoroquinolones, which should be administered within 120 minutes prior to incision - to ensure a

serum and tissue concentration that will have a bactericidal effect at the time of incision.<sup>3,4,7,8,11,33</sup> The dose of prophylactic antibiotics administered should be based on the patient's weight.<sup>3,32</sup> Healthcare providers are advised to consult standard references, or an IDS expert on dosing recommendations.

#### **14.3 Re-dosing of antibiotic**

Intraoperative re-dosing of prophylactic antibiotic is recommended if there is excessive blood loss (i.e. greater than or equal to 1,500 mL for adults)<sup>3,4,7,32</sup> or 25 mL/kg in children<sup>7</sup>; for prolonged procedures (4,7,32,34); or if the duration of the procedure exceeds the half-life of the antibiotic<sup>4,6</sup>

#### **14.4 Prolongation of surgical antibiotic prophylaxis**

Continuing the administration of SAP after incision closure in the operating room for clean and clean-contaminated procedures<sup>1</sup>, or even in the presence of a wound drain<sup>1</sup> is not recommended due to the lack of evidence linking it with the reduction of SSI risk<sup>3</sup>, the increased risk of antibiotic resistance<sup>4,35</sup>; and the increased risk of Clostridium difficile infections.<sup>4,36</sup> However, prolongation of SAP after incision closure in the operating room is generally recommended for implant-based breast reconstruction, joint arthroplasty, and cardiac procedures since the optimal duration of antibiotic therapy for these procedures remains unknown.<sup>3</sup> SAP is recommended to be discontinued within 24 hours after the end of surgery, especially for cardiac patients.<sup>4,8,32</sup>

#### **14.5 Topical/local antibiotics**

The use of topical antibiotics is generally not recommended except for such procedures as ophthalmic surgery, spine surgery, and total joint arthroplasty. For these types of surgeries, topical or local antibiotics in solution, ointment, or powder form are recommended for use.<sup>1</sup>

### **Recommendation # 15: Soaking prosthetic devices in antimicrobial solutions before implantation**

There is no specific recommendation on the practice of soaking prosthetic devices in antimicrobial or antiseptic agents prior to implantation due to lack of evidence linking it with reduction in SSI risk.<sup>1</sup>

### **Recommendation # 16: Wound irrigation/Wound lavage/Intra-cavity lavage**

There is no specific recommendation regarding incisional wound irrigation with saline solution due to the lack of evidence linking it with reduction in SSI risk. On the other hand, incisional wound irrigation with antibiotics is **not** recommended for the purpose of reducing SSI risk. Antimicrobial irrigation of deep, subcutaneous, or intra-abdominal tissues is **not** prescribed since its effect on reducing SSI risk remains unestablished.<sup>1,2,6</sup>

Antiseptic wound lavage, intra-cavity lavage, and intra-peritoneal lavage is generally **not** recommended. Specifically, intraperitoneal lavage with aqueous iodophor solution for abdominal surgeries that are classified as dirty or contaminated is not recommended.<sup>1,6</sup>

### **Recommendation # 17: Intraoperative re-disinfection before wound closure**

There is no specific recommendation on intraoperative re-disinfection before wound closure due to lack of evidence linking it with reduction in SSI risk.<sup>1</sup>

### **Recommendation # 18: Wound care**

#### **18.1 Wound closure**

There is no specific recommendation on the best type of wound closure for dirty and contaminated surgical incisions. In addition, there is lack of evidence on which between primary closure and delayed primary closure is more effective in reducing SSI risk.<sup>3</sup>

#### **18.2 Antibacterial/Antiseptic sutures**

WHO, ACS & SIS, and CDC recommend the use of triclosan-coated sutures to decrease the risk of SSI. WHO recommends it for all types of surgeries, especially for clean and clean-contaminated abdominal cases as specified by ACS & SIS.

#### **18.3 Dressings**

The application of appropriate interactive dressing and sterile wound dressing on surgical incision sites at the end of the procedure is recommended.<sup>6,7</sup> Moreover, standard dressing is preferred over advanced dressing to cover primarily closed incisional wounds.<sup>2</sup> For surgical wound healing by secondary intention, appropriate interactive dressing is recommended.<sup>2</sup>

#### **18.4 Topical antimicrobial agents for wound healing by primary intention**

The use of topical antimicrobial agents for surgical wound healing by primary intention to prevent SSI is not recommended.<sup>6</sup>

#### **18.5 Wound probing, wound cleansing, and changing of dressings**

It is recommended to keep the dressing intact without tampering or removal for 48 hours post-operatively, unless it is grossly contaminated. The use of aseptic, no-touch technique (preferably with the use of sterile or clean gloves) is also recommended to prevent the transfer of microbes from the environment to the surgical wound.<sup>7</sup> Handwashing is required before and after removing and changing dressings, and probing wounds.

Waiting 48 hours postoperatively before showering is recommended.<sup>6</sup> However, showering as early as 12 hours post-operatively is not known to increase SSI risk.<sup>3</sup>

## 18.6 Wound protectors

Impervious wound protectors in open abdominal surgery is recommended due to their ability to decrease SSI rates, especially in elective gastrointestinal (e.g. colorectal) and biliary tract procedures<sup>3-5</sup>, based on high-quality evidence.<sup>3</sup> Furthermore, the use of dual-ring protectors is recommended over single-ring protectors because of the former's greater positive, albeit non-significant, effects.<sup>4</sup>

### Recommendation # 19: Antibiotic treatment of surgical site infection

The administration of an antibiotic that targets the causative pathogen is recommended. When making a decision on the specific antibiotic to use, microbiological test results and local resistance patterns must be considered.<sup>6</sup>

### Recommendation # 20: Drapes and gowns/Patient theatre wear/Surgical attire/Staff theatre wear

Sterile disposable non-woven, or sterile reusable woven drapes and gowns are recommended as surgical attire.<sup>2,37</sup> In the pre-operative period, all health workers are advised to put on specific non-sterile theatre wear such as scrub suits, masks, hats, and overshoes in all areas where surgeries are undertaken. During surgery, the operating team should wear sterile gowns.<sup>6</sup>

In choosing the patient's wear, comfort and appropriate concealment must be taken into consideration. Patients should be dressed in specific theatre wear that is appropriate for the procedure and clinical setting such that there is easy access to the operative site, and areas for intravenous cannulas and other devices.<sup>6</sup>

### Recommendation # 21: Incise drapes

For the purpose of reducing SSI risk, the use of plastic adhesive drapes with or without antimicrobial properties is deemed inessential.<sup>1</sup> In agreement, WHO, SHEA & IDSA, and NICE do **not** recommend the use

of plastic adhesive incise drapes with or without antimicrobial properties, the routine use of antiseptic incise drapes, and the routine use of non-iodophor-impregnated incise drapes, respectively, for the reduction of SSI risk.

### Recommendation # 22: Facility scrub laundering

Facility scrub laundering is recommended. This practice is also accepted by the Joint Commission and Association of Perioperative Registered Nurses.

### Recommendation # 23: Antimicrobial skin sealants

The application of antimicrobial skin sealants after surgical site preparation is not recommended<sup>1,2</sup> because low- to very low- quality evidence linking it with reduction in SSI risk.

### Recommendation # 24: Use of mask

The use of surgical mask is recommended not only to prevent SSI, but also for the protection of the health care worker.

### Recommendation # 25: Gloves

No-touch technique is recommended when using sterile gloves. While WHO does not provide specific recommendation on double gloving, this should be considered if there is a high risk of glove perforation, or if contamination may lead to grave outcomes.<sup>3,4,6,38</sup> In addition, there is no specific recommendation on changing of gloves during surgery, and on the type of gloves that is most effective in preventing SSI due to the paucity of high quality evidence.<sup>2</sup>

### Recommendation # 26: Jewelry, artificial nails, and nail polish

Patients should remove all jewelry, artificial nails, and nail polish before surgery.<sup>3,6</sup>

**Recommendation # 27: Changing of surgical instruments**

There is no specific recommendation on the changing of surgical instruments for fascial, subcutaneous, and skin surgical incision closure due to insufficient data linking this practice with SSI rates.<sup>2</sup> However, for colorectal procedures, changing to new instruments during surgical incision closure is recommended.<sup>6</sup>

**Recommendation # 28: Surgeon skill / technique**

Delicate tissue handling and the removal of dead space are recommended.<sup>4</sup>

**Recommendation # 29: Operative time**

Operative time must be kept to a minimum, while ensuring that surgical and aseptic techniques are not compromised.<sup>4</sup>

**Recommendation # 30: Ventilation in the operating room**

Proper air handling and laminar air flow in the operating room is recommended. Air-conditioning machines are recommended to be used for this purpose. Fans are not recommended unless used as a last resort if the lack of air circulation in the operating room affects the surgeons' performance. All fans and air-conditioning machines in the operating room should be routinely cleaned.

**Recommendation # 31: Environmental surfaces**

For surfaces and equipment that are visibly soiled or contaminated, cleaning them with approved disinfectants is recommended.<sup>4</sup>

**Recommendation # 32: Sterilization of Surgical Equipment**

It is recommended to limit the use of immediate-use steam sterilization equipment such as flash autoclaves.<sup>4</sup>

Details of appropriate sterilization of equipment are as prescribed by PCS and ORNAP.<sup>37</sup>

**Recommendation # 33: Traffic**

Traffic in the operating room should be kept to a minimum.<sup>4,39,40</sup>

**Recommendation # 34: Information for Patients and Caregivers**

Educating patients and their caregivers on SSI is recommended. NICE specifically recommends including the following information in the education of patients and caregivers: risks of SSI, strategies to prevent SSI, management of SSI, caring for surgical incision wounds post-discharge, recognizing SSI, and the person to contact for the patient's or the caregiver's concerns.

**Recommendation # 35: Information for Surgeons and Perioperative Personnel**

Healthcare personnel involved in different perioperative phases should be provided with information regarding SSI. SHEA & IDSA specifically recommends including the following in the education of surgeons and perioperative personnel: SSI risk factors, SSI outcomes, local epidemiology (e.g., SSI rates by procedure, rate of MRSA infection in a facility), and basic prevention strategies.

**Recommendation # 36: Use of WHO Checklist**

The use of WHO Safety Checklist or a checklist that is based on it is recommended to ensure that best practices in patient safety are adhered to.<sup>4</sup>

**Surgical Site Infection Surveillance Program**

Implementation of surveillance system for SSIs is further advised, with hospitals or health care institutions responsible for its execution. Baseline SSI rates should be identified by surgical specialty, surgical procedure, and/or surgeon.<sup>4</sup> After identifying high-risk and high-volume surgical procedures that would be subject to SSI

surveillance, an indirect surveillance should additionally be performed. Patients re-admitted to the hospital are also prescribed to undergo SSI surveillance. The surveillance period is set 30 to 90 days post-operatively, depending on the surgical procedure performed.

Moreover, assessment of operating room personnel, environment of care in the operating room, and practices in the post-anesthesia care unit, surgical intensive care unit, and/or surgical ward is recommended.<sup>4</sup> Rates of compliance with process measures should continuously be reviewed to surgical staff, perioperative personnel, and leadership.<sup>4</sup>

## Discussion

The 2017 guidelines on the prevention and management of surgical site infections for the Philippine context, spearheaded by the Philippine College of Surgeons, in collaboration with Philippine Hospital Infection Control Society, Philippine Hospital Infection Control Nurses Association, and Operating Room Nurses Association of the Philippines, Inc., is the first in the country. These recommendations are thus expected to provide surgeons and other health workers better guidance because of its specificity to the situation and experience of the Philippine health care system. While there are still aspects of care with conflicting recommendations (such as systemic immunosuppressive therapy), majority of concordant and discordant recommendations were reconciled through deliberation and consensus of the expert panel engaged. Consequently, these guidelines are expected to improve the standard of care provided by health facilities and contribute to the reduction of the prevalence and incidence of SSI in the country.

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### Appendix 1. Composition of the panel of experts.

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Ruvy T. De Guzman	Philippine Hospital Infection Control Society Philippine Hospital Infection Control Nurses Association
Dickson R. Miciano	Operating Room Nurses Association of the Philippines

## References

- Berrios-Torres SI, Umscheid CA, Bratzler DW, Leas B, Stone EC, Kelz RR, Reinke CE, Morgan S, Solomkin JS, Mazuski JE, Dellinger EP, Itani KMF, Berbari EF, Segreti J, Parvizi J, Blanchard J, Allen G, Kluytmans JAJW, Donlan R, Schechter WP, for the Healthcare Infection Control Practices Advisory Committee. Centers for Disease Control and Prevention (CDC) guideline for the prevention of surgical site infection, 2017. *JAMA Surg* 2017; 152(8): 784-91. doi:10.1001/jamasurg.2017.0904
- World Health Organization (WHO). Global guidelines for the prevention of surgical site infection, 2016 [Internet]. Switzerland: WHO Document Production Services; 2016. 186p. Available from <http://apps.who.int/iris/bitstream/10665/250680/1/9789241549882-eng.pdf?ua=1>
- Ban K, Minei J, Laronga C, Harbrecht B, Jensen E, Fry D, et al. American College of Surgeons (ACS) and Surgical Infection Society (SIS): Surgical site infection guidelines, 2016 Update. *J Am Coll Surg* 2016; 224(1): 59-74. doi:10.1016/j.jamcollsurg.2016.10.029
- Anderson D, Podgorny K, Berrios-Torres S, Bratzler D, Dellinger E, Greene L et al. Society for Healthcare Epidemiology of America (SHEA)/Infectious Diseases Society of America (IDSA) Strategies to prevent surgical site infections in acute care hospitals: 2014 Update. *Infect Control Hosp Epidemiol* 2014; 35(06): 605-27. doi:10.1086/676022
- National Institute for Health and Care Excellence (NICE). Surgical site infection: Evidence update June 2013 [Internet]. Manchester: National Institute for Health and Care Excellence; 2013. 28p. Available from <https://arms.evidence.nhs.uk/resources/hub/1006598/attachment>
- National Institute for Health and Care Excellence (NICE). Surgical site infection: Prevention and treatment of surgical site infection clinical guideline, 2008 [Internet]. London: RCOG Press; 2008. 168p. Available from <https://www.nice.org.uk/guidance/cg74/evidence/full-guideline-242005933>
- Royal College of Surgeons in Ireland (RCSI) and Royal College of Physicians of Ireland (RCPI). Preventing surgical site infections: Key recommendations for practice, 2012 [Internet]. Available from <https://rcpi-live-cdn.s3.amazonaws.com/wp-content/uploads/2016/01/Preventing-Surgical-Site-Infections-Key-Recommendations-for-Practice.pdf>
- How-to Guide: Prevent Surgical Site Infections. Cambridge, MA: Institute for Healthcare Improvement; 2012. Available from [www.ihl.org](http://www.ihl.org)
- Brennan M, Pisters P, Posner M, Quesada O, Shike M. A prospective randomized trial of total parenteral nutrition after major pancreatic resection for malignancy. *Ann Surg* 2004; 220(4): 436-44. doi:10.1097/00000658-199410000-00003
- Veterans Affairs Total Parenteral Nutrition Cooperative Study Group. Perioperative total parenteral nutrition in surgical patients. *N Engl J Med* 1991; 325(8): 525-32.
- Bratzler D, Hunt D. Healthcare epidemiology: The surgical infection prevention and surgical care improvement projects: National initiatives to improve outcomes for patients having surgery. *Clin Infect Dis* 2006; 43(3): 322-30. doi:10.1086/505220
- Dronge AS, Perkal MF, Kancir S, Concato J, Aslan M, Rosenthal RA. Long-term glycemic control and postoperative infectious complications. *Arch Surg* 2006; 141(4): 375. doi:10.1001/archsurg.141.4.375
- Golden S, Peart-Vigilance C, Kao W, Brancati F. Perioperative glycemic control and the risk of infectious complications in a cohort of adults with diabetes. *Diabetes Care* 1999; 22(9): 1408-14. doi:10.2337/diacare.22.9.1408
- Kwon S, Thompson R, Dellinger P, Yanez D, Farrohki E, Flum D. Importance of perioperative glycemic control in General Surgery. *Ann Surg* 2013; 257(1): 8-14. doi:10.1097/sla.0b013e31827b6bbc
- Olsen M, Nepple J, Riew K, Lenke L, Bridwell K, Mayfield J, Fraser V. Risk factors for surgical site infection following orthopaedic spinal operations. *J Bone Joint Surg Am* 2008; 90(1): 62-9. doi:10.2106/jbjs.f.01515
- Umpierrez GE, Smiley D, Jacobs S et al. Randomized study of basal-bolus insulin therapy in the inpatient management of patients with type 2 diabetes undergoing general surgery (RABBIT 2 surgery). *Diabetes Care* 2011; 34(2): 256-61.
- Jeon C, Furuya E, Berman M, Larson E. The role of pre-operative and post-operative glucose control in surgical-site infections and mortality. *PLoS One* 2012; 7(9): e45616. doi:10.1371/journal.pone.0045616
- Bruno A, Kent T, Coull B, Shankar R, Saha C, Becker K, et al. Treatment of hyperglycemia in ischemic stroke (THIS): A randomized pilot trial. *Stroke* 2007; 39(2): 384-9. doi:10.1161/strokeaha.107.493544
- Luo M, Guan X, Luczak E, Lang D, Kutschke W, Gao Z, et al. Diabetes increases mortality after myocardial infarction by oxidizing CaMKII. *J Clin Invest* 2013; 123(3): 1262-74. doi:10.1172/jci65268
- E Duncan A. Hyperglycemia and perioperative glucose management. *Curr Pharm Des* 2012; 18(38): 6195-203. doi:10.2174/138161212803832236
- Sessler DI. Complications and treatment of mild hypothermia. *Anesthesiology* 2001; 95(2): 531-43.
- Belda FJ, Aguilera L, Garcia de la Asuncion J, Alberti J, Vicente R, Ferrandiz L, Spanish Reduccion de la Tasa de Infeccion Quirurgica Group et al. Supplemental perioperative oxygen and the risk of surgical wound infection: A randomized controlled trial. *JAMA* 2005; 294(16): 2035-42.
- Bickel A, Gurevits M, Vamos R, Ivry S, Eitan A. Perioperative hyperoxygenation and wound site infection following surgery for acute appendicitis: A randomized, prospective, controlled trial. *Arch Surg* 2011; 146(4): 464-70.
- Greif R, Akça O, Horn E, Kurz A, Sessler D. Supplemental perioperative oxygen to reduce the incidence of surgical-wound infection. *N Engl J Med* 2000; 342(3): 161-7. doi:10.1056/nejm200001203420303

25. Abad C, Pulia M, Safdar N. Does the nose know? An update on MRSA decolonization strategies. *Curr Infect Dis Rep* 2013; 15(6): 455-64. doi:10.1007/s11908-013-0364-y
26. Dodds Ashley E, Carroll D, Engemann J, Harris A, Fowler V, Sexton D, Kaye K. Risk factors for postoperative mediastinitis due to methicillin-resistant *Staphylococcus aureus*. *Clin Infect Dis* 2004; 38(11): 1555-60. <http://dx.doi.org/10.1086/420819>
27. Miller MA, Dascal A, Portnoy J, Mendelson J. Development of mupirocin resistance among methicillin-resistant *Staphylococcus aureus* after widespread use of nasal mupirocin ointment. *Infect Control Hosp Epidemiol* 1996; 17(12): 811-3.
28. Philippines, Department of Health. National Antibiotic Guidelines (Surgical Prophylaxis), 2016.
29. Tanner J, Woodings D, Moncaster K. Preoperative hair removal to reduce surgical site infection. *Cochrane Database of Systematic Reviews* 2006. doi:10.1002/14651858.cd004122.pub3
30. Mangram AJ, Horan TC, Pearson ML, Silver LC, Jarvis WR, Hospital Infection Control Practices Advisory Committee (HICPAC). Guideline for prevention of surgical site infection. *Infect Control Hosp Epidemiol* 1999; 20(4): 250-78.
31. Antimicrobial prophylaxis for surgery. *Treat Guidel Med Lett*. 2009;7(82): 47-52.
32. Bratzler D, Dellinger E, Olsen K, Perl T, Auwaerter P, Bolon M, et al. Clinical practice guidelines for antimicrobial prophylaxis in surgery. *Am J Health Syst Pharm* 2013;70(3):195-283. doi:10.2146/ajhp120568
33. Bratzler D, Houck P. Antimicrobial prophylaxis for surgery: An advisory statement from the National Surgical Infection Prevention Project. *Am J Surg* 2005; 189(4): 395-404. doi:10.1016/j.amjsurg.2005.01.015
34. Brown E, Wenzel R, Hendley J. Exploration of the microbial anatomy of normal human skin by using plasmid profiles of coagulase-negative *Staphylococci*: Search for the reservoir of resident skin flora. *J Infect Dis* 1989; 160(4): 644-50. doi:10.1093/infdis/160.4.644
35. Harbarth S, Samore M, Lichtenberg D, Carmeli Y. Prolonged antibiotic prophylaxis after cardiovascular surgery and its effect on surgical site infections and antimicrobial resistance. *Circulation*. 2000;101(25):2916-21. doi:10.1161/01.cir.101.25.2916
36. Coakley B, Sussman E, Wolfson T, Bhagavath A, Choi J, Ranasinghe N et al. Postoperative antibiotics correlate with worse outcomes after appendectomy for nonperforated appendicitis. *J Am Coll Surg* 2011; 213(6):778-83. doi:10.1016/j.jamcollsurg.2011.08.018
37. Philippine College of Surgeons & Operating Room Nurses Association of the Philippines. (2015). Guidelines and Recommendations in the Operating Room. (unpublished)
38. Alexander J, Solomkin J, Edwards M. Updated recommendations for control of surgical site infections. *Ann Surg* 2011; 253(6): 1082-93. doi:10.1097/sla.0b013e31821175f8
39. Andersson A, Bergh I, Karlsson J, Eriksson B, Nilsson K. Traffic flow in the operating room: An explorative and descriptive study on air quality during orthopedic trauma implant surgery. *Am J Infect Control* 2012; 40(8): 750-5. doi:10.1016/j.ajic.2011.09.015
40. Crolla R, van der Laan L, Veen E, Hendriks Y, van Schendel C, Kluytmans J. Reduction of surgical site infections after implementation of a bundle of care. *PLoS One* 2012; 7(9): e44599. doi: 10.1371/journal.pone.0044599