INFECTION CONTROL PRACTICES FOR THE PREVENTION OF SURGICAL SITE INFECTIONS IN THE OPERATING ROOM

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We hereby certify that we have language-edited the Master’s dissertation of Ms Olukemi Opadotun, entitled: INFECTION-CONTROL PRACTICES FOR THE PREVENTION OF SURGICAL-SITE INFECTIONS IN THE OPERATING ROOM.

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ABSTRACT

Infections are a major cause of morbidity and mortality during the post-operative phase of patients’ recovery. Wound infections are the second most commonly encountered type of nosocomial infection. Because wound infections can be introduced by not applying infection control measures and sterile technique principles in the operating room, the implementation of infection control principles is an imperative.

The aim of this study was to explore and describe infection control practices related to the prevention of Surgical site infections in the operating rooms in a public health care sector in the Nelson Mandela Bay Municipality. The findings were compared with practices, as indicated in an evidence-based guideline. The research design was quantitative, explorative, descriptive, comparative-descriptive and contextual in nature.

The research sample consisted of all the professional nurses, in the operating room. The data were collected by means of a self-administered questionnaire. Descriptive statistics was used to present the data in the form of tables and graphs. Based on the analysis of the data, some recommendations were made for the implementation of infection control practices, in order to prevent Surgical site infections in the operating room.

Keywords: Surgical site infection; Operating Room; Nosocomial infection; Professional Nurse; nursing-care practices; infection control practices; evidence-based practice.
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CHAPTER ONE
OVERVIEW OF THE STUDY

1.1 INTRODUCTION

According to the World Health Organization (WHO) (2009:42) report, surgical site infections account for about 15% of all health-care associated infections and about 37% of the hospital-acquired infections of surgical patients globally. Two thirds of surgical infections are incisional; while one third are confined to the organ space. In Western countries, the frequency of such infections is 15–20% of all cases, with an incidence of 2–15% occurring in general surgery. Surgical site infections lead to an average increase in the length of hospital stay of 4–7 days. Patients who have sustained surgical site infections are twice as likely to die, twice as likely to spend time in an intensive care unit, and five times more likely to be readmitted after discharge.

The Centre for Disease and Control (CDC) also added that surgical site infections (SSIs) are among the most common post-operative complications in surgical patients. The occurrence of SSIs results in reduced quality of life, increased hospital length of stay, increased likelihood of mortality, and markedly increased health-care costs. SSIs are the second most frequently cited hospital-acquired infections in the United States; and they lead to significant morbidity, prolonged hospitalization, increased medical costs, and overall compromised patient outcomes (Centre for Disease and Control, 2009). SSIs occur in 2% to 5% of clean, non-abdominal surgical procedures, and in 20% of intra-abdominal procedures (Rothrock, 2011:55).

Health-care costs increase substantially for patients with surgical site infections. In the United States, at least 780,000 surgical infections occur each year, with rates as high as 13% for high-risk colon surgery. Such infections resulted in 3.7 million excess hospital days and US$1.6–3 billion in excess hospital costs per year. In the United Kingdom, the excess cost has been calculated to be about £1594 per infection. In the European Union, surgical site infections exact an economic toll of €1.5–19.1 billion per year (WHO, 2009:43). To date, a paucity of literature exists with regard to South African data on this topic.
The nursing profession was officially initiated by Florence Nightingale, who was the world’s first nursing theorist; when she identified the concept of a nurse as a skilled worker, and demonstrated that the hospital environment, as well as the cleanliness thereof, has an ultimate effect on the patient (Fortunato, 2004:18). Since that time, the hospital environment, which includes the operating room, the cleanliness thereof, as well as the nursing personnel’s attention given to sterility included in the principles of asepsis, has played an important role in the reduction of surgical site infections.

The operating room environment is responsible for exposure to a variety of microorganisms; and therefore, the patient is at risk of exposure to nosocomial infections and the development of surgical site infections (Fortunato, 2004:205).

Infection control guidelines are aimed at providing a safe health-care environment for patients and staff alike. Good infection control practice should be established to improve health outcomes, and to prevent negative outcomes, such as morbidity, mortality, increased health-care costs and possible litigation. Operating room nurses who ensure compliance with an infection control programme, and continue to practice infection control principles in an operating-room environment can save the lives of patients, and prevent infections occurring post-operatively.

Operating room nurses share the responsibility with other health-care personnel for infection-risk reduction in patients across the entire continuum of care; and they play a vital role in reducing the risks for infection through a variety of direct care activities (Jacquelyn, Flaskerad & Serers, 2012:48).

Many guidelines are available for the prevention of hospital infections, including the “Guideline for [the] Prevention of Surgical site Infection” (1999), which was developed by the Hospital Infections’ Program, Center for Diseases Control (CDC), Atlanta. Part I of the guideline describes the epidemiology, definitions, microbiology, pathogenesis, and surveillance of SSIs; while Part II contains the recommendations that were the consensus of the Hospital-Infection Control Practices Advisory Committee (HICPAC) on strategies for the prevention of SSIs (Mangram, Horan, Pearson, Silver & Jarvis, 1999:123).
This guideline was the only guideline available at the time of the study that addresses the topic; and it was thus used for the study.

Preventing infection in the operating room (OR) is one of the primary goals of the surgical team (Romney, 2001:252). Despite this, many studies show that adherence to recommendations is very low (Fogg, 1999:25; Kim, Jeffe, Evanoff, Mutha, Freeman & Fraser, 2001:523; Osborne, 2003:417; Creedon, 2005:210; Ganczak & Szych, 2007:349). Research studies continue to indicate a less than 100% compliance rate with standard precautions among health-care professionals, in spite of the demonstrated benefits of compliance with standard precautions, including a decrease in disease transmission by the reduction of the risk of exposure.

Although each operating room worldwide has a multidisciplinary infection control committee, practices for preventing infection are applied randomly (Bisset, 2003; Osborne, 2003; Creedon, 2005; Ganczak & Szych, 2007). Recommendations, in the form of evidence-based guidelines for the prevention of SSI, have existed for many years, but little is known about what is practiced in the clinical area, and whether those recommendations are being implemented.

This research study, therefore, aims to explore and describe the current infection control practices for the prevention of surgical site infections in the operating room within the public hospitals in the Nelson Mandela Bay Municipality, and to compare these practices with the evidence-based practice guideline. The guideline chosen for the prevention of surgical site infections specifically and comprehensively addresses the problem of SSIs in the operating room.

### 1.2 THE PROBLEM STATEMENT

Patients are admitted daily to the operating room for either elective or emergency surgical interventions. The moment these patients enter the operative environment they are exposed to the risk of surgical site infections. It is known that health-care associated infections place a high burden of cost on health services by prolonging hospitalization, increasing the use of antimicrobial treatment and increasing the number of surgical and mechanical interventions per patient. Infection control
practices, especially in the operating room should be aimed at providing a safe health-care environment for patients (Rothrock, 2011:48).

Reports from the infection control units of the three public hospitals that make up Port Elizabeth Hospital Complex in Nelson Mandela Bay Municipality – where the researcher conducted the research study – show an increased incidence of post-operative surgical site infections between April and December 2012, which comprises about 15% to 20% increase rate of surgical infection at that period of time. The statistics show that during this time, 25% of post-operative sepsis cases in the three public hospitals were reported. The reported cases of sepsis were higher (about 20%) in general surgeries such as abdominal operations than for other cases. Furthermore, the Institutional Statistics (2013) revealed that, for every 20 patients undergoing elective major surgery, there are more than two of such patients developing surgical infection; while many other cases might not even be reported.

While working in the operating room of one of the public hospitals, the researcher observed that various practices were not consistently followed in preventing and/or minimizing surgical infections. First and foremost, the pre-operative surgical hand-washing technique, which is universally accepted, is not performed in the required manner. The researcher observed that many professional nurses’ fingernails were long and sharp: this could result in the puncturing of sterile gloves during surgical procedures. This could inadvertently lead to the transfer of micro-organisms through the broken gloves to the surgical site, since long nails can harbour micro-organisms (O’Grady, 2010:12).

Furthermore, some professional nurses wore nail polish or artificial nails, which could further increase the possibility of the spread of infection. Hedderwick, McNeil, Lyons and Kauffman (2008:506), point out that artificial fingernails and nail polish are more likely to harbour pathogens, especially gram-negative bacilli and yeasts, than do natural nails. The researcher also observed that most professional nurses ignored the technique of elevating the hands and forearms to drain excess water down the elbow, away from the body after washing and before gowning. In addition, some of the professional nurses in the operating room scrubbed without removing their rings – although, it has been established that jewelry or metals carry
85% of micro-organisms. Studies have shown that higher microbial (about 85%) counts after washing are found in health workers who prefer not to remove rings; and this may put patients at risk of nosocomial infections (AORN, 2013:70). The researcher also noticed that gowning and gloving before the operation are done incorrectly by some of the professional nurses, thereby breaking the sterile technique principle during the procedure.

Various infection control practices, needs to be considered in the prevention of surgical site infections. These practices are prescribed by the Centre for Disease Control and Prevention (CDC) guideline. This guideline for prevention of surgical site infections was chosen as the standard for this study because at the time, it was the only guideline available that contained specific OR practices for the prevention of SSI. For example, it includes preparation of the patient, hand/forearm antisepsis for surgical team members, management of infected or colonized surgical personnel, ventilation in the operating room, cleaning and disinfection of environmental surfaces, microbiologic sampling and sterilization of surgical instruments and surgical attire and drapes.

It is very important for nurses to practice according to the best available evidence based practice, so the research study will aim to explore and describe the current infection control practices amongst the sample of professional nurses and compare its findings to the evidence-based recommendations as indicated by the centre for disease control and prevention guideline.

1.3 RESEARCH QUESTIONS

The two key research questions are as follows:

- What is the current infection control practices related to the prevention of surgical site infections in the operating rooms of the Nelson Mandela Bay Municipality public health-care sector?
- What recommendations can be made for the facilitation of implementation of infection control practices, in order to prevent surgical site infections in the operating room?
1.4 **AIM OF THIS STUDY**

The aim of this study is to explore and describe the current infection control practices for surgical site infections in the operating room, and to compare these practices against selected evidence-based practice guideline in a public health-care sector in the Nelson Mandela Bay Municipality.

1.5 **RESEARCH OBJECTIVES**

The research objectives for the study are as follows:

- To explore and describe the current infection control practices for the prevention of surgical site infections in the operating rooms in the public hospitals in the Nelson Mandela Bay Municipality, and to compare these practices against a selected evidence-based practice guideline.
- To make recommendations for the facilitation of implementation of infection control practices, in order to prevent surgical site infections in the operating room.

1.6 **THEORETICAL FRAMEWORK**

The PARiHS (Promoting Action on Research Implementation in Health Services) will be used as the theoretical framework for this research study. The framework represents the complexities of implementing evidence into practice and could be used by practitioners as a diagnostic and evaluative tool to successfully implement evidence into practice (Kitson, Rycroft-Malone, Harvey, McCormack, Seers & Tichen, 2008:12).

The framework proposes that for the implementation of evidence and guidelines to be successful, there needs to be clarity about the nature of evidence used, the quality of context and the type of facilitation needed to ensure a successful change process. Evidence should be considered from a variety of sources that has been subjected to testing and has been found to be credible. Contextual factors, comprising of culture, leadership and evaluation, plays an important role in facilitating or inhibiting the implementation process. Facilitation refers to the process of enabling the implementation of evidence and/or guidelines into practice (Rycroft-
Malone, 2004:298,299). Within this research study, the facilitation component will be used in order to make recommendations for facilitation of implementation of infection control practices, in order to prevent surgical site infections in the operating room.

1.7 CLARIFICATION OF CONCEPTS

Concepts are linguistic labels that can be assigned to objects or events. They have been described as the building blocks of theories. Defining concepts allows consistency in the way that a term is used (Brink, 2006:25). The following concepts will be explained for the purpose of this study:

- **Professional nurse:**

  A professional nurse is a person who is registered as a nurse in terms of section 16 of the Nursing Act of 1978 (Nursing Act 33 of 2005:34). The study includes professional nurses who care for patients during the peri-operative period. Contextually, these professional nurses include nurses experienced in the operating room, and those who hold an additional qualification in operating-room techniques.

- **Operating room (OR)**

  Operating room is an operating suite, which usually forms part of a hospital where operations are performed (Philips, 2004: 198). There is more than one operating room where sterile procedures are performed, and other support facilities are carried out, such as set-up-rooms, sluice rooms, waste-disposal facilities and others (Infection Control Association of Southern Africa ICASA, 2002:4). For the purpose of this study, the OR will refer to the actual room where surgical procedures are performed on the patient in the public health-care sector.

- **Operating room nurse**

  Smeltzer and Bare (2010:330) define an operating room nurse as a registered nurse who scrubs for surgery and performs sterile technique procedures in the operating room, including for example, handling of sterile surgical supplies and instruments as well as handing sterile instruments to the surgeon. The terms “operating room nurse” and “scrub nurse” can be used interchangeably. Operating room nursing is caring
for the patient prior to, during and after surgery until the patient is ready to be transferred back to the respective medical and surgical units. In this study the terms professional nurse and operating room nurse will be used interchangeably.

- **Infection control practices**

Infection control practice refers to measures, practices, protocols and procedures aimed at preventing and controlling infections and the transmission of infections in health-care settings (Lucile, Arking, Barbara & McArthur, 2005: 104). These measures include the prevention of nosocomial infections by, for example, ensuring the efficient cleaning and sterilisation of anaesthetic equipment and respirators, to prevent post-operative respiratory infections (Damani, 2013:76).

In this study various infection control practices will be explored.

- **Nursing care**

Nursing care encompasses the autonomous and collaborative care of individuals of all ages, families, groups and communities, sick or well, and in all settings. Nursing care includes the promotion of health, the prevention of illness, and the care of ill, disabled and dying people, as well as the promotion of a safe environment for the sick, participation in shaping health policy, and in the management of patient and health systems (Lewis, Heitkemper, Mclean, Dirksen, O’Brien, Bucher & Camera, 2011:334). In this study nursing care is rendered to surgical patients in the operating room by professional nurses – by giving holistic care peri-operatively.

- **Surgical site infections (SSIs)**

The term ‘a surgical site infection refers to infections that occur within 30 days after the operation, and that involve the skin and subcutaneous tissue around the incision. SSIs also include the superficial incisional (an infection involving skin or subcutaneous tissue of the incision and excluding any stitch abscess), deep incisional (an infection involving deep soft tissue of the incision) and organ space (an infection involving any part of the anatomy, other than the incision, which was opened or manipulated during an operation) (Webster, Croger, Lister, Doidge, Terry & Jones, 2010:170).
Safe, clean, care and recovery is the right and expectation of every patient; healthcare-acquired infections can be prevented, and their incidence reduced, by the professional nurses in the operating room – by simply adhering to the principles of asepsis peri-operatively. This study focuses on the prevention of surgical site infections.

1.8 THE RESEARCH DESIGN

A research design, which can be defined as a plan or blueprint for how one intends conducting the research, focuses on the end product; it formulates a research problem, as a point of departure; and it focuses on the logic of research (de Vos, Strydom, Fouche & Delport, 2011:142). The researcher will explore and describe the current infection control practices in preventing surgical infections within the operating room; and it will utilize an explorative, descriptive, comparative-descriptive and contextual research design by using a quantitative approach.

The research design will be more comprehensively discussed in Chapter 3 of the study.

1.9 THE RESEARCH METHOD

The research methods will comprise the techniques and/or procedures used by the researcher to structure the study, and to gather and analyse the relevant information, thereby implementing the research design (Babbie & Mouton, 2007:187). Research methods are the techniques used by researchers to structure a study, and to gather and analyse any information relevant to the research question (Burns & Grove, 2011:289). An in-depth discussion of the research methods will be given in Chapter 3.

- Target population

The target population for the study will consist of all the professional nurses who are currently working in the three public health-care operating rooms in Nelson Mandela Bay Municipality.

- The sampling method
A sample thus consists of a selected group of elements or units of analysis from a defined population (Brink, 2006:124). There are approximately eighty professional nurses currently working in the operating rooms. All the professional nurses working in the public hospitals in the Nelson Mandela Metropolitan area will provide the population for the sample. Due to the specialization field and the small numbers available in these units, the researcher decided to use a non-probability, convenience-sampling method. The sample, therefore, includes all those professional nurses who volunteered to participate in the research study.

- **The data-collection instrument**

The data will be collected by means of a questionnaire. A questionnaire is a list of questions on a specific topic, which have been compiled by the researcher, in order to obtain relevant information on the topic (Fox & Bayat, 2007:88). The questionnaire will be compiled in English; the researcher will develop the questionnaire on the basis of a literature review; the questions will be constructed in such a way that they are unambiguous, and are user-friendly, thereby ensuring that all the participants interpret the questions in the same way.

- **The data-collection method**

According to Polit and Hungler (2007:455), data collection is the gathering of the information needed to address the research problem. After permission is granted from the respective authorities to collect the data, the participants will be given an opportunity to read through the questionnaire to clarify any misunderstandings with the researcher. The questionnaire will be completed in the department where the participants are working during working hours. The researcher will be present in the department when the participants complete the questionnaire, in order to clarify any questions and/or misunderstandings.

- **The pilot study**

A pilot study is a study done on a small scale that includes all the aspects to be used in the main study (de Vos et al., 2011:236). The researcher will first conduct a pilot study by administering eight questionnaires as the pilot sample (based on the
recommendations from the statistician); and she will then make adjustments, where needed, before starting with the actual study. The data collected from this study will be included in the main study for analysis, and will be kept for up to five years.

- **The data analysis**

The purpose of the data analysis is to select, sort and organise the raw data obtained during the data collection – in such a way that themes and interpretations that emerge from the process and that address the original research problem may be identified and highlighted (Tutty, Rothery & Grinnell, 2008:90). The data obtained from the questionnaires will be analysed by means of statistical analyses. These will include the use of inferential and descriptive statistics.

**1.10 THE QUALITY OF THE RESEARCH**

It is important to obtain valid and reliable data; and therefore, the researcher must ensure that the questionnaires have acceptable levels of validity and reliability: these are the most important concepts in the context of measurement (de Vos *et al.*, 2011:171). These concepts will be discussed comprehensively in Chapter 3 of the study.

**1.11 ETHICAL CONSIDERATIONS**

All participants have basic rights in a process, which involves the acquisition of material and the information that is to be provided: the research will, therefore, be conducted on the basis of mutual trust, with due consideration being given to the rights, interests and the sensitivities of the participants (Mouton, 2006:243). According to Mouton (2006:243), the basic rights of participants include the rights to privacy, anonymity and confidentiality, and informed consent, as well as the right not to be harmed in any manner. The ethical aspects will be adhered to and discussed in more detail in Chapter 3 of the study.

**1.12 DISSEMINATION OF THE RESULTS**

Dissemination of the results is the final part of the research process; and this is accomplished by presentation of the research findings to the participants, as well as
by giving them access to the research (Polit & Beck, 2012:727). The data that will be collected from the questionnaires will be analysed; and the findings will be incorporated in a detailed report. The research findings will be presented at a research conference and/or published in an academic or professional peer-review journal. The researcher will prepare a copy of the completed research study, which will be given to the relevant health authorities and to the library of the local university.

1.13 THE CHAPTER DIVISION

The chapters in the research document will be divided, as indicated in Table1.

Table 1. Outline of the chapters

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Name of chapter</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>An overview of the study</td>
</tr>
<tr>
<td>2</td>
<td>The literature review</td>
</tr>
<tr>
<td>3</td>
<td>The research design and method</td>
</tr>
<tr>
<td>4</td>
<td>Data analysis and discussion</td>
</tr>
<tr>
<td>5</td>
<td>Summary, conclusion, limitations and recommendations</td>
</tr>
</tbody>
</table>

1.14 SUMMARY OF THE CHAPTER

Surgical site infections can contribute to increased mortality and morbidity, increased length of stay, increased costs, and a decrease in the quality of the care rendered. Professional nurses, who are employed in the operating room can prevent and/or minimise surgical site infections by adhering to the infection control principles in the operating room. It is thus essential that these practices be based on the latest and best available evidence-based guidelines. The study will aim to explore and describe the current infection control practices, as implemented by professional nurses in the public health-care operating rooms in the Nelson Mandela Bay Municipality.

The data obtained will be compared with the selected evidence-based guidelines; and recommendations for the facilitation of implementation of the guidelines related to surgical site infections will be made. Chapter 2 will elaborate on the literature consulted for this study.
2.1 INTRODUCTION

An overview of the research study was given in the previous chapter. Chapter Two will aim to clarify the concept of infection control practices for the prevention of surgical site infections (SSIs) in the operating room.

A literature review can be defined as a body of text that aims to review the critical points of current knowledge on a particular topic, and that includes substantive findings, as well as any theoretical and methodological contributions to the topic (Delinger, 2005:41).

A comprehensive narrative literature review pertaining to the topic of discussion was undertaken through journal databases, including Medline, CINHAL, and a scientific search-engine EBSCO Host. The scientific search engine –EBSCO HOST available to students at the Nelson Mandela Metropolitan University (NMMU) was used with the help of a librarian. These databases and their locations were searched, using key words, such as ‘surgical site infections’, ‘operating room’, ‘infection control and prevention’, ‘nursing-care practices’, ‘infection control’, ‘recommended practice’ and ‘evidence-based practices’. A range of published papers and textbook references were included in the study.

2.2 SURGICAL SITE INFECTIONS

In order to orientate the reader to the study, a definition, together with the etiological factors (contributing factors to the development of surgical site infections) and infection control practices will be provided and discussed in this section.

The human body has three lines of defence to combat infection. The first line of defence consists of external barriers, such as the skin and the mucous membranes, which are usually impervious to most pathogenic organisms. The second line of defence is the inflammatory response, which prevents an invading pathogen from reproducing and possibly involving other tissue. The third line of defence, the
immune response, is triggered after the inflammatory response. When there is a break in any of these defence mechanisms, the possibility of infection increases (Rothrock, 2011:47).

Surgical site infections (SSIs) occur when the body wall layers have been incised; and the first line of defence have been penetrated. Various organisms, including: bacteria, fungi, protozoa, algae and viruses are responsible for infections in patients. However, bacteria cause most of the surgical site infections (SSIs) and the gram-positive cocci, as a group, are the most common cause of SSIs. The organisms most commonly found in post-operative SSIs include: staphylococcal, enterococcal, pseudomonal and streptococcal species (Rothrock, 2011:48).

Nichols (2007: 9) rates infection after surgery, according to the wound classification and the type of surgery. The wound classification system developed in 1964 has been widely used to predict the rate of infection after surgery. The four classes are differentiated as follows: clean, clean-contaminated, contaminated and dirty.

The CDC’s NNIS system has developed standardized surveillance criteria for defining SSIs (Table 1). For example, in a patient who has had an appendectomy and subsequently developed an intra-abdominal abscess not draining through the incision, the infection would be reported as an organ/space SSI at the intra-abdominal site. Failure to use objective criteria to define SSIs has been shown to substantially affect reported SSI rates (Centre for Disease Control (CDC), 2008).

According to these criteria, SSIs are classified as being either incisional or organ/space (CDC, 2011: 386).
Table 2:1 Criteria for defining a surgical site infection (CDC, 2008)

<table>
<thead>
<tr>
<th><strong>Superficial Incisional SSI</strong></th>
<th>Infection occurs within 30 days after the operation, and the infection involves only skin or the subcutaneous tissue of the incision, and at least one of the following:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1. Purulent drainage, with or without laboratory confirmation, from the superficial incision.</td>
</tr>
<tr>
<td></td>
<td>2. Organisms isolated from an aseptically obtained culture of fluid or tissue from the superficial incision.</td>
</tr>
<tr>
<td></td>
<td>3. At least one of the following signs or symptoms of infection: pain or tenderness, localized swelling, redness, or heat, where the <strong>superficial</strong> incision was deliberately opened by the surgeon, unless the infection is culture-negative.</td>
</tr>
<tr>
<td></td>
<td>4. A diagnosis of superficial incisional SSI by the surgeon or attending physician.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Deep Incisional SSI</strong></th>
<th>Infection occurs within 30 days after the operation, if no implant is left in place, or within 1 year, if an implant is in place, and the infection appears to be related to the operation.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>This infection involves deep soft tissues (e.g., fascial and muscle layers) of the incision, and at least one of the following:</td>
</tr>
<tr>
<td></td>
<td>1. Purulent drainage from the deep incision, but not from the organ/space component of the surgical site.</td>
</tr>
<tr>
<td></td>
<td>2. A deep incision spontaneously dehisces, or is deliberately opened by a surgeon when the patient has at least one of the following signs or symptoms: fever (&gt;38°C), localized pain, or tenderness, unless the site is culture-negative.</td>
</tr>
<tr>
<td></td>
<td>3. An abscess or other evidence of infection involving the deep incision is found on direct examination, during re-operation, or by histopathological or radiological examination.</td>
</tr>
</tbody>
</table>

*Note: CDC refers to the Centers for Disease Control and Prevention.*
4. Diagnosis of a deep incisional SSI by a surgeon or attending physician.

**Organ/Space SSI**

Infection occurs within 30 days after the operation, if no implant is left in place, or within 1 year, if an implant is in place, and the infection appears to be related to the operation; and where the infection involves any part of the anatomy (e.g., organs or spaces), other than the incision, which was opened or manipulated during an operation, and at least one of the following:

1. Purulent drainage from a drain that is placed through a stab wound into the organ/space.

2. Organisms isolated from an aseptically obtained culture of fluid or tissue in the organ/space.

3. An abscess, or other evidence of infection, involving the organ/space that is found on direct examination, during reoperation, or by histopathological, or by radiological examination.

4. Diagnosis of an organ/space SSI by a surgeon or attending physician.

Incisional SSIs are further divided into those involving only skin and subcutaneous tissue (superficial incisional SSI) and those involving the deeper soft tissues of the incision (deep-incisional SSIs). Organ/space SSIs involve any part of the anatomy (e.g., organ or space) other than the incised body wall layers, which was opened or manipulated during an operation. (Refer to Figure 2 for a schematic representation of the classification system.)
2.2.1 Aetiology related to surgical site Infections

Pathogens that are responsible for surgical site infections, are introduced into the wound at the time of the surgical procedure, and may only be noticed weeks after the surgical procedure (Fry & Fry, 2007:802). Furthermore, factors like an immunocompromised system, age, co-morbid disease; and certain drug therapies, such as immuno-suppressive drugs or broad spectrum antimicrobials, enhance the exposure risk of infections for patients who have had to undergo surgery (Xavier, 2005:51).

Surgical site infections require microbial contamination of the surgical wound to occur. The micro-organisms may originate from either endogenous or exogenous sources. Sources of endogenous flora include the patient’s skin, mucous membranes, or hollow viscera. Exogenous flora originate from any contaminated items in the sterile surgical field, including surgical team members, instruments, air, or materials (Owens & Stoessel, 2008:4). Such an infection is transmitted in a healthcare environment primarily by exogenous or endogenous modes (Phillip, 2007:233).

Exogenous transmission is through patient-to-patient, or staff-to-patient contact. Patients who do not have an infection, but have bacterial colonization can act as vectors of transmission. Staff members can also act as vectors, as the result of
colonization or contamination. Endogenous transmission of infections may occur within an individual patient through displacement of commensal micro-organisms (Phillip, 2007: 233). In general, the spread of infectious disease is prevented by eliminating the conditions necessary for the micro-organism to be transmitted from a reservoir to a susceptible host, which can be accomplished by:

i. Destroying the micro-organism;
ii. Blocking the transmission;
iii. Protecting individuals from becoming vectors of transmission;
iv. Decreasing the susceptibility (Centre for Disease Control [CDC], 2008).

Owens and Stoessel (2008:5) further explain that, infection only occurs if the number and virulence of the bacteria or fungi overwhelm the host's natural defence mechanisms. Typically, more than $10^5$ micro-organisms per gram of tissue must be present for infection to develop, unless foreign material is present in the surgical site (i.e. a suture, or some mesh).

The Hospital Infection Control Practices Advisory Committee of the Centres for Disease Control and Prevention published guidelines for the prevention of surgical site infections in 1999. Both patient and operation characteristics were examined to determine the risk factors, and to identify the prevention measures pertinent to surgical site infections. The patient characteristics found to possibly increase the risk of SSI included diabetes, the use of nicotine, steroid use, malnutrition, prolonged pre-operative hospital stay, pre-operative nares colonization with *Staphylococcus aureus*, and peri-operative transfusion.

In addition, older age, obesity, remote body-site infections, and systemic immune-compromise can increase the risk of SSIs (Olsen, Chu-Ongsakul, Brandt, Dietz, Mayfield & Fraser, 2012: 55). (See Table 2.)
Table 2.1: Patient and operation characteristics that might influence the risk of surgical site infection development (Babkin & Raveh, 2007: 892)

<table>
<thead>
<tr>
<th>Patient</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Age</td>
<td>• Duration of surgical scrub</td>
</tr>
<tr>
<td>• Nutritional status</td>
<td>• Skin antisepsis</td>
</tr>
<tr>
<td>• Diabetes</td>
<td>• Pre-operative shaving</td>
</tr>
<tr>
<td>• Smoking</td>
<td>• Pre-operative skin prep</td>
</tr>
<tr>
<td>• Obesity</td>
<td>• Duration of operation</td>
</tr>
<tr>
<td>• Co-existent infections at a remote body site</td>
<td>• Antimicrobial prophylaxis</td>
</tr>
<tr>
<td>• Colonization with micro-organisms</td>
<td>• Operating room ventilation</td>
</tr>
<tr>
<td>• Altered immune response</td>
<td>• Inadequate sterilization of instruments</td>
</tr>
<tr>
<td>• Length of pre-operative stay</td>
<td>• Foreign material in the surgical site</td>
</tr>
<tr>
<td></td>
<td>• Surgical drains</td>
</tr>
<tr>
<td></td>
<td>• Surgical technique</td>
</tr>
<tr>
<td></td>
<td>• Poor haemostasis</td>
</tr>
</tbody>
</table>

According to the Centres for Disease Control and Prevention (CDC, 2008), advances in medical treatments have led to more patients suffering from decreased immune function or chronic disease. This coupled with a shift in health care to the outpatient setting, yields a hospital population that is both more susceptible to infection and more vulnerable once infected. In addition, the increased use of invasive devices and procedures has also contributed to higher rates of infection. Another particular danger is the several resistant strains of bacteria that have developed through their natural course of adaptation, and the overuse of antibiotics.

2.2.2 Factors that cause an increase in the incidence of Surgical site infections

According to the WHO (2009:107), the sources of surgical site infections can be categorized as being related to the following factors: environmental (air, water, architecture), patient-related (age, degree of illness/immune status, length of hospital
stay), and iatrogenic (surgery and invasive procedures, devices and equipment, and antibiotic use). Taken together, these sources have made a substantial impact on the increasing incidence of surgical site infections: the WHO notes that the rate of infections will continue to rise, as a result of three possible factors: environmental, patient-related and iatrogenic factors.

(a) **Environmental factors**

Factors specifically related to the healthcare environment are the most common causes of surgical site infections. However, consideration should be given to the prevention of infection by environmental pathogens. In 2008, the CDC report provided clear recommendations for infection control measures, according to several environment-related categories, including air (normal ventilation and filtration, as well as handling during construction or repair), water (water-supply systems, ice machines, hydrotherapy tanks and pools), and environmental services (laundry, housekeeping) (CDC, 2008).

Bearman, Munro, Sessler and Wenzel (2006:311) found that healthcare environments can increase the risk of infection for two primary reasons: Firstly, it is likely that normally sterile body sites will become exposed, allowing pathogens to cause infection through contact with mucous membranes, non-intact skin, and internal body areas. Secondly, the likelihood of a susceptible host is high, because of the vulnerable health status of patients. Especially in an era of decreased hospital stays and increased outpatient treatments, it is the sickest patients who are hospitalized, increasing the risk not only for infection to develop in these patients, but also for their infection to become more severe, and for it to be transmitted to others.

Patients expect to be treated and cared for in clean conditions, and not to be exposed to the risks of acquiring an infection by poor practice on the part of health-care workers. Therefore, infection control in perioperative settings assumes an even greater significance because of the vulnerability of patients who are already ill or injured; and because surgery, anaesthesia and immediate post-operative recovery could expose them to invasive procedures, allowing more portals of entry for infection (Stone, Larson & Kawar, 2002:146).
According to William (2008:270), cleaning and environmental services comprise a critical component of infection control in the operating room. A comprehensive approach to cleaning provides the most effective means of removing pathogens, and minimizing the risk of surgical site infections.

(b) Patient-related factors

Patient-related risk factors for surgical site infection include age, general health status, and the type of procedure to be carried out. In such cases, the risks can be classified as minimal, medium, or high. Patients are at minimal risk if they have no significant underlying disease, have an intact immune system, and will not submit to any invasive procedure. Medium risk is assigned to older patients, who are susceptible to disease for a variety of reasons, including decreased immune function, comorbid conditions, and low nutritional status (Radford, County & Oakley, 2004:46).

In a study conducted by the Association of Peri-operative Registered Nurses (AORN) in 2008, the statistics show that for 185 hospitalised patients, together averaging 82 years of age, the rate of nosocomial infection was 59%; another independent risk factor for infection was the patient’s altered nutritional status. Medium risk also refers to patients who are to have a non-surgical invasive procedure, such as the insertion of a urinary or peripheral venous catheter. High risk is also assigned to those patients with multiple trauma or severe burns, or those who have surgery or an invasive procedure that is considered to be high risk, such as endotracheal intubation or the insertion of a central venous catheter. In this same study, it was found that, for patients in burn units, the body surface area burned, comorbidities, and the use of invasive devices were significantly associated with surgical site infection; while Staphylococcus Aureus and Pseudomonas were the most common resistant organisms identified (AORN [a], 2012:89).

(c) Iatrogenic factors

Three primary iatrogenic factors that could contribute to the development of surgical site infections are: devices and equipment used in the operating room setting, surgery, and the use of antibiotics. The four most common nosocomial infections
are: urinary-tract infections, surgical site infections, pneumonia, and intravascular device-related bloodstream infection. The latter are related to invasive procedures or the use of invasive devices: these infections comprise approximately 80% of all surgical site infections (Radford et al., 2004:48).

Orthopaedic implants, such as joint prostheses and fracture-fixation devices, are associated with the lowest rate of infection; but reported mortality rates have been as high as 18%. Many implanted device-related infections are caused by contamination during insertion, but these infections are not always the result of micro-organisms transmitted in the healthcare setting (Mangram et al., 1999:250).

2.3 INFECTION CONTROL PRACTICES

Infection control practices should primarily focus on prevention; and they include: measures, practices, protocols and procedures aimed at preventing and controlling site infection. These measures should include fitness for work, the application of aseptic principles, and the provision of adequate physical facilities, appropriate surgical supplies, and operational controls in the peri-operative area (Rothrock, 2011:57).

A study that was done in the United States, known as the Study of Nosocomial Infection Control (SONIC), found that about one third of all surgical site infections could be prevented when effective infection control programmes are put in place in the operating room. Whereas a breach in infection control practices promotes the transmission of infection from patients to the nurses, and to other patients, an infection control programme consolidates the different practices that need to be implemented, in order to control and reduce the spread of infections (Smeltzer & Bare, 2010:1876). Although some surgical complications are unavoidable, surgical care can be improved through decisions and subsequent care focusing on evidence-based recommendations. Numerous projects have shown that institutional implementation of evidence-based practices can have a significant impact on the reduction of surgical complications and the prevention of SSIs. The application of the National Surgical Quality Improvement Program (NSQIP) in the Veterans’ Health Administration resulted in a 27% reduction in mortality related to surgery (Dimick, Chen, Taheri, Henderson, Khuri & Campbell, 2004:532).
Hospitals participating in the CDC and National Nosocomial Infection Surveillance System (NNISS) have shown reductions of 44% in device-associate infection rates and SSIs rates (www.cdc.gov/ncidod/hip/SURVEILL).

The national network of Medicare quality-improvement organizations (QIOs) conducted a surgical-infection prevention collaborative that effectively reduced SSIs by 27% at 56 centres across the United States (www.medqic.org/scip). The Joint Commission has established several National Safety Patient Goals (NPSGs) to provide organizational guidance for key patient safety issues. One of the goals, NPSG 7, focuses on how organizations can reduce the patients’ risk for developing health-care associated infections and surgical site infections (The Joint Commission, 2009:21-22).

Furthermore, infection control practices are regarded as an integral component of nursing-care delivery in any health-care setting, in order to reduce the risks for morbidity and mortality in both patients and health-care personnel at all levels. Moreover, more comprehensive infection-risk reduction strategies are required for the management of indwelling devices, such as central venous catheters and equipment for assisted ventilation and for surgical procedures that involve permanently implanted prosthetic devices, such as total-joint replacements (Mogotlane, Mokoena & Chauke, 2005:64).

Infection control practices in the operating room include the following: hand hygiene, aseptic techniques, waste management, surveillance, risk management, rational antibiotic use, cleaning and the use of chemical cleaning agents, the cleaning of items or objects, disinfection and sterilisation of instruments, the management of a contaminated operating room, the use of personal protective equipment, and the maintenance of an effective ventilation system (Xavier, 2005:45). The application of infection control principles is a fundamental requirement in preventing surgical site infection (Shields & Werder, 2009:34).
2.3.1 Pre-operative preparation

In the pre-operative care of patients, reducing the number of bacteria on the skin has been a common practice. Standards and recommended practices from the AORN(a) (2012:82) state that in pre-operative antiseptic showering, hand/forearm antisepsis, the skin preparation of surgical patients should include little or no hair removal. In addition, cleansing of the area around the surgical site, and the use of an antiseptic agent immediately before the surgical incision are all important in the prevention of SSIs.

2.3.2 Pre-operative hair removal

The increased SSI risk associated with shaving has been attributed to microscopic cuts in the skin that later serve as foci for bacterial multiplication (Nichols 2007:11). Shaving immediately before the operation compared to shaving 24 hours pre-operatively was found to be associated with decreased SSI rates, when the shaving was performed 24 hours prior to operation (AORN [a], 2012:88). Clipping hair immediately before an operation has also been associated with a lower risk of SSI than shaving or clipping the night before an operation. Also the use of depilatories has been associated with a lower SSI risk than shaving or clipping (AORN [a], 2012:90).

2.3.3 Pre-operative antiseptic showering

A pre-operative antiseptic shower or bath decreases skin microbial colony counts. Patients, who receive pre-operative antiseptic showers, show reduced bacterial colony counts by a nine-fold factor (AORN [a], 2012:87). According to Mangram et al. (1999:106), in their corroborated studies, the findings show that Chlorhexidine gluconate-containing products require several applications, in order to attain maximum antimicrobial benefit; so, repeated antiseptic showers are usually indicated.

2.3.4 Patient skin preparation in the operating room

Antiseptic skin preparation of the surgical patient is an important measure for the prevention of SSIs. Many antiseptic agents with bactericidal (killing of micro-
organisms) and bacteriostatic (inhibiting the growth of micro-organisms) activities are available for pre-operative scrub procedures and for preparation of the skin of the surgical patient before an operation (Urban, 2010:23). Several characteristics of antiseptic agents are important for determining their efficacy in reducing SSIs, including a broad spectrum of antimicrobial activity, rapid bactericidal action, and persistence of the agent on the skin. In addition, antiseptic agents should retain their efficacy in the presence of organic matter, and result in little or no skin sensitivity for the patient (Damani, 2013:29).

According to (AORN [b], 2012:98), the purpose of pre-operative skin antisepsis is to remove soil and transient organisms from the skin. The skin provides a dynamic home to a large number of bacteria, with up to 3 million micro-organisms on each square centimetre of skin. Most commonly, SSI occurs from commensal organisms, such as staphylococci, diphtheroid organisms, Pseudomonas, and propionibacterium species that are consistently present on a patient’s skin, compared with transient organisms that are more easily removed.

Any chemical agent for microbial reduction of the skin ideally kills all skin-based organisms, is non-toxic and hypo-allergenic, does not result in significant systemic re-absorption, has residual activity, and is safe for repetitive use. Antiseptics are split into three major types: iodine/iodophor, chlorhexidine, and alcohol-based preparations (Dahya, 2011:33). Several antiseptic agents are available for the pre-operative preparation of skin at the incision site. The iodophors (e.g., povidone-iodine), alcohol-containing products, and chlorhexidine gluconate are deemed the most suitable skin antiseptics for countering SSI risk in well-controlled, operation-specific studies (William, 2008:270). AORN (2012 [a]:90) has defined alcohol as containing one of the following active ingredients: ethyl alcohol, with 60% to 95% by volume in an aqueous solution, or isopropyl alcohol, with 50% to 91.3% by volume in an aqueous solution.

Alcohol is readily available, inexpensive; and it remains one of the most effective and rapid-acting skin antiseptics.

Aqueous 70% to 92% alcohol solutions provide germicidal activity against bacteria, fungi, and viruses, but spores can be resistant. One potential disadvantage of the
use of alcohol in the operating room is its flammability. Both chlorhexidine gluconate and iodophors have broad spectra of antimicrobial activity. In some comparisons of the two antiseptics when used as pre-operative hand scrubs, chlorhexidine gluconate achieved greater reductions in skin microflora than did povidone-iodine; and it also had greater residual activity after a single application.

(www.cdc.gov/ncidod/hip/SURVEILL)

Before the skin preparation of a patient is initiated, the skin should be free of gross contamination (i.e., dirt, soil, or any other debris). The patient’s skin is prepared by applying an antiseptic in concentric circles, beginning in the area of the proposed incision. The prepared area should be large enough to accommodate any extending of the incision or creating new incisions or drain sites, if necessary. The application of the skin preparation may need to be modified, depending on the condition of the skin (e.g., burns) or the location of the incision site (e.g., face) (Rothrock, 2011:57).

While SSIs can occur even with proper precautions, they are believed to occur more frequently in patients who have undergone a surgical procedure, during which the patient, the surgical personnel, or the environment were not adequately prepared. Several procedures currently used in the pre- and intra-operative period include pre-operative antiseptic showers, hair clipping rather than shaving; patient skin preparation in the operating room; and the hand hygiene of the surgical staff; in addition to the management of infected or colonized surgical personnel, and surgical attire and drapes. The CDC recommends that patients must shower with an antiseptic agent before a surgical procedure, in order to reduce bacterial colony counts (Olsen et al., 2012: 420).

2.3.5 Pre-operative hand/forearm antisepsis

Hand hygiene, which is the single most important means of preventing the spread of infection, should be emphasized. Using the proper hand-hygiene technique is critical to the effectiveness of infection control measures that help in preventing surgical site infection (Damani, 2013:49). In a more recent study involving more than 60 intensive care unit nurses, multivariable analysis revealed that rings were the only substantial risk factor for the carriage of gram-negative bacilli and S. Aureus, and
that the concentration of organisms recovered correlated with the number of rings worn (Mogotlane et al., 2005:64).

Two studies determined that the mean bacterial colony counts on hands after hand washing were similar among persons wearing rings and those not wearing rings (WHO, 2012:12).

In order to reduce the transfer of micro-organisms to patients during surgery – that might result in post-surgical infections, operating room staff members are required to perform surgical hand-scrubbing with a detergent-based antiseptic solution prior to each surgical procedure (Hsieh, Chiu & Lee, 2006:68). Surgical hand-washing or surgical hand-rubbing techniques utilizing an effective broad-spectrum antiseptic must be performed pre-operatively by the professional nurses in the operating room, in order to eliminate transient infections, and to reduce any resident hand flora, thus reducing the risk of surgical site infections (Lucile et al., 2005: 201).

Members of the surgical team who have direct contact with the sterile operating field or sterile instruments or supplies used in the field are required to wash their hands and forearms by performing a traditional procedure known as scrubbing (or the surgical scrub) immediately before donning sterile gowns and gloves (AORN, 2012[b]:86). Ideally, the optimum antiseptic used for the scrub should have a broad spectrum of activity, be fast-acting, and have a persistent effect. Alcohol is considered the gold standard for surgical hand preparation in several European countries. Povidone-iodine and chlorhexidine gluconate are the current agents of choice for most European countries. However, when 7.5% povidone-iodine or 4% chlorhexidine gluconate was compared with alcoholic chlorhexidine (60% isopropanol and 0.5% chlorhexidine gluconate in 70% isopropanol), alcoholic chlorhexidine was found to have a greater residual antimicrobial activity (Fry & Fry, 2007:803).

**2.3.5.1 Duration of the surgical scrub**

The timing of the surgical scrub is an important part of the protocol. Historically, a longer scrub has been thought to be more effective; but a number of studies
question the minimum scrub time for an effective outcome (AORN, 2013:67). Scrubbing technique, the duration of the scrub, the condition of the hands, or the techniques used for drying and gloving are issues that all play an important role in SSIs. Recent studies conducted by AORN in 2012, suggest that scrubbing for at least 5-7 minutes is as effective as the traditional 10-minute scrub in reducing the hand bacterial count (AORN, 2013:67).

The first scrub of the day should include a thorough cleaning beneath the fingernails (usually with a brush), according to Myers and Parini (2003:7). After performing the surgical scrub, the hands should be kept up and away from the body (elbows in flexed position), so that water runs from the fingertips towards the elbows. Sterile towels should be used for drying the hands and forearms before the donning of a sterile gown and gloves (Rothrock, 2011:62).

### 2.3.5.2 The wearing of artificial nails

A surgical team member who wears artificial nails may have increased bacterial and fungal colonization of the hands – despite performing an adequate hand scrub. Hand carriage of gram-negative organisms has been shown to be greater among wearers of artificial nails than among non-wearers. An outbreak of *Serratia Marcescens* SSIs in cardiovascular surgery patients was found to be associated with a surgical nurse who wore artificial nails. Long nails – artificial or natural – may be associated with tears in surgical gloves (Hedderwick *et al.*, 2008:506).

### 2.3.5.3 The wearing of hand jewellery

Studies have demonstrated that skin underneath rings is more heavily colonized than comparable areas of skin on fingers without rings. In a study of intensive-care nurses, multivariable analysis determined that rings were the only substantial risk factor for the carriage of gram-negative bacilli and *Staphylococcus Aureus*; moreover, the concentration of organisms correlated with the number of rings worn (Urban, 2010:22).

Two other studies demonstrated that mean bacterial colony counts on hands after hand washing were higher among persons wearing rings than those not wearing
rings (Phillips, 2007:267). Rings and decorative nail jewellery can make donning
gloves more difficult and cause gloves to tear more readily. Thus, jewellery should
not interfere with glove use (e.g., they can impair the ability to wear the correct-sized
glove or alter glove integrity) (Patrick & Van Wicklin, 2012:495).

2.3.6 Aseptic technique

According to AORN (2012 [a]:94), aseptic techniques refer to the practices
performed immediately before and during a clinical procedure, so as to reduce post-
operative infection; these include patient-skin preparation; hand washing; surgical
scrubs; using barrier protection for the patient (draping), and for the surgical team
(surgical attire), maintaining the sterile field, using safe operative techniques, and
maintaining a safe and sterile environment in the surgical arena.

The CDC’s (2012:18) guideline for the prevention of surgical infections notes that,
“Rigorous adherence to the principles of asepsis by all scrubbed personnel is the
foundation of surgical site infection prevention. Others who work in close proximity to
the sterile surgical field, such as anaesthesia personnel who are separated from the
field only by a drape barrier, must also abide by these principles.”

Aseptic technique is the method by which contamination with micro-organisms is
prevented in the surgical environment. It prevents normal body flora, (i.e. both
resident and transient micro-organisms), which are present on the skin of surgical
team members and on the patient from contaminating the surgical site (Damani,
2013:70).

Aseptic technique employs the knowledge and principles of ‘confine and contain’,
because most infections invade the body from outside (i.e., exogenous) sources.
During invasive procedures, peri-operative team members must protect the patient
by keeping the surgical site free of all living bacteria, including those initially present
on the patient’s skin. Adherence to the aseptic-technique principles may reduce
contamination of wounds by potentially pathogenic organisms. It is important that the
surgical team should understand these principles (Phillip, 2007: 251).
Sterile technique and infection control principles are inseparable and must be implemented in professional nurses’ everyday practices, to ensure that the patients’ recovery is not to be delayed by any acquired infection.

2.3.7 Management of infected or colonized surgical personnel

Surgical personnel who have active infections or are colonized with certain microorganisms have been linked to outbreaks or clusters of SSIs. Thus, it is important that healthcare organizations implement policies to prevent the transmission of micro-organisms from personnel to patients. These policies should address the management of job-related illnesses, the provision of post-exposure prophylaxis after job-related exposures, and when necessary, the exclusion of ill personnel from work or patient contact. While work-exclusion policies should be enforceable and include a statement of the authority to exclude ill personnel, they should also be designed, so as to encourage personnel to report their illnesses and exposures and not penalize them with any loss of wages, benefits, or job status floor (Mangram et al., 1999:108).

Control of the environment is a necessary part of overall infection prevention in the operating room. The inanimate and animate environment of the operating room suite presents a risk for the transmission of micro-organisms (Phillip, 2007:254). Environmental services include procedures, such as cleaning and disinfecting the operating room environment, handling soiled laundry, and disposing of solid waste. Moreover, it should be noted that equipment or procedures that require water in their operation can support microbial growth, especially if the water is not changed frequently (William, 2008:274). It is important to perform routine cleaning of these surfaces – in order to re-establish a clean environment after each operation.

To address environmental hygiene in the operation room and other patient areas, there are several key components that must be in place, in order to deliver improved cleaning outcomes. These key components should include:

- Training and education on best practices;
- Standardized processes to consistently disinfect high-touch objects;
- Objective metrics to measure programme effectiveness;
• Infection control practices to prevent cross contamination;
• Consistent delivery of correct disinfectant concentrations (Ignatavicius, 2010:63).

2.3.8 Intra-operative preparation and ventilation

Maintaining a high quality of air in operating rooms is an essential factor in preventing post-operative infection, the rate of air exchange, the initial quality of the air, the quality of the staff clothing and cleaning processes, and the level of compliance with infection control practices can all help in reducing surgical site infections (William & David, 2008: 225). The air-conditioning is an important aspect of the operating room complex. In order to control bio-particulate matter within the operating room environment, ventilating air should be delivered to the room from ceiling vents or vents located high on the walls (Phillips, 2007:253).

The prevalence of infection in a healthcare setting has been strongly associated with Aspergillus spore counts. Consequently, air-conditioning systems with high-efficiency particulate air (HEPA) filters are needed to minimize any such contamination. A CDC study, showed that a conditioning system with these filters eliminated all Aspergillus spores, as documented with microbiological testing (Damani, 2013:78).

In comparison, evidence of Aspergillus spores was found in hospital wards that had no air-conditioning or a conditioning system with minimum efficiency filters. Routine inspection and cleaning of conditioning equipment is also needed to ensure proper filtration (AORN, 2012[a]:87).

According to AORN (2012[a]:88), HEPA filters are especially needed to prevent infection with Aspergillus in patients at high risk, such as those in organ and bone-marrow transplantation units, where mortality rates associated with such infections can reach 95%. In these units, the air-exchange rate should be high (more than 15 exchanges per hour), the rooms should be tightly sealed, and the air pressure in the rooms should be positive in relation to the hallway. HEPA filters are also used in the hoods in microbiology laboratories and pharmacies, in laminar-flow units in intensive care units, and for unidirectional flow units in operating-room suites.
Operating room air may contain microbial-laden dust, lint, skin or respiratory droplets, because the microbial level in an operating room air is directly proportional to the number of people moving about in the room. Therefore, efforts should be made to minimize personnel traffic during operations. Outbreaks of SSIs caused by group A beta-haemolytic streptococci have been traced to the airborne transmission of the organism from colonized operating-room personnel to patients. In these outbreaks, the strain causing the outbreak was recovered from the air in the operating room (Mangram et al., 1999:110).

Operating rooms should be maintained at positive air pressure with respect to corridors and other adjacent areas. Such positive pressure prevents airflow from less clean areas into more clean areas. All ventilation or air-conditioning systems in hospitals, including those in operating rooms, should have two filter beds in series, with the efficiency of the first filter bed being greater than 30%, and that of the second filter bed being greater than 90%. Conventional operating room ventilation systems produce a minimum of about 15 air changes of filtered air per hour, three (20%) of which must be fresh air. Air should be introduced at the ceiling and exhausted near the floor (Mangram et al., 1999:263).

Laminar airflow is designed to move particle-free air over the aseptic operating field in one direction. It can be designed to flow vertically or horizontally; and it is usually combined with high efficiency particulate-air (HEPA) filters. HEPA filters remove particles of greater than 0.3 microns in diameter with an efficiency of 99.97%. Ultraclean air can reduce the incidence of SSIs – especially for orthopaedic implant operations. However, some studies suggest that other interventions, such as the appropriate timing of pre-operative antibiotics and good OT practices, such as limiting non-essential traffic, can also lower this incidence. Therefore, laminar flow with HEPA filtration is essential for high quality surgical care (Phillips, 2007:256).

Dahya (2011:30) studied vertical laminar airflow systems and exhaust-ventilated clothing, and found that their use decreased the surgical site infection (SSI) rate from 9% to 1%. However, other variables (i.e., the surgeon’s experience and surgical technique) changed at the same time as did the type of ventilation. The SSI rate following operations in which ultraclean air alone was used decreased from 3.4% to
1.6%, whereas the rate for those that received only antimicrobial prophylaxis decreased from 3.4% to 0.8%. When both interventions were used in combination, the SSI rate decreased from 3.4% to 0.7%.

These findings suggest that both ultraclean air and antimicrobial prophylaxis could reduce the incidence of SSI following orthopaedic implant operations; but antimicrobial prophylaxis can be more beneficial than ultra-clean air. However, intraoperative UV radiation has not been shown to decrease the overall SSIs.

The CDC in 2009 made several suggestions on ventilation in the operating room – in its guidelines for the prevention of surgical site infections. The recommendations (those with the greatest strength of evidence) include the following:

i. Maintain positive-pressure ventilation in the operating room with respect to the corridors and adjacent areas.

ii. Maintain a minimum of 15 air changes per hour, of which at least three should be fresh air.

iii. Filter all air, recirculated and fresh, through the appropriate filters according to the recommendations of the CDC.

iv. Introduce all air at the ceiling and exhaust near the floor.

v. Do not use ultraviolet radiation in the operating room to prevent surgical site infections.

vi. Keep operating room doors closed, except when needed for the passage of equipment, personnel, and the patient (CDC, 2009).

2.3.9 Cleaning and disinfection of environmental surfaces

One of the most practical sets of guidelines for disinfection that is available to healthcare facilities seeking guidance on improving cleanliness in the surgical suite was published by the Association of Peri-Operative Professional nurses (AORN). According to AORN’s best practices for environmental cleaning in surgical practice settings in 2007 recommends that, procedure rooms and utility areas of the surgical suite should be thoroughly cleaned every 24 hours. The AORN further recommends
that operating-room floors must be cleaned after the last operation of the day or night (Fry & Fry, 2007:802).

AORN’s recommended practices for environmental cleaning in the peri-operative settings further mandate specific time-frames for cleaning. These include surgical and invasive procedure rooms and scrub/room utility areas that should be thoroughly cleaned daily, including:

- Unused rooms that should be cleaned once during each 24-hour period during the regularly scheduled work week.
- The entire floor should be wet-vacuumed with an Environmental Protection Agency (EPA)-registered disinfectant after scheduled procedures are performed.
- Equipment should be disassembled, disinfected, cleaned with an EPA-registered disinfectant, and dried before re-use and storage.
- Operating room beds should be moved to check for any items that may be hidden under the bed and mattresses (Fry & Fry, 2007:803).

Additionally, AORN recommends that any operating room with a patient in it should be considered contaminated by that patient. This means that extensive cleaning must be completed between each procedure, and that the cleaning process should not be started until the current patient has left the room. Beginning the cleaning processes before the patient has been fully removed could result in ongoing contamination (Fry & Fry, 2007:804). From a practical standpoint, the availability of cleaning supplies and tools for use between cases, and at the end of the day, contributes to reducing the transmission of infectious diseases. Having these items within easy reach could eliminate delays in cleaning a room. While operating room turnover time needs to be kept to a reasonable minimum, achieving optimum cleaning and disinfection still demands a higher priority rating.

This is easier to accomplish with well-established cleaning processes and individual practices and supplies (William, 2008:272).
2.3.10 Sterilization of surgical instruments

Sterilization is described as a process that destroys or eliminates all forms of microbial life; and it is carried out in health-care facilities via physical or chemical methods. Steam under pressure, dry heat, Ethylene oxide gas, hydrogen peroxide gas plasma, and liquid chemicals are the principal sterilizing agents used in disinfecting surgical instruments in the operating room. When chemicals are used to destroy all forms of microbiological life, they can be called chemical sterilisers (Nichols, 2007: 12).

Contaminated equipment that has not been disinfected between surgical cases may become the reservoir for pathogens that are likely to cause surgical site infection. When the operating room nurse touches the surface of the equipment, it may then become the transmitter of infections (William, 2008:274). Microbial contamination of a surgical wound leads to the development of SSIs. During a surgical, or other invasive procedure, the wound is at risk of contamination from both endogenous and exogenous micro-organisms, some of which have become resistant to current treatment modalities; furthermore, the risk of an SSI increases with a dose of bacterial contamination, and from the degree of virulence of the bacteria. Hence, inadequate sterilization of instruments is recognized as a factor that may lead to SSIs (Moss & Kneedler, 2013:8).

Sterilization is essential for ensuring that surgical instruments do not transmit infectious pathogens to patients. Because sterilization of all patient-care items is not necessary, health-care policies must identify, primarily on the basis of the items’ intended use, whether cleaning, disinfection, or sterilization is indicated (Rothrock, 2011:67).

Inadequate sterilization of surgical instruments has resulted in infection outbreaks: therefore, surgical instruments should be sterilized by steam under pressure, dry heat, ethylene oxide, or other approved methods. The importance of routinely monitoring the quality of sterilization procedures is well established. Microbial monitoring of steam-autoclave performance is necessary; and this can be accomplished by the use of a biological indicator. Detailed recommendations for the sterilization of surgical instruments have been published (Nichols, 2007: 22).
Phillips (2007:306) defines flash sterilization as, “the process designated for the steam sterilization of patient-care items for immediate use”. During any operation, the need for emergency sterilization of equipment may arise (e.g., to reprocess an inadvertently dropped instrument). However, flash sterilization is not intended to be used for either reasons of convenience, or as an alternative to purchasing additional instrument sets, or to save time. Flash sterilization is not recommended for implantable devices – because of the potential for serious infections. Nor is it recommended as a routine sterilization method, because of the lack of timely biological indicators to monitor the performance, and the absence of protective packaging following sterilization, as well as the possibility for contamination of processed items during transportation to operating rooms, and the use of minimal sterilization cycle parameters (i.e., time, temperature, pressure). Nevertheless, flash sterilization should be restricted to its intended purpose – until studies are performed that can demonstrate its comparability with conventional sterilization methods with regard to the risk of infections (Nichols, 2007: 13).

The methods discussed above are sterilizing methods, commonly used in healthcare settings, as well as for the specific requirements needed to achieve this purpose. Saturated steam under pressure is an efficient, non-toxic, economical and rapid sterilization method that kills micro-organisms by coagulating their protoplasm, if used correctly. It is the method of choice for all instruments that can withstand the moist heat of saturated steam under pressure, without deterioration or damage. This method is dependent on the temperature, the time and pressure in autoclaves (Ziady & Small, 2012:168).

As steam must penetrate to the core of the load, air removal, packaging material, the arrangement of items inside the pack, and the way the packs are loaded into the autoclaves are all critical to the success of the process. Autoclaves during sterilization are monitored via mechanical indicators, e.g. gauges, thermometers, timers, recorders and other devices that monitor their functions. Most sterilizers have automatic controls and locking devices, as well as alarm systems that are activated if the sterilizer fails to operate correctly. These tests are devised so as to identify any processing errors (Phillips, 2007:299). An external chemical indicator should be used
on all packages to be sterilized, except for those that allow direct visualization into the package.

Chemical indicators refer to external indicator tape, labels or paper strips that should be clearly visible on the outside of every item to differentiate between sterile and unsterile items. These indicators monitor the physical condition within the sterilizer to alert personnel to malfunctions, human errors in packaging, or to the improper loading of the autoclave. An internal indicator may be placed in a position that might be difficult for the steam to penetrate – and if there is any expected chemical reaction with the indicator, the item should not be used. It is important to remember that indicators do not establish the sterility of an item; but they merely indicate only that the process parameters have been met (Phillips, 2007:299).

2.3.11 Surgical attire and drapes

Aspects that should be included in an infection control programme or guideline in the operating room are the wearing of protective wear, such as, gloves, gowns, and masks (Fry & Fry, 2007:807). In this section, the term surgical attire refers to scrub suits, caps/hoods, shoe covers, masks, gloves, and gowns. Damani (2013:50) explained that experimental data have shown that live micro-organisms are shed from hair, exposed skin, and mucous membranes of operating room personnel; however, few controlled clinical studies have evaluated the relationship between the use of surgical attire and infection risk in the operating room.

Nevertheless, the use of barriers seems prudent to minimize a patient's exposure to the skin, mucous membranes, or hair of surgical team members, as well as to protect surgical team members from exposure to blood and blood-borne pathogens (e.g., human immunodeficiency virus and hepatitis viruses).

Wearing surgical attire and the appropriate personal protective equipment in the semi-restricted and restricted areas of health-care facilities promotes personnel safety; and it helps ensure cleanliness in the peri-operative environment. It is understood that the human body and the various surfaces in the peri-operative setting are sources of microbial contamination and microbe transmission, which can cause infection. Clean surgical attire helps to minimize the introduction of micro-
organisms, and the lint from health-care personnel to clean items and the environment (Braswell & Spruce, 2012:123).

(a) Scrub suits

According to (AORN [a], 2012:90), surgical team members often wear a uniform called a “scrub suit” that consists of pants and a shirt. Policies for laundering, wearing, covering, and changing scrub suits vary greatly. Some policies restrict the laundering of scrub suits to the facility; while other facilities have policies that allow laundering by employees. There are no well-controlled studies evaluating scrub-suit laundering as an SSI risk factor. Some facilities have policies that restrict the wearing of scrub suits to the operating suite; while other facilities allow the wearing of cover gowns over scrub suits, when personnel leave the suite. AORN recommends that scrub suits be changed after they become visibly soiled, and that they be laundered only in an approved and monitored laundry facility. Additionally, AORN regulations require that, “if a garment(s) is penetrated by blood or other potentially infectious materials, the garment(s) shall be removed immediately, or as soon as feasible” (Braswell & Spruce, 2012:122).

(b) Masks

The wearing of surgical masks during operations to prevent potential microbial contamination of incisions is a longstanding surgical tradition. However, some studies have raised questions about the efficacy and cost-benefits of surgical masks in reducing infection in operating rooms. However, wearing a mask could be beneficial, since it protects the wearer’s nose and mouth from inadvertent exposures (i.e. via splashes) to blood and other body fluids. AORN regulations require that masks, in combination with protective eyewear, such as goggles or glasses with solid shields, or face shields, be worn whenever splashes, spray, spatter, or droplets of blood, or other potentially infectious material are possibly generated, and where eye, nose, or mouth contamination should reasonably be anticipated (AORN [a], 2012:90).
(c) **Surgical caps/hoods and shoe covers**

Surgical caps/hoods reduce contamination of the surgical field by organisms shed from the hair and scalp. SSI outbreaks have occasionally been traced to organisms isolated from the hair or scalp (*S. Aureus* and group A *Streptococcus*), even when caps were worn by personnel during the operation and in the operating suites. The use of shoe covers has never been shown to decrease SSI risk, or to decrease bacteria counts on the operating room floor. Shoe covers may, however, protect surgical team members from exposure to blood and other body fluids during an operation.

AORN regulations require that surgical caps, or hoods and shoe covers be worn in situations when gross contamination can reasonably be anticipated, e.g. for orthopaedic operations, penetrating trauma cases and suchlike (AORN [a], 2012:92).

(d) **Sterile gloves**

Sterile gloves are put on after donning sterile gowns. A strong theoretical rationale supports the wearing of sterile gloves by all scrubbed members of the surgical team. Sterile gloves are worn to minimize the transmission of micro-organisms from the hands of team members to patients, and to prevent the contamination of team members’ hands with patients’ blood and body fluids. If the integrity of a glove is compromised (e.g., punctured), it should be changed as promptly as safety permits. Wearing two pairs of gloves (double-gloving) has been shown to reduce hand contact with patients’ blood and body fluids as compared to wearing only a single pair (Nichols, 2007:17).

(e) **Gowns and drapes**

Sterile surgical gowns and drapes are used to create a barrier between the surgical field and any potential sources of bacteria. Gowns are worn by all scrubbed surgical team members, and drapes are placed over the patient. There are limited data available to assist with understanding the relationship of gown or drape characteristics and SSI risk. The wide variation in the products and study designs
make interpretation of the literature difficult. Gowns and drapes are classified as disposable (single use) or re-usable (multiple uses).

Regardless of the material used to manufacture gowns and drapes, these items should be impermeable to liquids and viruses. In general, only gowns reinforced with films, coatings, or membranes appear to meet the standards developed by the American Society for Testing and Materials. However, such “liquid-proof” gowns may be uncomfortable, because they also inhibit heat loss and the evaporation of sweat from the wearer’s body (Mangram et al., 1999:263).

2.4 SUMMARY OF THE CHAPTER

Surgical site infection can be controlled and reduced in the hospital setting. The personnel must be made aware of SSI incidences and the potential dangers within the hospital, as well as the measures that are necessary, in order to control and reduce the infection rate. Surgical site infections can be controlled and reduced by implementing measures, such as the sterile technique, and by heeding infection control principles. Evidence-based measures exist that are effective in reducing surgical site infections; moreover, the sterilisation of instruments, aseptic techniques, clean air, and pre- and intra-operative practices to prevent surgical site infections have been shown to reduce the incidence of surgical site infections.

Professional nurses must keep up-to-date with new developments in infection control, in order to become increasingly efficient at preventing surgical site infection.
CHAPTER THREE
RESEARCH DESIGN AND METHOD

3.1 INTRODUCTION

In Chapter 2, a literature review was conducted, in order to provide understanding and comprehension of the research area, which focused on infection control practices for the prevention of surgical site infections in the operating room.

The focus of this chapter is to describe the research method and the design of the study.

3.2 OBJECTIVES OF THE RESEARCH STUDY

The objectives of this research were twofold:

- To explore and describe the current infection control practices for surgical site infections in the operating room in the public hospitals in the Nelson Mandela Bay Municipality area, and to compare these practices against a selected evidence-based practice guideline.
- To make recommendations for the implementation of infection control practices, in order to prevent surgical site infections in the operating room.

3.3 THE RESEARCH DESIGN

De Vos et al., (2011:142) refer to research design as the plan, structure and strategy of an investigation; it is a blueprint, specifically created to answer the research question. The choice of research design depends on what is known, and what is not known about the research problem – and on the researcher's expertise.

A quantitative, explorative, descriptive, comparative-descriptive and contextual research design was used in this study, in order to gather information on the current infection control practices for the prevention of surgical infections in the operating room.
3.3.1 Quantitative research

Quantitative research is an approach to research, frequently used in all the sciences; it is highly formalized and explicitly controlled; and it involves the systematic collection of numerical information for analysis via statistical procedures (Houser, 2008:395). In quantitative research, the measurement and classification requirements of the information that is gathered demand that study designs are more structured, rigid, fixed and predetermined in their use, so as to ensure accuracy in measurement classification (Kumar, 2011:104).

Burns and Grove (2009:34) further define quantitative research as involving the systematic collection of numerical information and the analysis of that information by using statistical procedures. These authors tend to emphasize deductive reasoning, the rules of logic, and the measurable attributes of human experience, in order to explain this approach. According to Mouton and Marais (cited in de Vos et al., 2011:104), quantitative research is highly formalised and explicitly controlled; it has a range that is exactly defined; and it is relatively close to the physical sciences.

Furthermore, quantitative research-based studies attempt to investigate a research question or hypothesis by focusing on discrete and measurable aspects of an area of clinical and theoretical interest (Martin & Thompson, 2008:2).

This study is quantitative, as the researcher used a structured, self-administered questionnaire, which was the chosen data-collection method: the data obtained could then be analysed and interpreted, so as to explore and describe the infection control practices for the prevention of surgical site infections, as used by professional nurses in the operating room. A quantitative research study was chosen because this study deals with statistical analysis, and would therefore have a numerical value, which could then give a more precise indication of the professional nurses’ current infection control practices for the prevention of surgical site infections in the operating room.

3.3.2 Explorative Research

Explorative research begins with some phenomenon of interest, and is aimed at exploring the dimensions of that phenomenon; or it refines hypotheses about
relationships between phenomena and other factors to which they are related (Polit & Beck, 2012:727). The exploratory design is utilised during a research study when the researcher wants to explore a particular topic, or wants to examine a new interest, or the subject of the research study is relatively new (Babbie & Mouton, 2007:79).

According to Babbie (2010:92), exploratory research is conducted to gain insight into a situation, phenomenon, community or individual, where little is known regarding a specific topic. This is typically done for three purposes:

- To satisfy the researcher’s curiosity and desire for better understanding;
- To test the feasibility of undertaking a more extensive study;
- To develop the methods to be employed in any subsequent study.

The aim of this study was, therefore, to explore the infection control practices for the prevention of surgical site infections, as performed by professional nurses in the operating room.

3.3.3 Descriptive research

The purpose of descriptive designs is to explore and describe phenomena in real situations. This approach is used to generate new knowledge on concepts or topics about which limited, or no research, has previously been conducted (Burns & Grove, 2009:45).

Descriptive research is used when the primary purpose of a study is to name, characterize or thoroughly describe a phenomenon. Numerous methods can be used to collect the data, ranging from observations and physiological monitoring, to interviews and questionnaires (Polit & Beck, 2012:725). A descriptive study is also designed to gain more information about the characteristics within the particular field of study. Its purpose is to provide a picture of a situation, as it naturally happens. A descriptive design may be used to develop theories, identify problems with current practice, justify current practice, make judgements, or determine what other nurses in similar situations are doing.
No manipulation of the variables is permitted in a descriptive design (Burns & Grove, 2011:256).

According to Nardi (2006:9), descriptive research seeks to provide the basic information that describes the topic and the respondents involved. It is often the first step in conducting research. In this study, the researcher aimed to describe the infection control practices for the prevention of surgical site infections, as performed by professional nurses in the operating room.

### 3.3.4 Comparative-descriptive design

According to Mills, van de Bunt and de Bruijn (2006: 620), comparative research simply put, is the act of comparing two or more things – with a view to discovering something about one or all of the things being compared. A comparative-descriptive design describes the variables, as well as the differences between or among two or more groups, to see if, and if so, how – they differ on some variable (Brink, van der Walt & van Rensburg, 2012:110).

There are certain methods far more common than others in comparative studies, however. Quantitative analysis is much more frequently pursued than in qualitative studies; and this is seen in the majority of comparative studies, which use quantitative data. The general method of comparing things is the same as it is for comparative research (Mills et al., 2006: 620). The researcher explored and described the current infection control practices for the prevention of surgical site infections in the operating room in the three public hospitals in the Nelson Mandela Bay Municipality, and compared these practices with the selected evidence-based practice guidelines for the prevention of surgical site infections.

### 3.3.5 Contextual research

Context refers to matters that relate to a specific situation (Burns & Grove, 2009:693). The contextuality of the research refers to a study being done in the situation in which it normally occurs (Burns & Grove, 2011:268). Contextual research refers to the conditions at the site being investigated. These include the surroundings, the circumstances, or the setting where the study is to be conducted.
A contextual design is one where the phenomenon of interest is the immediate environment and physical location of the people studied. In a contextual study, the results and conclusions of the study are only valid for the context in which the research was performed (Brink, 2006:64).

The researcher conducted the research study in the operating rooms of three public hospitals in the Nelson Mandela Bay Municipality area. These public operating rooms (all contexts that are familiar to the researcher), have a turnover of about a thousand patients per month. Different surgical procedures are carried out routinely; for example, these could include orthopaedic, urological, neurological, gynaecological and general surgical procedures.

Therefore, the research study was contextual, since it was conducted in the operating rooms, where the participants are confronted daily with the need for infection control and the implementation of sterile-technique principles. The study was conducted amongst professional nurses working in the operating rooms of public hospitals in the Nelson Mandela Bay Municipal area.

3.4 THE RESEARCH METHOD

According to Burns and Grove (2011:58), the research method is the section of a research report that describes how the study was conducted; and it usually includes outlines of the study design, treatment, sample, setting, methods and measurement, as well as the data-collection process. Researchers must decide what methods they are going to use, in order to reach the research objectives.

3.4.1 The research population

The research population can be described as the set of elements the researcher focuses on, and to which the results of the study can be generalized. It includes the entire set of units for which the survey data are to be used, in order to make inferences (Burns & Grove, 2011:290). The target population is also referred to as the entire group of persons of interest to the researcher (Brink, 2006:132).

The target population included all available professional nurses at the time of the data collection. At this point, the population consisted of 80 respondents who are
permanently employed, and were working in the operating rooms. In this study, the results obtained from the sample were indeed generalized to the target population.

3.4.2 The sampling method

A sample is the unit of analysis, the element that the researcher is observing, or from which s/he is collecting the data, in an effort to understand the population from which it was drawn (De Vos et al., 2011:194).

Sampling can also involve selecting a group of people, events, behaviours, or other elements with which to conduct a study. The sampling method or sampling plan defines the selection process; and the sample defines the selected group of people. Samples should represent a sufficient proportion of the population they represent (Burns & Grove, 2011:290).

A non-probability convenience-sampling method was chosen for the study. In non-probability sampling, the odds of being included in the study are unknown, as it is not based on random selection. However, non-probability sampling methods can increase the likelihood of obtaining samples that are not representative of the target population (Burn & Grove, 2009:353).

In other words, convenience sampling can be defined as a form of non-probability sampling that includes respondents that are conveniently available to the researcher (Houser, 2008:223).

Furthermore, due to the fact that the professional nurses work both day and night shifts, convenience sampling was the most appropriate sampling method to choose. All professional nurses working in the operating room, except those that were on leave, or did not want to participate in the study, were included in the sample.

3.4.3 The data-collection instrument

Burns and Grove (2009:43) describe data collection as the precise, systematic gathering of information relevant to the research purpose, or the specific objectives, questions or hypotheses of a study; and the most widely used data-collection method by the researchers is structured self-reporting, which involves a formal,
written instrument. It is called a questionnaire or an SAQ (Self-administered questionnaire), where the participants complete the instrument themselves, either in a paper-and-pencil format, or on a computer (Polit & Beck, 2012:297).

According to Fox and Bayat (2007:88), questionnaires have the following advantages:

(a) They are cost-effective compared to investigations involving large sample sizes and large geographical areas, especially when the number of questions increases.
(b) They can be easily analysed via many computer-software packages.
(c) They are familiar to most people.
(d) They reduce the incidence of bias, because there is a uniform question presentation, and no middleman bias.
(e) They are less intrusive than telephonic, or face-to-face, surveys.

The data were collected by means of a questionnaire which was developed by the researcher, with the aid of the guidelines identified by means of the literature survey (see Chapter 2). The questions were relevant to the primary objective of the study.

Structured instruments vary in their degree of structure through different combinations of open-ended and closed-ended questions. Open-ended questions allow people to respond in their own words, in narrative fashion. Closed-ended questions offer response options, from which the participants must choose the one that most closely matches – what they consider is – the appropriate answer. The alternative may be a simple yes or no. Both open- and close-ended questions have certain strengths and weaknesses. Good closed-ended items are often difficult to construct, but easy to administer, and especially, to analyse (Polit & Beck, 2012:297).

According to Babbie (2010:240), closed-ended questions are popular, because they provide a greater uniformity of responses; and they are easily processed. The researcher explored the topic by using closed, open and Likert-type scale questions from a self-administered questionnaire. These aimed to encourage the respondents to identify what issues were important to their understanding of the research topic,
and to express their concerns. Moreover self-administered questionnaires gave the participants a feeling of anonymity, and thus encouraged honest responses. The questionnaires (Annexure F) consisted of two parts:

- **Section A:** This section was concerned with the demographic data, including the biographical information, such as the following: gender; professional qualifications; years working as a professional nurse in the operating room; and experience related to the care of patients;

- **Section B:** This section focused on infection control practices related to the prevention of surgical site infections in the operating room. The researcher based the questionnaire on the literature review that was developed by the Centre for Disease Control and Prevention, which was the guideline for the prevention of SSI, formulated for the Operating Room, and which was based on the infection control principles (Mangram *et al.*, 1999).

The 39-item questionnaire was compiled in English; and the questions were constructed in such a way that they were unambiguous and user-friendly; thereby, ensuring that all the participants interpreted the questions in the same way. The subsections of the questionnaire were based on the information, as described in the evidence-based practice guidelines. The subsections of the questionnaire consisted of the following: pre-operative preparation of the patient (5 items); hand/forearm antisepsis for surgical team members (6 items); management of infected or colonized surgical personnel (4 items); ventilation in operating room (8 items); cleaning and disinfection of environmental surfaces (5 items); microbiological sample (1 item); sterilization of surgical instruments (2 item); and surgical attire and drapes (7 items).

The most widely used scaling technique is the Likert scale, named after the psychologist, Rensis Likert, who devised standardized response categories in survey questionnaires (Babbie, 2010:180). A Likert scale consists of several declarative items that express a viewpoint on a topic. Participants typically are asked to indicate the degree to which they agree or disagree with the opinion expressed by the statement (Polit & Beck, 2012:300).
A Likert-type scale, with yes and no questions, was used. In the response options for the Likert scale, there is typically a list of statements to which the participants indicate whether they strongly agree, agree or disagree; while true or false may also be a response option in some cases (Babbie, 2010: 179).

3.4.4 The pilot study

The function of the pilot study is to obtain information for improving the project, or for assessing its feasibility; it is commonly defined as a smaller version of the proposed study conducted, in order to refine the methodology (Burns & Groove, 2009:44). The researcher needs to ensure that the pilot study has been completed before the commencement of the real study, so that s/he can check the feasibility of the techniques, and determine the reliability and feasibility of the instrument.

The researcher is then given the opportunity to correct problems identified during the pilot study (Jooste, 2010:300).

A pilot study was, therefore, conducted using eight professional nurses, in a public hospital's operating rooms in the Nelson Mandela Bay Municipality (the pilot study was based on discussions with, and recommendations from, the statistician). Consent was obtained from the hospital and unit manager of the hospital – prior to conducting the pilot study. A pre-arranged time and date for doing the pilot study was established with the unit manager, in order to avoid disruption of normal activities in the operating room. The research objectives and purpose were explained to the participants; and their informed consent was obtained from those individuals who wanted to participate in the pilot study.

No problems were encountered in answering and understanding the questions. The results from the pilot study were included in the body of the research study.

3.4.5 The data-collection method

Data collection is a process of acquiring the subjects and collecting the data from the study. The actual steps of collecting the data are specific to each study; and they depend on the research design and the measurement techniques. During the data collection period, the researcher focused on obtaining participants; collecting the
data in a consistent way; maintaining research controls and solving problems that might threaten to disrupt the study (Burns & Grove, 2011:361).

The researcher obtained permission from management of the public hospitals, in the Nelson Mandela Bay Municipality area, to conduct the research study (see Annexures C, D, and E). The professional nurses, working in the operating rooms, were approached; and their consent was obtained for their voluntary participation in the research study. The participants were assured that they would remain anonymous; and they were asked not to write their names anywhere on the questionnaire (Annexure A).

After permission to conduct the study had been granted by the hospital management; and the respondents had agreed to participate in the study – by signing the consent form (Annexure B) – the process of data collection commenced. The researcher distributed the questionnaires (Annexure F) in a sealed envelope, and delivered them personally to the participants at the institution where they worked; this was done 10-15 minutes prior to the commencement of duty on each shift: night and day.

The participants were given an opportunity to read through the questionnaire to clarify any misunderstandings with the researcher. The questionnaire was completed by the participant working in the operating room. To clarify questions and misunderstandings, the researcher was present in the operating room, when the participants completed the questionnaire. The completed questionnaires were handed over to the researcher – in a sealed envelope.

### 3.4.6 The data analysis

Inferential statistics are used to estimate the generalizability of the findings of the data through the analysis of the sample to the larger population, from which the sample was selected (Babbie, 2010:445). Descriptive statistics summarise patterns in a sample (LoBiondo-Wood & Haber, 2010:310). In this study, the researcher aimed to use descriptive statistics to analyse and describe the data. Descriptive statistics, with the assistance of a statistician, were used during the research study, to describe the professional nurses’ responses in the questionnaires, and also to
summarise their use of infection control practices for the prevention of surgical site infections in the operating room.

The following steps were performed as part of the data-analysis process (Myatt & Johnson 2009:6):

(a) Questionnaire checking – this involves eliminating unacceptable questionnaires. This comprises incomplete questionnaires, those with missing pages, or where instructions have been grossly disregarded, such as marking more than one answer, where the instructions stipulate choosing only one option. As agreed with the statistician, a questionnaire must not have more than three missing or incorrectly marked answers, in order to be included in the data analysis. However, no questionnaires needed to be eliminated in this study. Questionnaire checking was the responsibility of the researcher.

(b) Coding comprises the assignment of numerical codes to the raw data, in order to prepare them for statistical techniques. Coding was performed by the researcher. Numbers, from 1-68, were assigned to each questionnaire collected from the participants. The coding process was necessary in order to assist in capturing the findings from the health-care sectors; and the allocated numbers were thus only reflected in the data verification and frequency tables, but not in the final presentation of the data.

(c) Transcribing the transferred of encoded data onto a system or program in order to perform the statistical analyses. The statistician transferred the encoded data onto a spread sheet, in order to perform the required statistical analyses.

(d) Analysis strategy selection was the responsibility of the statistician, who had decided that descriptive statistics constituted an appropriate data-analysis strategy.

(e) The tabulation and coding of the raw data were the responsibility of the researcher. The data were first edited, to detect any errors, and then encoded.
Descriptive statistics are used to describe and synthesise the data; this helps the researcher to organize the data in ways that give meaning and insight – and also to examine a phenomenon from a variety of angles. Averages and percentages are examples of descriptive statistics (Burn & Groove, 2009:470). The data that were analysed with the assistance of a statistician are represented and displayed in the form of tables and graphs. The Statistica version 11 program was used for the data analysis.

STATISTICA is a set of computer programs for analysing, storing and reporting the data. These programmes are licensed to a statistician at the Nelson Mandela Metropolitan University (NMMU).

The researcher grouped the questions in the questionnaire into sections A and B; and she could immediately see the results of the participants in each section; this enabled presentation of the results of the study in tables and graph form, making use primarily of bar graphs, thereby indicating the frequency of the responses, as well as the frequency distribution scores obtained by the respondents.

3.5 QUALITY OF THE RESEARCH

To gain high quality in the research study, the researcher ensured that the questionnaires had acceptable levels of reliability and validity.

3.5.1 Reliability

Reliability is defined as the stability and consistency of a measurement; i.e. if the same variable is measured under the same conditions, the measurement instrument should yield the same, or almost identical, results. A reliable instrument provides consistent, stable and repeatable results. Reliability refers to the degree of consistency or dependability with which an instrument measures the attribute it is designed to measure. The reliability and validity of an instrument are not totally independent qualities, because an instrument that is not reliable cannot provide a valid measurement (Polit & Beck, 2012:331).

Reliability is concerned with how consistently an instrument measures the phenomenon of interest, or the accuracy of the data – in the sense that they reflect
the true measures of the phenomenon under investigation. Test-retest can be used to establish the reliability of an instrument (De Vos et al., 2011:177). The questionnaire was developed by the researcher, and was test-retested by distributing the questionnaire to professional nurses.

Furthermore, the reliability of the questionnaire was established by submitting it to the experts in operating-room technique, to ensure that the information gathered from the questionnaire was consistent with the research study, and that the questions were consistent with the topic of the research study. The reliability of the questionnaires was also ensured by conducting a pilot study.

### 3.5.2 Validity

Validity refers to whether the instrument actually measures the concept in question, and whether the concept is measured accurately. A validity-measuring instrument has been described as doing what it is intended to do. In other words, is it measuring what it is supposed to measure, and yielding scores whose differences are reflected in the variable being measured, rather than reflecting any random or constant error? (De Vos et al., 2011:172)

According to Polit and Beck (2012:175), validity is an important criterion for evaluating methods intended to measure variables. Therefore, validity refers to whether the instrument does measure the actual concept in the question, and if so, whether the concept is accurately measured. Babbie (2010:153) describes validity as the extent to which an empirical measure adequately reflects the real meaning of the concept under consideration.

Validity can be divided into two sub-groups, namely: internal and external validity. External validity is the degree to which the study results can be generalized to settings or samples other than the one studied; while internal validity refers to the scientific rigour applied in the study, and also, whether different causes or explanations for the research results obtained have been taken into account. Internal validity thus enables the researcher to draw unambiguous conclusions from the results (Polit & Beck, 2012:727).
The two components of internal validity, used for the present study, i.e. content and face validity, will be discussed briefly, as they relate to this study:

**Content validity:** According to de Vos et al. (2011:173), content validity is established on the basis of experts’ judgements of whether the instrument covers all the facets that make up the concept. According to Babbie (2010:155), content validity is the degree to which the items in the instrument represent the content of the research study.

The researcher ensured the content validity of the instrument by consulting experts in the field of operating-room techniques. The questionnaire was given to a statistician, a clinical facilitator in the operating room, as well as to a lecturer in operating-room nursing – to assess the content.

**Face validity:** Face validity is concerned with the superficial appearance of a measurement procedure. It refers to whether the instrument looks as if it is, in actual fact, measuring the target construct. The instrument must be structured in such a way that it not only accurately measures the concept, but also appears to be a relevant measure of those concepts (Polit & Beck, 2012:336). According to de Vos et al. (2011:173), face validity refers to whether the instrument looks – or appears – as if it is measuring the appropriate construct.

The questionnaire was reviewed by the research supervisor and the statistician before handing it to the participants. An easy-to-read format was provided by using unambiguous terms in easy-to-understand language, and by ensuring that the range of possible answers covered each question posed.

### 3.6 ETHICAL CONSIDERATIONS

Research ethics involves the application of fundamental ethical principles to a variety of topics in scientific research. Ethics refers to the standards of behaviour and practical procedures that the researcher is expected to follow, when humans are used as the study participants. Care must be exercised to ensure that the participants’ rights are protected (Polit & Beck, 2012:150). Ethical research is
essential to generate a sound evidence-based practice for nursing (Burns & Groove, 2009:184).

Polit and Beck (2012:150) attempt to summarize the basic ethics into four broad principles, on which the standards of ethical conduct in research are based, namely: confidentiality, the anonymity of the participants, informed consent and privacy.

3.6.1 The right to privacy

According to (Jooste, 2010:278), privacy is that which is not intended for others to observe or analyse. It is important, therefore, to respect research participants’ right to privacy. This right should always reflect the freedom people have to determine the time, extent, and general circumstances under which their private information will be shared with, or withheld, from others. Such information may include person’s attitudes, beliefs, behaviours, opinions, and records. The research participants’ privacy is protected if each participant is kept fully informed, consents to participate in the study, and voluntarily shares private information with the researcher (Burns & Grove, 2011:114).

Polit and Beck (2012:156) explain that, the right to privacy encompasses the individual’s right to decide when, where, to whom, and to what extent, his or her attitudes, beliefs and behaviour will be revealed. Researchers should ensure that their research is not more intrusive than it needs to be, and that the participant’s privacy is maintained throughout the study. Participants have the right to expect that any data they provide will be kept in the strictest confidence.

The researcher assured the participants that no identification number would be used on the questionnaire, and would thereby reveal for their privacy (Annexure A). Moreover, only the researcher, the supervisors and the statistician had access to the information that had been gathered from the participants.

3.6.2 The right to anonymity

According to De Vos et al. (2011:28), anonymity means no-one, including the researcher, should know the identity of any participant after the research has been completed. According to Mouton (2006:244), anonymity refers to the principle that
the participant’s identity is kept secret, whereas the principle of confidentiality refers to the information that has been gathered from the participants. Polit and Hungler (2007:451) state that anonymity refers to the protection of the participant in a study, so that even the researcher is not able to link him/her to the information provided.

Hence, the names of the participants were substituted with codes; and the name of the hospital, where the study was conducted, is not revealed in the final report of the study.

3.6.3 Confidentiality

Confidentiality refers to the protection of the participants in a study, so that their individual identities cannot be linked to the information that they provide, and would never be publicly divulged (Polit & Hungler, 2007:454). Confidentiality refers to the researcher’s responsibility to protect all the data gathered – within the scope of the project – from being divulged, or made available to any other person. This means that the research data should never be shared with outsiders, and that this is reflected in the researcher’s management of private information shared by a participant (Polit & Beck, 2012:162).

The researcher must refrain from sharing that information without the authorization of the participant. Confidentiality is grounded on the following premises: (1) Individuals can share personal information to the extent they wish to – and they are entitled to have secrets; (2) one can choose with whom to share one’s personal information; (3) those accepting information in confidence have an obligation to maintain confidentiality; and (4) professionals, such as researchers, have a duty to maintain confidentiality that goes beyond ordinary loyalty (Burns & Grove, 2013:117).

The participants were given an assurance that all the information they shared would be kept private, and would not be discussed with any other person besides those involved with the research (Annexure A).

3.6.4 The right to informed consent

According to De Vos et al. (2011:24), informed consent refers to the consent obtained from the participants, once all the information regarding the study (that is,
the purpose of the study, the potential risks or benefits and all other relevant information) has been revealed to the participants. Informed consent means that a person must understand that to which s/he is agreeing. The right to informed consent means that all the relevant information must be supplied to the participants, in order for them to become the participants in this study (Burns & Grove, 2011:112).

Permission was obtained from the Departmental Research Committee (DRC), Faculty Research, Technology and Innovation Committee (FRTI, reference number: H13-HEA-NUR-008) and also from the Human Ethics committee of the Nelson Mandela Metropolitan University (NMMU), as well as the Department of Health of the Eastern Cape Province. The participants were given a letter describing the nature of the study. Consent was requested from the relevant persons prior to conducting the research (Annexures, A, C, D, E, H and I). Written consent was obtained from all the participants.

3.6.5 The right not to be harmed in any manner

According to Mouton (2006:245), the process of conducting research must not expose the participants to any risk of personal harm.

In this research, the study questionnaires were only used for the data collection. To avoid harming participants emotionally, the anonymity rule was strictly enforced. Moreover, no personal questions were asked and the questionnaires were numerically coded, and no identifying information appeared on them.

3.7 THE THEORETICAL FRAMEWORK

The research study was based on the PARiHS (Promoting Action on Research Implementation in Health Services). According to Rycroft-Malone (2004:299), the PARiHS framework presents successful research implementation as a function of the relationships connecting evidence, context, and facilitation. The framework considers these elements to have a dynamic, simultaneous relationship; and has therefore provided a measure of theoretical rigour and conceptual clarity for this investigation into the causes of the increased rate of surgical site infection in the
operating rooms. The following sections outline the three elements of the PARiHS framework that are relevant to this research and development work:

- Evidence
- Context
- Facilitation

The proposition is that for the implementation of evidence to be successful, there needs to be clarity about the nature of the evidence being used, the quality of the context, and the type of facilitation needed to ensure a successful change process. Most successful implementations seem to occur when evidence is scientifically robust, and matches professional consensus and patients' preferences (high evidence). Furthermore, the context needs to be receptive to change with sympathetic cultures, strong leadership, and appropriate monitoring and feedback systems (high context); and there should also be an appropriate facilitation of change, with input from skilled external and internal facilitators (high facilitation), (Kitson et al., 2008:12).

In this research study, the facilitation component will be used, in order to make recommendations for the implementation of infection control practices, and to prevent surgical site infections in the operating room.

3.8 FACILITATION

In the context of the PARiHS framework, facilitation refers to the process of enabling the implementation of evidence in practice. Thus, facilitation is achieved by an individual carrying out a specific role (i.e. a facilitator), which aims to help others. This indicates that facilitators are individuals with the appropriate roles, skills, and knowledge to help individuals, teams, and organizations apply evidence in practice (Rycroft-Malone, 2004:299).

In the PARiHS framework, high facilitation relates to the presence of appropriate facilitation, and to the absence of appropriate facilitation, or inappropriate facilitation. Appropriate facilitation may encompass a range of roles and interventions,
depending on the needs of the situation. The facets of facilitation are organized into the three broad themes of: purpose, role, skills and attributes (Kitson et al., 2008:13).

The PARiHS framework acknowledges that the purpose of facilitation can vary from a focused process of providing help and support to achieving a specific task ("task") to a more complex, holistic process of enabling teams and individuals to analyse, reflect, and change their own attitudes, behaviours, and ways of working ("holistic"). As the approach moves toward the holistic goal, facilitation is increasingly concerned with addressing the whole situation and the whole person.

As the purpose of facilitation appears to vary within the literature, there also are multiple interpretations of the facilitator role in practice (Rycroft-Malone, 2004:300).

The researcher might play the facilitator role in implementing the findings of the study or facilitating the implementation of the evidence based practice guideline if required for further research studies. The concept of facilitation would only be achieved after the researcher's evaluation of the research findings; and these will be delivered to the professional nurses in the operating theatre in the form of recommendations for the implementation of infection control practices, in order to help prevent surgical site infections in the operating room.

### 3.9 SUMMARY OF THE CHAPTER

The research was conducted in a quantitative, explorative, comparative-descriptive, and descriptive manner. The aim of this study is to explore and describe the current infection control practices for the prevention of surgical site infections in the operating room, and to compare these practices against an evidence-based practice guideline in a public health-care sector in the Nelson Mandela Bay Municipality. In order to gain the information needed to conclude the study, questionnaires were used as the instrument for the data collection. The researcher considered the ethical aspects of the research study as important; and this concern was carefully maintained throughout the study. Chapter Four will provide a comprehensive description and discussion of the results of the research study.
CHAPTER FOUR
DATA-ANALYSIS AND DISCUSSION

4.1. INTRODUCTION

In Chapter Three, a full description was given of the research design and method. The objectives of the study were to explore and describe the current infection control practices for surgical site infections in the operating room in the public hospitals in the Nelson Mandela Bay Municipality, and to compare these practices those in a selected evidence-based practice guideline.

This chapter consists of the results and discussion of the information obtained through the questionnaires. The results guided the researcher in making recommendations for change to the existing guidelines on infection control in the operating-room complex. The information gathered from the participants will be presented in the form of tables and figures. The questionnaires consisted of two sections (A and B). Section A addressed the biographical data of the participants, while section B looked at the infection control practices for the prevention of surgical-site infections in the operating room.

The questionnaires were completed by professional nurses working in the operating rooms of the public hospitals in the Nelson Mandela Bay Municipality.

This chapter will focus on the data collection and the analysis. Each section of the questionnaire will be discussed separately. An outline of the data results, together with a discussion of the results, will be provided.

4.2. DATA COLLECTION AND ANALYSIS

The data-collection method, instrument and the process of analysis have already been discussed in Chapter Three.

A total of 80 respondents were initially considered for inclusion in the study. However, 12 were excluded for varying reasons, such as: being on annual leave (5);
sick leave (4); study leave (3). The stated reasons for the exclusion are depicted by the arrow on the Figure 4.1 below.

A total number of 68 questionnaires were distributed and returned; and all the questionnaires were adequately completed, and could be included in the analysis.

A total of 68 respondents were included in the study. An 85% response rate was thus obtained. A schematic presentation of the sampling process is illustrated in Figure 4.1.

![Figure 4.1: The sampling process](image-url)
4.3 SECTION A – DEMOGRAPHIC DATA

Section A addressed the participants’ demographic data, which was conducted in order to determine the participants’ gender, age, the number of years practising as a professional nurse, the highest nursing qualification, and the surgical discipline(s) in which they were currently working in the operating room.

Table 4.1: Demographic data

<table>
<thead>
<tr>
<th>Gender of the participants</th>
<th>Responses (n=68)</th>
<th>Percentages %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>2</td>
<td>3%</td>
</tr>
<tr>
<td>Female</td>
<td>66</td>
<td>97%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age of the participants</th>
<th>Responses (n=68)</th>
<th>Percentages %</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-34 years</td>
<td>5</td>
<td>8%</td>
</tr>
<tr>
<td>35-40 years</td>
<td>9</td>
<td>13%</td>
</tr>
<tr>
<td>41-50 years</td>
<td>22</td>
<td>32%</td>
</tr>
<tr>
<td>51-60 years</td>
<td>32</td>
<td>47%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Years working in the operating room</th>
<th>Responses (n=68)</th>
<th>Percentages %</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;1 year</td>
<td>1</td>
<td>2%</td>
</tr>
<tr>
<td>1-2 years</td>
<td>1</td>
<td>2%</td>
</tr>
<tr>
<td>3-4 years</td>
<td>1</td>
<td>2%</td>
</tr>
<tr>
<td>5-10 years</td>
<td>16</td>
<td>22%</td>
</tr>
<tr>
<td>11 years or more</td>
<td>49</td>
<td>72%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Basic qualification</th>
<th>Responses (n=68)</th>
<th>Percentages %</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-year diploma</td>
<td>40</td>
<td>59%</td>
</tr>
<tr>
<td>4-year degree</td>
<td>4</td>
<td>6%</td>
</tr>
<tr>
<td>Bridging course</td>
<td>14</td>
<td>20%</td>
</tr>
<tr>
<td>Other</td>
<td>10</td>
<td>15%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Post-registration qualification</th>
<th>Responses (n=68)</th>
<th>Percentages %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>49</td>
<td>72%</td>
</tr>
<tr>
<td>No</td>
<td>19</td>
<td>28%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Indication of post qualification</th>
<th>Responses (n=68)</th>
<th>Percentages %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating-room nursing</td>
<td>46</td>
<td>85%</td>
</tr>
<tr>
<td>Other</td>
<td>8</td>
<td>15%</td>
</tr>
</tbody>
</table>
4.3.1 DISCUSSION PERTAINING TO THE DEMOGRAPHIC DATA

Of the 68 participants, two were males (3%); and sixty-six (97%) were females. The reason for this result might be due to the fact that there are more females than males in the nursing profession in the Eastern Cape, and probably because nursing is a predominantly female profession. However, much has been written about nurses, with particular reference to their being a predominantly female group. According to statistics, there are only 827 male registered nurses and 12 400 female registered nurses in South Africa (SANC, 2008).

With regard to the participants’ age, the data revealed that of the 68 participants, 32 (47%) were older than 50 years; twenty-two (32%) of the participants were between the ages of 41-50 years; 9 (13%) of the participants were between the ages of 35-40 years; and five (8%) were between the ages of 30-34 years.

Therefore, it is shown in the study that the highest percentage of registered nurses were within the range of 51-60 years of age, which comprises 47% of the largest group of the research study; and this could affect their level of competency, based on the old, and more traditional ways of practice, in preventing surgical site infection in their various operating rooms; and this might therefore, affect their compliance with the best recommended practice, which is evidence-based practices that are to be implemented.

The respondents had varied experience practising as professional nurses. The highest number of 49 respondents (72%) had more than 11 years’ experience; 16 respondents (22%) falling between five to ten years; and 1 (2%) with three to four years. One respondent (2%) had less than one year of experience practising as a professional nurse; and one (2%) had between 1-2 years of experience. It can be seen that the majority of the respondents have had more than eleven years’ experience in the operating room, which emphasises the important role of experience and competency in handling of cases in the operating room.

It is also important, in the case of professional nurses, to assess their view on evidence-based practice in preventing surgical site infections.
In terms of basic qualifications, the following results indicate that the majority of the participants had completed a four-year diploma: 40 (59%); and four (6%) that had done a degree course. Fourteen participants (20%) completed the bridging course; and the remaining 10 (15%) had obtained other additional qualifications.

There were forty-nine participants that had done a post-registration nursing course, of whom forty-six (85%) had done the course in operating-room technique; and one participant had completed a post-basic nursing administration course. Other qualifications (e.g. from nursing administration, education, management) comprised eight (15%). Fourteen participants left the question blank.

It is important for professional nurses in the operating theatre to have the additional qualification in operating-room technique with the necessary skills and training to perform quality nursing care, by carrying out standardized practices in maintaining sterile technique and preventing surgical site infections. Table 4.1 above summarises the findings.

### 4.3.2 SURGICAL DISCIPLINES IN THE OPERATING ROOM

Table 4.2 below indicates the percentages of registered nurses working in different surgical disciplines in the operating room. The percentage does not total 100%, since some of the respondents selected more than one discipline.

**Table 4.2: Registered nurses working in different surgical disciplines**

<table>
<thead>
<tr>
<th>Discipline</th>
<th>Responses</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orthopaedic surgery</td>
<td>35</td>
<td>51%</td>
</tr>
<tr>
<td>Neurosurgery</td>
<td>26</td>
<td>38%</td>
</tr>
<tr>
<td>Gynaecological surgery</td>
<td>29</td>
<td>43%</td>
</tr>
<tr>
<td>General surgery</td>
<td>53</td>
<td>78%</td>
</tr>
<tr>
<td>Urological surgery</td>
<td>15</td>
<td>22%</td>
</tr>
<tr>
<td>Otorhinolaryngological surgery</td>
<td>10</td>
<td>15%</td>
</tr>
<tr>
<td>Thoracic</td>
<td>23</td>
<td>34%</td>
</tr>
<tr>
<td>Reconstructive</td>
<td>14</td>
<td>20%</td>
</tr>
<tr>
<td>Ophthalmology</td>
<td>13</td>
<td>19%</td>
</tr>
<tr>
<td>Endoscopic</td>
<td>28</td>
<td>41%</td>
</tr>
</tbody>
</table>
The results indicate that the majority of the participants are currently working in general surgery 53 (78%); while the remaining participants are working in orthopaedics 35 (51%); and neurosurgery 26 (38%); and in gynaecology 29 (43%); otorhinolaryngology 10 (15%); reconstructive surgery 14 (20%); ophthalmology 13 (19%); thoracic surgery 23 (34%); and urological surgery 15 (22%). General, orthopaedic, gynaecological and neurosurgery are the disciplines that need more attention in preventing surgical site infection, because the patient may develop septicaemia, which can be fatal.

Mangram et al. (1999: 254) explain that when a gastrointestinal organ is opened during general surgery, pathogens like gram-negative bacilli (e.g., *E. coli*), organisms (e.g., enterococci), and sometimes anaerobes (e.g., *Bacillus fragilis*) are the typical source of SSI isolates.

In all of the disciplines mentioned in the Table 4.2, the patient could develop infection during surgical procedures, which would cause a delay in the healing process, and increase the hospital stay of the patient, and could also lead to various complications. This increases the importance of professional nurses having experience of, and also implementing, the necessary infection control in the prevention of surgical site infection.

### 4.4 SECTION B – INFECTION CONTROL PRACTICES RELATED TO THE PREVENTION OF SURGICAL SITE INFECTIONS IN THE OPERATING ROOM

This section was related to infection control practices for the prevention of surgical site infections. Respondents were given statements; and they had to choose from a Likert Scale ranging from 1 to 5 (to what extent they agreed or disagreed) and 1 (always) to 4 (never) with the statements provided. Each statement will be discussed separately, starting from pre-operative and intra-operative preparation of the patient. The results are graphically presented in the form of bar graphs, as allocated figures in this chapter. A summary of the results is provided.
4.4.1 Removal of hair pre-operatively

The participants were given a statement below to explore whether they remove hair pre-operatively – in case the hair at or around the incision site might interfere with the operation. The data revealed that, of the 68 participants, 30 (44%) of the participants always agreed with the statement (although the guideline does not recommend this; shaving should be done on the night before the surgery (Mangram et al., 1999:266). Twelve (18%) of the participants agreed with the statement; and 8 (12%) of the participants seldom agreed with the statement; while 18 (26%) of the participants never agreed with the statement.

![Bar Chart]

**Figure 4.2: Removal of hair pre-operatively**

De Lange (2007:44) suggests that the hair must not be removed, unless it is necessary, in order to perform the procedure. If removed, it must be done with clippers immediately prior to surgery. Razors abrade the skin, causing niches for microbial colonization of bacteria to continue to multiply, migrating upward from along the shaft, sebaceous ducts and glands during surgery. These could contaminate the wound. Warmth, moisture builds up, and occlusions, created with the use of impervious adhesive drapes, cause a dangerous effect, and thus increase microbial counts (Mangram, 1999:265).
Comparing the results with the CDC guideline used for this study, it was found that air removal was not all done according to the guideline, because shaving must be done on the night before the surgery, and not on the operating table.

### 4.4.2 Removal of hair immediately before the operation

In response to a question on the removal of hair immediately before the operation, the data revealed that of the 68 participants, 18 (26) always agreed with the statement; 16 (24%) often agreed with the statement; 8 (12%) seldom agreed with the statement; while 26 (38%) of the participants never agreed with the statement.

![Figure 4.3: Percentage of those that do remove hair immediately before the operation](image)

According to these data collected, it was found that pre-operative hair removal was done by 46% of the participants. However, this is incorrect practice, as the guideline does not recommend this. According to the guideline, traditionally, shaving has to be done on the night before surgery, believing that the removal of the hair reduces the incidence of wound infection (Mangram et al., 1999:266). However, studies have also shown that shaving the surgical site is associated with a significantly higher SSI risk, because of microscopic cuts in the skin that later serve as foci for bacterial multiplication (CDC, 2011:380).
4.4.3 Pre-operative antiseptic shower

The data revealed that of the 68 participants, 29 (42%) of the participants always agreed with the correct statement; 8 (12%) of the participants often agreed with the statement; 8 (12%) of the participants seldom agreed with the statement; and 23 (34%) of the participants never agreed with the statement.

Figure 4.4: Pre-operative antiseptic shower

The results show that pre-operative antiseptic showers were not done in some of the operating rooms, as indicated in Figure 4.4. This is incorrect, since the guideline requires patient to shower or bathe with an antiseptic agent on at least the night before the operation (Mangram et al., 1999:266). The patient’s skin is a major source of bacterial contamination in clean wound operations; and a pre-operative antiseptic shower or bath decreases skin microbial colony counts (Thurston, 2009: 138).

4.4.4 Aseptic skin preparation

The data reveal that of the 68 participants, 41 (61%) of the participants always agreed with the statement, which was correct; 14 (20%) of the participants often agreed with the statement; 4 (6%) of the participants seldom agreed with the statement; and 9 (13%) of the participants never agreed with the statement.
Therefore, it may be deduced that 81% of the participants agreed that thorough washing and cleaning at or around the incision site to remove gross contamination before performing antiseptic preparation should be practised, which is in accordance with the guideline used for this study (Mangram et al., 1999:266).

4.4.5 Antiseptic agent use for skin preparation

The participants were given the above statement to discover whether they are using the appropriate antiseptic agents for skin preparation during the pre-operative care of the patient. The data revealed that of the 68 participants, 61 (89%) of the participants always agreed with the statement, which was correct; 5 (7%) of the participants often agreed with the statement; while only 1 (2%) of the participants seldom agreed with the statement. Moreover, only 1 (2%) of the participants never agreed with the statement of antiseptic agent used for skin preparation.
The results show in Figure 4.6 that pre-operative antiseptic skin preparations were done correctly in the majority of the operating rooms, which is in accordance with the guideline used for this study. The CDC (2011:384) revealed that skin antiseptics control the SSI risk in the pre-operative management of patients.

### 4.4.6 Nail care

The question aimed at exploring whether the participants keep their nails short, and do not wear artificial nails, in order to prevent surgical site infection in the operating room. The data revealed that of the 68 participants, 63 (92%) always agreed that the nails should be kept short, and that artificial nails should not be worn; 2 (3%) of the participants often agreed with the statement; 1 (2%) of the participants seldom agreed with the statement; 2 (3%) of participants never agreed with the statement.
The result was according to the guideline used: fingernails should be kept clean, and should not extend beyond the fingertips; and artificial nails should not be worn (Mangram et al., 1999:268). Fingernails that are long and extend beyond the fingertips can puncture the gloves – thereby placing the patient at risk of SSI from exposure to the transient and resident skin flora. Additionally, long fingernails place the patient at risk for injury when the surgical team member is providing direct care to the patient, such as assisting the patient in moving from the stretcher to the O.R. bed, patient positioning, and suchlike (AORN, 2012[b]:75).

The subungual area has been identified as harbouring the majority of microorganisms compared to the skin of the hands and forearms. Debris should be removed from the subungual area with the use of a sterile, plastic single-use, disposable nail cleaner that is usually provided with the scrub-brush package (Gayle, 2008:45).

According to AORN (2012 [b]:79), studies found that hand carriage of gram-negative organisms is higher among wearers of artificial nails than among non-wearers. Cultures of surgical team members who wear artificial nails demonstrate increased bacterial and fungal counts compared to personnel who do not wear artificial nails.
(Gayle, 2008:42). Additionally, hand carriage of gram-negative organisms has been shown to be greater among wearers of artificial nails than among non-wearers (CDC, 2008).

4.4.7 Duration of first pre-operative surgical scrub

The participants were given the above statement to discover whether they perform a pre-operative surgical scrub for at least five to seven minutes, using an appropriate antiseptic for the first scrub of the day. The data revealed that of the 68 participants, 48 (71%) of the participants always agreed with the statement; 10 (15%) of the participants often agreed with the statement; 7 (10%) of the participants seldom agreed with the statement; and 3 (4%) of the participants never agreed with the statement.

![Figure 4.8: Duration of first pre-operative surgical scrub](image)

The CDC 1999 recommends that, hand washing – first with an antiseptic solution and running water – and then surgical hand antisepsis, by washing with an antimicrobial surgical scrub or an alcohol-based antiseptic hand rub, would help in reducing the microbial count (Mangram et al., 1999:267).
The timing of the surgical scrub is an important part of the procedure. Historically, a longer scrub has been thought to be more effective. They found that 5-7 minutes scrub is quite sufficient for the first scrub of the day, as this proves to be just as effective in lowering bacterial counts (AORN, 2013:64).

An antiseptic must meet several qualifications including: decreasing microbial counts; be fast-acting; and prevent regrowth of organisms, particularly in a gloved hand where a warm, moist environment can easily foster the growth of organisms. Other traits are the bactericidal nature of the antiseptic, a broad spectrum of activity and the timing of the scrub. Antiseptics include: alcohols, chlorhexidine, chloroxylenol, hexachlorophene, iodine and iodophors, quaternary ammonium compounds, and triclosan (AORN, 2013: 64).

The most effective antiseptics contain 60% to 95% alcohol alone, or contain 50% to 95% alcohol and quaternary ammonium compounds, hexachlorophene, or chlorhexidine gluconate. However, bacterial growth is slowed after pre-operative scrubbing with an antiseptic agent, reducing resident skin flora on the hands of the surgical team for the duration of a procedure, and thereby reducing the risk of bacteria being released into the surgical field if gloves become punctured or torn during surgery (CDC, 2011:382).

### 4.4.8 Duration of subsequent pre-operative surgical scrub

The participants were given the above statement to discover whether the participants perform a pre-operative surgical scrub for at least three to five minutes, using an appropriate antiseptic for the remaining scrubs of the day. The data reveal that of 68 participants, 40 (59%) of the participants always agreed with the statement; 12 (17%) of the participants often agreed with the statement; 10 (15%) of the participants seldom agreed with the statement; and 6 (9%) of the participants never agreed with the statement.
Figure 4.9: Duration of subsequent pre-operative surgical scrub

It may, therefore, be concluded that more than half (76%) of the participants perform a pre-operative surgical scrub for at least 3-5 minutes, using an appropriate antiseptic for the remaining scrubs of the day, which is the correct practice when comparing the results with the guideline used (Mangram et al., 1999:267).

Pratt and Pellowe (2007:62) provide a detailed evidence-based guideline for hand hygiene in all healthcare settings, hand washing being required for all occasions where soiling and visible contamination are present, which includes the need for a hand wash after removing gloves. The same report advises that alcohol-based hand rubs are effective for use between caring interventions with the same patient.

4.4.9 Care underneath fingernails

The participants were given the above statement to discover whether the participants trim underneath each fingernail prior to performing the first scrub of the day. The data reveal that of the 68 participants, 41 (60%) of the participants always agreed with the statement, by cleaning underneath each fingernail prior to the first surgical scrub of the day; 11 (16%) of the participants often agreed with the statement; 10 (15%) of the participants seldom agreed with the statement; and 6 (9%) of the participants never agreed with the statement.
According to Kennedy (2013:17) the CDC suggested that the first scrub of the day should include a thorough cleaning underneath the fingernails (usually with a brush).

The 60% of participants therefore did adhere to best-recommended practices, by cleaning underneath each fingernail prior to performing the first surgical scrub of the day. The guideline stated that, underneath each fingernail must be cleaned, prior to performing the first surgical scrub of the day (Mangram et al., 1999:267).

4.4.10 Surgical hand scrub

The results revealed that the majority of the respondents: 63 (92%) always agreed with the statement, by keeping their hands up and away from the body (elbows in flexed position), so that water runs from the tips of the fingers towards the elbows after a surgical scrub; 3 (4%) of the often agreed with the statement; 1 (2%) of the participants seldom agreed with the statement; and 1 (2%) of the participants never agreed with the statement.
The results reveal that the participants did adhere to the best-recommended practice. The guideline stated that after performing the surgical scrub, hands should be kept up and away from the body (elbows in flexed position), so that water runs from the tips of the fingers towards the elbow. This procedure influences the effectiveness of the surgical scrub (Mangram et al., 1999:267).

The surgical scrub, when properly performed, has been shown to remove transient skin flora from the fingernails, hands and forearms; to reduce the resident microbial population to an irreducible minimum; and to slow the growth of bacteria, in order to contribute to reducing the risk of a SSI (Kennedy, 2013:17).

4.4.11 Wearing of jewellery (e.g: rings, bangles)

The participants were given the above statement to discover whether the participants wear hand or arm jewellery, such as rings, bangles, and suchlike. The data revealed that of the 68 participants, 20 (30%) always agreed with the statement, which is incorrect. This means that some of the participants do scrub with their rings on; 14 (20%) of the participants often agreed with the statement, which is also incorrect; 3 of the (5%) participants seldom agreed with the statement; while only 31(45%) of the participants never agreed with the statement.
Figure 4.12: Wearing of jewellery (such as rings, bangles and suchlike)

According to the guideline, jewellery is not recommended in ORs; however, in this study, jewellery was worn amongst the participant. These are areas of concern for the researcher, which need to be addressed, so that recommendations can be made (Mangram et al., 1999:267).

According to AORN (2012 [a]:91), studies have demonstrated that the skin underneath rings is more heavily colonized than comparable areas of skin on the fingers without rings. One study found that 40% of nurses harboured gram-negative bacilli (e.g., *E. cloacae*, *Klebsiella*, and *Acinetobacter*) on skin under rings, and that certain nurses carried the same organism under their rings for several months (AORN [b], 2012:84).

**4.4.12 Health Education for surgical personnel on transmissible diseases**

The participants were given the above statement to discover whether there is a policy that educates surgical personnel, who have the signs and symptoms of a transmissible infectious illness, to report these conditions promptly to their supervisory personnel. The results show that 52 (76%) of the participants strongly agreed with the statement; while 9 (13%) of the participants agreed with the statement, which is altogether correct. Only 5 (7%) of the participants were neutral
about the statement; while 1 (2%) of the participants disagreed with the statement; and 1 (2%) of the participants strongly disagreed with the statement.

**Figure 4.13: Health Education for surgical personnel on transmissible diseases**

The majority 76% of the participants were correct with the statement in figure 4.13. The guideline stated that, surgical personnel who have active infections, or are colonized with certain micro-organisms have been linked to outbreaks or clusters of SSIs. Thus, it is important that healthcare organizations implement policies to prevent the transmission of micro-organisms from personnel to patients (Mangram et al., 1999:267).

### 4.4.13 Development of policies concerning transmissible infectious conditions

The participants were given the above statement to discover whether there are well-defined policies concerning patient-care responsibilities when personnel have potentially transmissible infectious conditions. The data revealed that of the 68 participants, 42 (61%) strongly agreed with the statement; 19 (28%) of the participants agreed with the statement; 5 (7%) were neutral about the statement; while 1 (2%) of the participants disagreed with the statement; and 1 (2%) of the
participants strongly disagreed with the statement. The results are graphically displayed in Figure 4.14.

![Graph showing participants' responses]

**Figure 4.14: Development of policies concerning transmissible infectious conditions**

Comparing the result with the guideline used for the study, the majority (89%) of the participants were correct, because the guideline stated that there must be well-developed policies concerning patient-care responsibilities when personnel have potentially transmissible infectious conditions (Mangram *et al.*, 1999:267). However, there are still (11%) of the participants that did not adhere to the best-practice recommendations.

It is important that healthcare organizations implement policies to prevent the transmission of micro-organisms from personnel to patients. These policies should address the management of job-related illnesses, the provision of post-exposure prophylaxis after job-related exposures, and, when necessary, the exclusion of ill personnel from work or patient contact. While work-exclusion policies should be enforceable, and should include a statement of authority to exclude ill personnel, they should also be designed to encourage personnel to report their illnesses and exposures, and not to penalize personnel with loss of wages, benefits, or job status.
This would protect both the patient and the health-care worker by reducing the spread of transmissible infections (Kennedy, 2013:19).

4.4.14 Cultures of surgical personnel skin lesions and exclusion from duty

The question aimed at exploring whether the participants obtain appropriate cultures from, and exclude from duty, those surgical personnel who have draining skin lesions – until infection has been ruled out – or personnel have received adequate therapy, and the infection has been treated and resolved.

The data revealed that of the 68 participants, 37 (54%) strongly agreed with the statement; 16 (24%) of the participants agreed with the statement; 4 (6%) of the participants disagreed with the statement; 5 (7%) of the participants strongly disagreed with the statement; while 6 (9%) of the participants were neutral about the statement (cultures of surgical personnel skin lesions and exclusion from duty).

Figure 4.15: Cultures of surgical personnel skin lesions and exclusion from duty

The majority agreed with the statement, which is the correct response; the guidelines stated that appropriate cultures must be obtained from the surgical personnel who have draining skin lesions – until the possibility of infection has been ruled out – and
they must be excluded from duty; or the personnel must have received adequate therapy, and the infection has been resolved (Mangram et al., 1999:267).

4.4.15 Adherence to the principles of aseptic technique

The results indicated that of the 68 participants, 53 (78%) of the participants strongly agreed that adherence to the principle of aseptic technique in the OR is key, while 8 (12%) agreed with the statement; 3 (4%) of the participants were neutral about the statement; while 1 (2%) of the participants disagreed; and 3 (4%) of the participants strongly disagreed with the statement.

![Figure 4.16: Adherence to the principles of aseptic technique](image)

Aseptic technique principles must be strictly enforced, in order to prevent the transmission of organisms causing surgical site infections. Thorough adherence to the principles of asepsis by all scrubbed personnel is the foundation of surgical site infection prevention (Demir, 2009: 103).
4.4.16 Ventilation in the operating room

The question (ventilation in the operating room), aimed at exploring whether the participants maintain positive pressure ventilation in the operating room with respect to the corridors and adjacent area, in order to prevent infection in the operating room. The data revealed that of the 68 participants, 41 (60%) strongly agreed with the statement, which is the correct answer; while 12 (18%) of the participants agreed with the statement, which is also correct; but 5 (8%) of the participants disagreed with the statement; and 3 (4%) of the participants strongly disagreed with the statement; while 7 (10%) of the participant remained neutral about this statement.

![Bar chart showing the percentage of participants' responses]

**Figure 4.17: Ventilation in the operating room**

As many as 78% agreed with the statement, which is correct; but the data results still show that 10% of the participants were neutral; 8% disagreed; and 4% strongly disagreed with the above statement, which means that some of the participants had no idea about air circulation in the operating room. There should be a 100% response in agreement to the need for proper ventilation in the operating room. This is an area of concern in the operating, when comparing the results with the evidence-based guideline used; and thus, 20% of the responses were incorrect.
The guideline stated that, “Operating rooms should be maintained at positive pressure with respect to corridors and adjacent areas. Positive pressure prevents airflow from less clean areas into more clean areas (Mangram et al., 1999:268).

4.4.17 Air exchanges in the operating room

The question (air exchanges in the operating room) aimed at discovering whether the participants thought it necessary in the operating rooms to maintain a minimum of 15 air changes per hour, of which at least three should be fresh air, in order to prevent infection in the operating room. The data revealed that of the 68 participants, 31 (46%) strongly agreed with the statement; 17 (25%) of the participants agreed with the statement; 12 (18%) of the participants were neutral as regards the statement; 3 (4%) of the participants disagreed with the statement; while 2 (3%) strongly disagreed with this statement.

Figure 4.18: Air exchanges in the operating room

The data results from the statement show that 29% of the participants in the operating rooms did not understand what air exchanges mean, and the effect it has on surgical procedures. Comparing the result with the guideline, this is not according
to the recommended practices for the prevention of surgical site infection. The
guideline stated that, a minimum of 15 air changes per hour, of which at least 3
should be fresh air, must be maintained.

4.4.18 Air introduction at the ceiling, and exhaust near the floor

The question (air introduction at the ceiling, and exhaust near the floor) aimed at
exploring whether the participants believed that the introduction of air at the ceiling,
and exhaust near the floor, was critical. The data revealed that of the 68 participants,
52 (76%) of the participants strongly agreed with the statement; 8 (12%) of the
participants agreed with the statement; 2 (3%) of the participants were neutral about
the statement; and only 1 (2%) of the participants disagreed with the statement;
while 5 (7%) of the participants strongly disagreed with the statement.

Figure 4.19: Air introduction at the ceiling, and exhaust near the floor

Comparing the results with the guideline, the majority (88%) of the participants were
correct. The guideline stated that all the air should be introduced at the ceiling, and
expelled near the floor.
4.4.19 Keeping the operating-room doors closed

The participants were given the above statement (Keeping the operating-room doors closed) to discover whether they closed the operating doors – except when they needed to be opened for the passage of equipment, personnel, and the patient. The data revealed that of the 68 participants, 49 (72%) of the participants strongly agreed with the statement; 11 (16%) of the participants agreed with the statement; 4 (6%) participants were neutral about the statement; 2 (3%) of the participants disagreed with the statement; and 2 (3%) of the participants strongly disagreed with the statement.

![Bar chart showing the percentage of participants agreeing or disagreeing with the statement.]

**Figure 4.20: Keeping the operating-room doors closed**

A total of 88% of the participants were correct; this is in accordance with the guideline, which states that the doors to the operating room should be kept closed – except when it is necessary to open them for the passage of the patient and personnel, supplies and equipment. If the door is left open, the positive air pressure in the operating room equalizes with the negative air pressure in the hallway, and the desired status quo would be disrupted (Mangram et al., 1999:267).
4.4.20 Traffic control in the operating room

The participants were given the above statement on traffic control in the operating room to assess whether they limited the number of personnel entering the operating room to the necessary personnel during surgical procedures. The data revealed that of the 68 participants, 56 (83%) of the participants strongly agreed with the statement; none (0%) of the participants agreed with the statement; 2 (3%) of the participants were neutral about the statement; 5 (7%) of the participants disagreed with the statement; and 5 (7%) of the participants strongly disagreed with the statement.

![Bar chart showing the distribution of responses to the traffic control statement.]

**Figure 4.21: Traffic control in the operating room**

According to the guideline, traffic in and out of the operating room should be kept to a minimum; and only essential personnel should be allowed inside the operating room (Mangram *et al.*, 1999:268). As many as 83% of the participants agreed with the statement above, which is correct.

The amount of activity in the OR increases as the number of people present in the operating room increases; this, in turn, increases the potential for contamination, as a result of the air turbulence that carries microbes to the surgical wound (Mangram *et al.*, 1999:268).
4.4.21 Sterility of the surgical equipment

The participants were given the statement (sterility of the surgical equipment) to assess whether the participants agreed with the statement above that equipment should be used without checking for sterility indicators. The data revealed that of the 68 participants, 3 (5%) of the participants strongly agreed with the statement; 1 (2%) of the participants agreed with the statement; 2 (3%) of the participants were neutral about the statement; while 5 (7%) of the participants disagreed with the statement; and 57 (83%) of the participants strongly disagreed with the statement.

Figure 4.22: Sterility of the surgical equipment

The results of the data analysis show that the majority (90%) of the participants answered the question correctly. According to the CDC guidelines used for the study, only sterile items are to be used within the sterile field. OR personnel dispensing sterile items to the sterile field must look and see whether the sterilization indicator is visible in the package, because any items without sterility indicators must be considered unsterile. So, equipment must be check for package integrity and package expiration date before use (Mangram et al., 1999:268).
4.4.22 Using sterile packaging during emergencies

The participants were given the statement below (Figure 4.23) to discover whether the participants understood the statement that if a sterile package drops to the floor, it may only be used in cases of emergency, and only when the packaging is not torn. The data revealed that of the 68 participants, 7 (10%) of the participants strongly agreed with the statement; 9 (13%) of the participants agreed with the statement; 8 (12%) of the participants were neutral about the statement; while 12 (18%) of the participants disagreed with the statement; and 32 (47%) of the participants strongly disagreed with the statement.

![Bar chart showing percentage of participants' responses to the statement on using sterile packages during emergencies.]

Figure 4.23: Using sterile packages during an emergency

In the guideline, it was stated that if sterile packages wrapped in a previously woven material drop to the floor, they must not be used in cases of emergency; 35% of the participant were incorrect in answering the question (Mangram et al., 1999:268).

4.4.23 Protective wear in the operating room

The participants were given the above statement to assess whether the participants wear protective wear, such as aprons, gloves and masks. These should be worn at all times in the operating room. The data revealed that of the 68 participants, 43
(63%) of the participants strongly agreed with the statement; 14 (21%) of the participants agreed with the statement; 2 (3%) participants were neutral about the statement; 6 (9%) of the participants disagreed with the statement; and 3 (4%) of the participants strongly disagreed with the statement.

Figure 4.24: Protective wear in the operating room

The data revealed that 84% of the participants were correct; and this is in accordance with the guidelines used for the study. The guidelines stated that the wearing of gloves, gowns, and masks by OR personnel is a necessary requirement, in order to establish and maintain an aseptic environment for the patient – so as to decrease the chance of SSIs (Mangram et al., 1999:268).

According to AORN regulations, to prevent the transmission of micro-organisms from patient to personnel, it is required that personnel wear personal protective equipment when it could be reasonably anticipated that these individuals might come in contact with blood or other potentially infectious materials (Rothrock, 2011:910).
4.4.24 Cleaning of operating-room floors

The participants were given the above statement (cleaning of operating-room floors) to assess whether the participants ensured that the operating-room floor must be cleaned before each operation. The data revealed that of the 68 participants, 58 (85%) of the participants strongly agreed with the statement; 6 (9%) of the participants agreed with the statement; none (0%) of the participants were neutral about the statement; none (0%) of the participants disagreed with the statement; and 4 (6%) of the participants strongly disagreed with the statement.

![Percentage of Participant Agreement](chart.png)

Figure 4.25: Cleaning of operating-room floors

When comparing the result with the guideline used for the study, it was found that 94% of the participants answered the question correctly. The guidelines stated that the operating-room floor must be cleaned before each operation (Mangram et al., 1999:268).

4.4.25 The use of EPA-approved hospital disinfectant in the operating room

The participants were given the above statement (the use of EPA-approved hospital disinfectant in the operating room), that when visible soiling or contamination with blood or other body fluids of surfaces or equipment occurs during an operation, the
use an EPA-approved hospital disinfectant to clean the affected areas before the next operation is mandatory. The data revealed that of the 68 participants, 52 (77%) of the participants strongly agreed with the statement; 9 (13%) of the participants agreed with the statement; 2 (3%) participants were neutral about the statement; none (0%) of the participants disagreed with the statement; and 5 (7%) of the participants strongly disagreed with the statement.

Figure 4.26: The Use of EPA-approved hospital disinfectant in the operating room

The data revealed that (90%) of the participants were correct, and in agreement with the statement, that when visible soiling or contamination with blood or other body fluids of surfaces or equipment occurs during an operation, the use of an EPA-approved hospital disinfectant to clean the affected areas before the next operation is essential.

According to the guidelines, an Environmental Protection Agency (EPA)-approved hospital disinfectant should be used to decontaminate the affected areas before the next operation (Mangram et al., 1999:268).
4.4.26 The cleaning and disinfecting of environmental surfaces

The participants were given the above statement to discover whether the participants undertook any special cleaning or closing of operating rooms after contaminated or dirty operations. In the figure below, the data revealed that of the 68 participants, 3 (4%) strongly agreed with the statement; 7 (10%) of the participants agreed with the statement; 2 (3%) of the participants were neutral about the statement; while 10 (15%) of the participants disagreed with the statement; and 46 (68%) of the participants strongly disagreed with the statement.

Figure 4.27: Cleaning and disinfecting of environmental surfaces

A total of 83%, of the participants disagreed and strongly disagreed with the statement, which is incorrect; since this is contrary to the guideline. According to the guideline, it was stated that no special cleaning or closing of operating rooms after contaminated or dirty operations is permissible (Mangram et al., 1999:268).

4.4.27 Disinfection of the floor after the last operation of the day

The participants were given the above statement on disinfection of the floor after the last operation of the day, to assess whether they wet-vacuumed the operating-room floor after the last operation of the day or night with an EPA-approved hospital
disinfectant. The data revealed that of the 68 participants, 41 (60%) strongly agreed with the statement; 11 (16%) of the participants agreed with the statement; 6 (9%) of the participants were neutral; 8 (12%) of the participants strongly disagreed with the statement; and 2 (3%) of the participants disagreed with the statement.

Figure 4.28: Disinfection of the floor after the last operation of the day

A total of 76% of the results were in accordance to the guidelines used for the study; while 24% of the results proved to be incorrect.

The guidelines state that the best practices for environmental cleaning in surgical practice settings recommend that procedure rooms and utility areas of the surgical suite should be terminally cleaned every 24 hours. The guideline further recommends that operating-room floors must be cleaned after the last operation of the day or night with an EPA-approved hospital disinfectant (Mangram et al., 1999:268).

4.4.28 Recommendations on disinfecting the environment or the equipment used in operating rooms

The participants were given the above statement to explore whether there is any recommendation on disinfecting environmental surfaces or equipment used in
operating rooms between operations – even in the absence of visible soiling. The data revealed that of the 68 participants, 10 (14%) strongly agreed with the statement; 8 (12%) of the participants agreed with the statement; 4 (6%) of the participants were neutral about the statement; while 6 (8%) of the participants disagreed with the statement; and 40 (60%) participants strongly disagreed with the statement.

Figure 4.29: Recommendations on disinfecting the environment or the equipment used in operating rooms

As many as 68% of the participants disagreed and strongly disagreed with the statement, which is correct, when comparing it with the guideline used in the study. According to the guideline, it is important that every operating room should develop its own policy manual to perform routine cleaning of these surfaces, in order to re-establish a clean environment after each operation. When visible soiling of surfaces or equipment occurs during an operation, an Environmental Protection Agency (EPA)-approved hospital disinfectant should be used to decontaminate the affected areas – before, the next operation (Mangram et al., 1999:268).
4.4.29 Routine environmental sampling

The participants were given the above statement on routine environmental sampling to explore whether they do, or do not, perform routine environmental sampling of the operating room. Performing microbiological sampling of the operating-room environmental surfaces or air is only as part of an epidemiological investigation. The data revealed that of the 68 participants, 11 (16%) strongly agreed with the statement; 13 (20%) of the participants agreed with the statement; 4 (6%) of the participants were neutral about the statement; while 15 (21%) of the participants disagreed with the statement; and 25 (37%) of the participants strongly disagreed with the statement.

![Percentage of Agreement and Disagreement](image)

**Figure 4.30: Routine environmental sampling**

Only 58% of the participants were correct on the statement. According to the guideline, it was stated that, no routine environmental sampling of the operating room must be performed, and that only microbiological sampling of the operating room environmental surfaces or air – as part of an epidemiological investigation must be done (Mangram *et al.*, 1999:268).
4.4.30 Flash sterilization

The participants were given the above statement on flash sterilization to discover whether they performed flash sterilization - only for patient-care items that would be used immediately. The data revealed that of the 68 participants, 34 (51%) strongly agreed with the statement; 15 (22%) of the participants agreed with the statement; 5 (7%) of the participants were neutral about the statement; while 3 (4%) of the participants disagreed with the statement; and 11 (16%) participants strongly disagreed with the statement.

![Bar chart showing the distribution of participant opinions on flash sterilization]

**Figure 4.31: The need for flash sterilization**

A total of 73% of the participants were incorrect on this statement in Figure 4.31, when comparing the result with the guidelines used. Consequently, these are areas of concern in the operating room.

The guideline states that flash sterilization is not recommended as a routine sterilization method, because of the lack of timely biological indicators to monitor the performance, the absence of protective packaging following sterilization, the possibility for contamination of processed items during transportation to the
operating rooms, and the use of minimal sterilization cycle parameters (Mangram et al., 1999:268).

4.4.31 The use of flash sterilization for reasons of convenience

The participants were given the above statement to discover whether they performed flash sterilization, but only for patient-care items that would be used immediately. The data revealed that of the 68 participants, 40 (60%) strongly agreed with the statement; 9 (13%) of the participants agreed with the statement; 2 (3%) of the participants were neutral about the statement; while 5 (7%) of the participants disagreed with the statement; and 12 (17%) of the participants strongly disagreed with the statement.

---

**Figure 4.32: The use of flash sterilization for reasons of convenience**

During any operation, the need for emergency sterilization of equipment may arise (e.g., to reprocess an inadvertently dropped instrument). However, flash sterilization is not intended to be used for either reasons of convenience, or as an alternative to purchasing additional instrument sets or to save time. Also, flash sterilization is not
recommended for implantable devices because of the potential for serious infections (Thurston, 2009:138).

4.4.32 The wearing of surgical masks in the operating room

The participants were given the above statement to explore whether they wear a surgical mask that fully covers the mouth and nose when entering the operating room – if an operation is about to begin or is already under way, or if sterile instruments are exposed. The data revealed that of the 68 participants, 60 (88%) strongly agreed with the statement; 5 (7%) of the participants agreed with the statement; none (0%) of the participants were neutral about the statement; while 1 (2%) of the participants disagreed with the statement; and 2 (3%) of the participants strongly disagreed with the statement.

This result shows that the majority of the participants strongly agreed with the statement, which is the correct response, according to the recommendation.

![Bar Chart](image)

**Figure 4.33: The wearing of surgical masks in the operating room**

The majority (95%) of the participants adhered to the wearing of a surgical mask that fully covers the mouth and nose, when entering the operating room, if an operation is
about to begin, or is already under way, or if sterile instruments are exposed. This is according to the guideline used for the study (Mangram et al., 1999:268).

According to the CDC (2011:383), the use of barriers seems prudent, in order to minimize a patient’s exposure to the skin, mucous membranes, or the hair of surgical-team members, as well as to protect the surgical team members from exposure to blood and blood-borne pathogens (e.g., the human immunodeficiency virus and hepatitis viruses).

Phillip (2007:268) explains that sebaceous glands and sweat glands in and around hair follicles over the entire surface of the body contain micro-organisms that are continually being shed into the environment. The OR attire is intended to provide effective barriers that prevent the dissemination of micro-organisms to patients, and to protect personnel from blood and body substances of the patient. In addition, OR attire has been shown to reduce microbial shedding from more than 10,000 particles per 3000, or from 50,000 micro-organisms per cubic foot to 500, and to prevent contamination of the surgical site and sterile field by way of any direct contact.

4.4.33 Wearing or a cap or hood in the operating room

The participants were given the above statement (Wearing or a cap or hood in the operating room) to discover whether they do wear a cap or hood, in order to fully cover the hair on the head and face when entering the operating room. The data revealed that of the 68 participants, 55 (81%) strongly agreed with the statement; 6 (8%) of the participants agreed with the statement; 1 (2%) of the participants were neutral about the statement; while 1 (2%) of the participants disagreed with the statement; and 5 (3%) of the participants strongly disagreed with the statement.
Figure 4.34: Wearing of a cap or hood in the operating room

According to the guidelines used, 89% of the participants were correct with the statement of wearing a cap or hood to fully cover the hair on the head and face when entering the operating room.

The guidelines state that a cap or hood should fully cover the hair on the head and face; and it must be worn when entering the operating room (Mangram et al., 1999:268).

The purpose of head coverings, while in semi-restricted and restricted areas of the surgical suite, is to protect both the patient and the staff by maintaining a limited microbial spread (Phillips, 2007: 267).

4.4.34 Wearing shoe covers for the prevention of SURGICAL SITE infection

The participants were given the above statement to ascertain whether they wear sterile gloves if a scrubbed surgical team member puts on gloves after donning a sterile gown. The data revealed that of the 68 participants, 11 (16%) strongly agreed with the statement; 1 (2%) of the participants agreed with the statement; 2 (3%) of the participants were neutral about the statement; while 6 (9%) of the participants disagreed with the statement; and 46 (67%) of the participants strongly disagreed
with the statement; while 2 (3%) of the participants never even attempted to answer the question.

![Bar chart showing the percentage of participants' agreement with the statement about wearing shoe covers for the prevention of surgical site infections.](chart)

**Figure 4.35: shoe covers for the prevention of surgical site infection**

As many as 76% of the participants strongly disagreed, or merely disagreed with the statement, which is incorrect when comparing it with the guideline. The guideline states that: one does not wear shoe covers for the prevention of surgical site infections (Mangram et al., 1999:268).

The use of shoe covers has never been shown to decrease the risk of SSIs, or to decrease bacteria counts on the operating-room floor (Damani, 2013: 123). Shoe covers may, however, protect surgical-team members from exposure to blood and other body fluids during an operation. AORN regulations require that surgical caps or hoods and shoe covers or boots be worn in situations when gross contamination can reasonably be anticipated (e.g., orthopaedic operations, penetrating trauma cases) (AORN, 2013:65).

### 4.4.35 The wearing of sterile gloves

The participants were given the above statement to discover whether they wear sterile gloves when a scrubbed surgical team member puts on gloves after donning a
sterile gown. The data revealed that of the 68 participants 47 (70%) strongly agreed with the statement; 7 (10%) of the participants agreed with the statement; 4 (6%) of the participants were neutral about the statement; while 3 (4%) of the participants disagreed with the statement; and 7 (10%) of the participants strongly disagreed with the statement.

Figure 4.36: The wearing of sterile gloves

The data revealed that (80%) of the participants were in agreement with the guideline on this issue. The guideline states that sterile gloves must be worn if a scrubbed surgical-team member put on gloves, after donning a sterile gown (Mangram et al., 1999:268).

Sterile gloves are worn to minimize the transmission of micro-organisms from the hands of team members to patients, and to prevent contamination of team members’ hands with patients’ blood and body fluids. If the integrity of a glove is compromised (e.g., it is punctured), it should be changed as promptly as safety permits. Wearing two pairs of gloves (double-gloving) has been shown to reduce hand contact with patients’ blood and body fluids compared to wearing only a single pair (Rothrock, 2011:86).
4.4.36 The uses of surgical gowns and drapes

The participants were given the above statement to discover whether they use surgical gowns and drapes that are effective barriers when wet (i.e., materials that resist liquid penetration). The data revealed that of the 68 participants, 53 (77%) strongly agreed with the statement; 10 (15%) of the participants agreed with the statement; and only 1 (2%) of the participants were neutral about the statement; while none (0%) of the participants disagreed with the statement; and 4 (6%) of the participants strongly disagreed with the statement.

![Bar chart showing the distribution of responses to the statement regarding the uses of surgical gowns and drapes.](chart.png)

<table>
<thead>
<tr>
<th></th>
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</tr>
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<td>1</td>
</tr>
<tr>
<td>DISAGREED</td>
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<td>0</td>
</tr>
<tr>
<td>STRONGLY DISAGREED</td>
<td>6</td>
<td>4</td>
</tr>
</tbody>
</table>

**Figure 4.37: Uses of surgical gowns and drapes**

The majority of the participants (92%) agreed with the statement in Figure 4.37, which is correct when comparing the response with the guideline used for the study. In the guideline, surgical gowns and drapes that are effective barriers when wet (i.e., materials that resist liquid penetration) must be used in the operating room.

Sterile surgical gowns and drapes are used to create a barrier between the surgical field and any potential sources of bacteria. Gowns are worn by all scrubbed surgical team members, and drapes are placed over the patient. Gowns and drapes are classified as disposable (single use) or reusable (multiple uses). Regardless of the
material used to manufacture gowns and drapes, these items should be impermeable to liquids and viruses (AORN, 2013:65).

4.4.37 Changing of scrub suits when contaminated

The participants were given the above statement to discover whether they used surgical gowns and drapes that are effective barriers when wet (i.e., materials that resist liquid penetration. The data revealed that of the 68 participants, 56 (82%) strongly agreed with the statement; 12 (8%) of the participants agreed with the statement; none (0%) of the participants were neutral about the statement; while none (0%) of the participants disagreed with the statement; and 4 (6%) of the participants strongly disagreed with the statement.

<table>
<thead>
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<th></th>
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<th>NEUTRAL</th>
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Figure 4.38: Changing of scrub suits when contaminated

The data revealed that the majority (94%) of the participants were correct with the statement, when comparing it with the guideline used for the study. The guideline stated that scrub suits that are visibly soiled, contaminated, and/or penetrated by blood or other potentially infectious materials must be changed immediately (Mangram et al., 1999:268).
4.4.38 Recommendations on how to launder scrub suits

The participants were given the above statement to ascertain whether there were any recommendations on how or where to launder scrub suits, on restricting use of scrub suits to the operating suite, or for covering scrub suits when out of the operating suite. The data revealed that of the 68 participants, 13 (19%) strongly agreed with the statement; 9 (13%) of the participants agreed with the statement; 10 (15%) of the participants were neutral about the statement; while 7 (10%) of the participants disagreed with the statement; and 29 (43%) of the participants strongly disagreed with the statement.

Figure 4.39: Recommendations on how to launder scrub suits

In the results, (53%) of the participants disagreed with the statement; while 32% agreed with the statement. The guideline stated that “each operating room must develop their own policies concerning how or where to launder scrub suits, on restricting the use of scrub suits to the operating suite, or for covering scrub suits when out of the operating suite” (Mangram et al., 1999:268).

Surgical suits are intended to protect both the patient and the perioperative personnel. AORN published the recommended practice for scrub suite to guide the perioperative professional nurse in establishing protocols for selecting, wearing and
The recommendation that a scrub suit is not to be home laundered was supported by evidence that perioperative nurses can share with their colleagues and managers to help support the appropriate practice (Braswell & Spruce, 2012:122).

4.5 SUMMARY OF THE CHAPTER

Professional nurses in their role, as the patients’ advocates, are involved in providing a safe perioperative environment, as well as protecting the patients from practices that do not meet the standards of sterile technique (Smeltzer et al., 2008:507). Preventing infection in the OR is one of the primary goals of the surgical team (Romney, 2001: 253). Despite the above, many studies, however, have shown that adherence to recommendations is very low (Ganczak & Szych, 2007:346).

In this context, the researcher continues to report a less than 100% compliance rate with infection control practices for the prevention of surgical site infections in the operating room among health-care professionals – in spite of the demonstrated benefits of compliance, including a decrease in disease transmission by the reduction in the risk of exposure.

In accordance with the results of the data above, the report showed that the ORs included in this study generally did not practice according to the guidelines of the CDC, 1999, “Recommended practices for the prevention of surgical site infections”; which both WHO and AORN were currently following, in preventing surgical site infections. The researcher concluded that professional nurses lack adequate understanding of infection control practices for the prevention of surgical site infections in the operating rooms. Areas where lapses were identified will be specified when recommending changes to the current guidelines on infection control practices for the prevention of surgical site infections in the operating room.

Chapter Five discusses in detail the conclusions, recommendations, limitations and the guidelines for infection control practices in the operating room complex.
CHAPTER FIVE

SUMMARY, CONCLUSIONS, LIMITATIONS AND RECOMMENDATIONS

5.1 INTRODUCTION

The first objective of the study was to explore and describe the current infection control practices for the prevention of surgical site infections in the operating rooms in the public hospitals, and to compare these practices with selected evidence-based practice guidelines. The second objective was to make recommendations for the implementation of infection control practices, in order to prevent surgical site infections in the operating room. This chapter includes the limitations of the study, as well as some recommendations for future research.

It is important that professional nurses apply infection control practices in preventing surgical site infections in their nursing practices because these measures can reduce and control the spread of micro-organisms, thereby promoting optimal health for the patient – as well as for the personnel.

5.2 SUMMARY AND CONCLUSIONS

The researcher gathered the data from the participants by means of questionnaires, in order to achieve the objectives mentioned above. The data were compared to the relevant literature; and the data gathered from the participants, was analysed with the assistance of a statistician. Linking to the findings discussed in Chapter 4, the following major conclusions can be reached:

A self-administered questionnaire was used to gather the information on infection control practices for the prevention of surgical site infections in the operating room. The questionnaire was divided into two sections. Section A concerned the demographic data of the participants in the research study. These participants are professional nurses working in the operating room. Section B explored the questions on infection control practices related to the prevention of surgical site infections in the operating room. Included in the research study were 80 participants, but only 68 questionnaires were returned, the reasons being, that three were on study leave; five
were on annual leave; and four were on sick leave. An 85% response rate was thus obtained.

5.2.1 Section A – Demographic data

The demographic data were comprehensively discussed in Chapter Four (see Table 4.1).

The majority (97%) of the participants were females, with only two male participants. A high proportion of the participants (47%) were older than 50 years of age.

A large proportion of the respondents, 49 (72%), had more than 11 years of experience in the operating room setting, with only a few having more than 5-10 years; and the majority of the participants (59%) had diplomas in nursing as their basic qualification.

Almost half of the participants (49%) had a post-graduate/post-basic qualification. More than half of the professional nurses who participated in this study (46%) had an operating-room qualification; and approximately (8%) of the professional nurses had there additional qualification – in other areas of discipline in nursing.

The majority of the participants were working in general (78%) operating theatres, gynaecological (43%), neurological (38%), orthopaedic surgery (51%) and gynaecological surgery (43%).

5.2.2 Section B – Infection control practices related to the prevention of surgical site infections in the operating room

The following conclusions can be drawn from section B of the questionnaire.

The report from the questionnaires in this study showed that the participants included in this study, generally, did not practise their nursing in line with the recommendations for the prevention of surgical infections. It is known that occupational exposures of health-care workers occur because of inconsistent compliance with the standard precautions.
The current practices, as compared to the recommended practices, according to the guidelines, as indicated inform of a table (Table 5.1 and 5.2).

- According to the data collected, 62% agreed; 44%; often agreed; 18% of the participants did shave their patients (Figure 4.2).
- In requiring patients to shower or bath with antiseptic agent on at least the night before the operation, only 42% of the participants agreed with this statement.
- About 81% of the participants always routinely clean the incision area before skin preparation (Figure 4.5).
- The data revealed that 96% of the participants did use an appropriate antiseptic agent for skin preparation (Figure 4.6).
- The majority (95%) of the participants’ fingernails were kept short; and no artificial nails were found; the underneath of each fingernail was cleaned; and hands were kept up and away from the body after washing; and then dried with a sterile towel; and a sterile gown and gloves were worn.
- The duration of hand antisepsis was 5–7 minutes for the first scrub of the day in 71% of operating rooms; and the majority (76%) did wash for 3-5 minutes, using an appropriate antiseptic for the rest of the scrub.
- Half (50%) of the participants wore jewellery during surgical hand scrubbing pre-operatively in the operating rooms.
- Policies on the patient-care responsibilities of personnel with transmissible infections had been developed in all the operating rooms; and education in transmissible infections was given to 76% of the participants; 78% of the participants agreed that surgical team members with signs and symptoms of a transmissible infectious illness must report such conditions promptly to their supervisory personnel.
- Only 51% of the participants strongly agreed with performing flash sterilization in the operating room; and routine microbiological sampling was done by 50% of the professional nurses. And 46% did not have patients showering with an antiseptic agent pre-operatively; while 89% used appropriate antiseptic solutions in pre-operative skin preparation.
• Of the 68 participants, only 60% strongly agreed with positive pressure ventilation; 46% strongly agreed with the need to maintain a minimum of 15 air changes per hour, of which at least 3 should be fresh air; and 72% kept the operating-room door closed, except when needed for the passage of equipment, personnel, and the patient; and majority of the participants (83%), limited the number of people who entered the operating room.

• The majority (90%) of the participants checked the sterility indicators before using equipment during an operation.

• In all of the operating rooms, 83% of the participants used masks and caps; 63% did not use shoe covers; 80% of the scrubbed personnel put on sterile gloves (Figure 4.24), and used surgical gowns and aprons.

• The majority strongly agreed (85%) with the operating-room floor being cleaned before each operation; and when visible soiling or contamination with blood or other body fluids of surfaces or equipment occurred during an operation, using an EPA-approved hospital disinfectant to clean the affected areas before the next operation, should be the next action.

According to the result gathered in Chapter Four, comparing the result with the evidenced-based guidelines on infection control practices in the prevention of surgical site infections that were implemented by the CDCs, in the year 1999, which were accepted by WHO, AORN and many other institutions globally. It was shown that there is a lack of adherence to the guidelines. The most compliant areas to the guideline were hand/forearm antisepsis (e.g. scrubbing with rings on, during surgical procedures (Figure 4.12) and the use of surgical gowns and drapes.

5.3 RECOMMENDATIONS FOR THE FACILITATION AND THE IMPLEMENTATION OF INFECTION CONTROL PRACTICES, FOR THE PREVENTION OF SURGICAL SITE INFECTIONS IN THE OPERATING ROOM

The guidelines for the prevention of surgical site infections were developed by CDC, 1999, based on the recommendations for the reduction of surgical site infection risks. These guidelines remain the definitive work on evidence-based practice for the prevention of SSIs (Mangram et al., 1999:250). These guidelines were the only ones
available, no updates, in line with the best-recommended practices, had been used and validated by previous studies; each recommendation is categorized on the basis of existing scientific data, theoretical rationale, and applicability. The evidence-based guidelines for infection control practices in preventing surgical site infections in the operating room used for the study were compared with the results gathered from the participants in Chapter 4. These were formulated to make changes to the current guidelines; and they will be presented (as discussed in Chapter two); and the recommendations are presented in the form of Table 5.1 below.

Table 5.1: Pre-operative Care

<table>
<thead>
<tr>
<th>1.</th>
<th>PRE-OPERATIVE COMPARISONS</th>
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<tbody>
<tr>
<td>CURRENT PRACTICE</td>
<td>CDC GUIDELINES FOR THE PREVENTION CONTROL OF SURGICAL INFECTIONS (MANGRAM et AL., 1999)</td>
</tr>
</tbody>
</table>

**A. PREPARATION OF PATIENT**

1. In Figure 4.2, the data revealed that, of the 68 participants, 30 (44%) of the participants always agreed with the statement, while other (56%) participants were non-compliant compared to the recommendation.

2. According to the data collected in Figure 4.3, it was found that pre-operative hair removal was done by (46%) of the participants, which is incorrect practice, as the guideline does not recommend this.

3. The data revealed that out of the 68 participants, only 37 (54%) required patients to shower or bathe with an antiseptic agent on at least the night before the operation day; while (46%) participants did not. Adherence to the best-recommended practice was thus maintained by only half of the participants.

1. Do not remove hair pre-operatively unless the hair at or around the incision site would interfere with the operation.

2. If hair is removed, remove immediately before the operation, preferably with electric clippers.

3. Require patients to shower or bathe with an antiseptic agent on at least the night before the operation day.
4. The data revealed that of the 68 participants, 55 (81%) of the participants did thoroughly wash and clean at and around the incision site to remove gross contamination before performing antiseptic skin preparation.

5. In Figure 4.6, the data revealed in Figure 4.6, that of the 68 participants, 66 (96%) of the participants did use an appropriate antiseptic agent for skin preparation, which is in line with the best-recommended practices.

**B. HAND / FOREARM ANTI-SEPSIS FOR SURGICAL TEAM MEMBERS**

1. In Figure 4.7, the data revealed that of the 68 participants, 65 (95%) agreed that nails should be kept short and that artificial nails should not be worn, which is in line with the best recommendations. However, there are still 5% of the participants that were not adhering to the best-practice recommendations.

2. The data revealed that of the 68 participants, 58 (86%) perform a pre-operative surgical scrub for at least 5 to 7 minutes using an appropriate antiseptic. Scrub the hands and forearms up to the elbows Figure 4.8.; while 14% of the participants did not practise, according to the best practice recommendations.

3. The data revealed that of the 68 participants, 52 (76%) of the participants always with agreed with the statement by cleaning underneath each fingernail prior to the first surgical

1. Thoroughly wash and clean at and around the incision site to remove gross contamination before performing antiseptic skin preparation.

5. Use an appropriate antiseptic agent for skin preparation.

Apply pre-operative antiseptic skin preparation in concentric circles moving towards the periphery. The prepared area must be large enough to extend the incision or to create new incisions or drain sites, if necessary.

2. Perform a pre-operative surgical scrub for at least 5 to 7 minutes, using an appropriate antiseptic. Scrub the hands and forearms up to the elbows.

3. Clean underneath each fingernail prior to performing the first surgical scrub of the day.
The remaining 24% of the participants did not adhere to the best-practice recommendations.

4. The majority of the participants, 66 (96%) always keep their hands up and away from the body (elbows in flexed position), so that water runs from the tips of the fingers towards the elbows after a surgical scrub, which is congruent with the best-practice recommendations.

5. The data revealed that of the 68 participants, 34 (50%) did perform surgical scrub/hand wash with their hand or arm jewellery (Figure 4.12) in place. According to the best practice recommendation, this practice was incorrect; and this might be detrimental to the care of the surgical patient.

4. After performing the surgical scrub, keep hands up and away from the body (elbows in flexed position) so that water runs from the tips of the fingers toward the elbows. Dry hands with a sterile towel and put on a sterile gown and gloves.

5. Do not wear hand or arm jewellery during surgical scrubbing.

C. MANAGEMENT OF INFECTED OR COLONIZED SURGICAL PERSONNEL

1. About 61 (89%) of the participants strongly agreed with this recommendation to educate and encourage surgical personnel who have signs and symptoms of a transmissible infectious illness that they should report conditions promptly to their supervisory and occupational health-service personnel (Figure 4.13).

2. About 61 (89%) strongly agreed that well-defined policies concerning patient-care responsibilities, when personnel have potentially transmissible infectious conditions, must be developed. The results are graphically displayed in Figure 4.14.

1. Educate and encourage surgical personnel who have signs and symptoms of a transmissible infectious illness to report conditions promptly to their supervisory and occupational health-service personnel.

2. Develop well-defined policies concerning patient-care responsibilities when personnel have potentially transmissible infectious conditions.
3. Only 53 (78%) of the participants agreed with the recommendation that surgical personnel who have draining skin lesions must be ruled out, or personnel must have received adequate therapy and infection has subsided (Figure 4.15). While the remaining (24%) of the participants did not adhere to the best-practice recommendations.

3. Exclude from duty surgical personnel who have draining skin lesions until infection has been ruled out or personnel have received adequate therapy and infection has subsided.

4. Do not routinely exclude surgical personnel who are colonized with organisms such as *S. aureus* (nose, hands or other body site) or group A *Streptococcus*, unless such personnel have been linked epidemiologically to dissemination of the organism in the healthcare setting.

Table 5.2: Intra-operative

<table>
<thead>
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<th>2. INTRA-OPERATIVE</th>
<th>CURRENT PRACTICE</th>
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</tr>
</thead>
<tbody>
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<td>A. VENTILATION</td>
<td></td>
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</tr>
<tr>
<td>1. From the results gathered, 53 (78%) agreed that positive-pressure ventilation in the operating room should be maintained with respect to the corridors and adjacent areas (Figure 4.17). While 22% of the participants were not practising the best recommendation.</td>
<td>1. Maintain positive-pressure ventilation in the operating room with respect to the corridors and adjacent areas.</td>
<td></td>
</tr>
</tbody>
</table>

While 29% of the participants were not

2. The data revealed that of the 68 participants, 48 (71%) agreed with the statement of maintaining a minimum of 15 air changes per hour, of which at least 3 should be fresh air.

2. Maintain a minimum of 15 air changes per hour, of which at least 3 should be fresh air.
adhering to the best practice recommendation.

3. The data revealed that of the 68 participants, 60 (88%) of the participants agreed with the statement of air introduction at the ceiling, and exhaust near the floor (Figure 4.19); while 12% of the participants did not adhere to the best practice recommendation.

4. Of the 68 participants, 60 (88%) kept the operating room doors closed except as needed for passage of equipment, personnel and the patient (Figure 4.20); while the remaining (12%) of the participants does not adhere to the best-recommended practice.

5. Of the 68 participants, 56 (83%) stated that they would limit the number of personnel entering the operating room to only the necessary personnel required, which is congruent with the best recommendations. However, (17%) of the participants did not adhere to the best-recommended practices.

### B. CLEANING AND DISINFECTION OF ENVIRONMENTAL SURFACES

1. The data revealed that of the 68 participants, 61 (90%) agreed with the statement that when visible soiling or contamination with blood or other body fluids of surfaces or equipment occurs during an operation, disinfectant must be used to clean the affected areas before the next operation (Figure 4.26). While the remaining (10%) of the participants

2. Introduce all air at the ceiling, and exhaust near the floor.

4. Keep operating room doors closed, except as needed for the passage of equipment, personnel and the patient.

5. Limit the number of personnel entering the operating room to the necessary personnel.

1. When visible soiling or contamination with blood or other body fluids of surfaces or equipment occurs during an operation, use disinfectant to clean the affected areas before the next operation.
2. Only 56 (83%) of the participants disagreed that special cleaning or closing of operating rooms after contaminated or dirty operations should not be done, which is correct, according to the best-practice recommendation (Figure 4.27).

3. The data revealed that of the 68 participants, 52 of the participants (76%) agreed that wet-vacuuming of the operating-room floor after the last operation of the day or night with disinfectant should be done, which is in line with the best-recommended practices. However, 24% of the participants disagreed; and this might have an impact on infection control practices (Figure 4.28).

4. About 46 (68%) of the participants disagreed with the statement of no recommendation on disinfecting environmental surfaces or equipment used in operating rooms between operations in the absence of visible soiling (Figure 4.29). This shows that, there are recommendations in the operating rooms of the participant concerning disinfecting environmental surface or equipment used in the operating rooms. While the remaining (32%) participants did not know if there are recommended practices for the disinfection of the environment and the equipment used in the operating room.

2. Do not perform special cleaning or closing of operating rooms after contaminated or dirty operations.

3. Wet-vacuum the operating room floor after the last operation of the day or night with disinfectant.

4. No recommendation on disinfecting environmental surfaces or equipment used in operating rooms between operations in the absence of visible soiling.
### C. MICROBIOLOGICAL SAMPLING

1. The data revealed that of the 68 participants, only 23 (36%) agreed that they would not perform routine environmental sampling of the operating room. Performing microbiologic sampling of the operating room environmental surfaces or air only as part of an epidemiologic investigation (Figure 4.30). The remaining 64% indicated that they would perform microbiological sampling, which is not the recommended practice.

1. Do not perform routine environmental sampling of the operating room. Perform microbiologic sampling of the operating room environmental surfaces or air only as part of an epidemiologic investigation.

### D. STERILIZATION OF SURGICAL INSTRUMENTS

1. In Figure 4.31 out of 68 participants, 49 (73%) agreed that they would perform flash sterilization only for patient-care items that were to be used immediately (e.g., to reprocess an inadvertently dropped instrument); while (27%) did not adhere to the best-recommended practice.

2. The data revealed that of the 68 participants, 49 (73%) did not use flash sterilization for reasons of convenience, as an alternative to purchasing additional instrument sets, or to save time (Figure 4.32); while (27%) of the participants did use flash sterilization for reasons of convenience, which is not in accordance with best-recommended practices.

1. Perform flash sterilization only for patient-care items that would be used immediately (e.g., to reprocess an inadvertently dropped instrument).

2. Do not use flash sterilization for reasons of convenience, as an alternative to purchasing additional instrument sets, or to save time.

### E. SURGICAL ATTIRE AND DRAPE

1. The data revealed that of the 68 participants, 65 (95%) did wear a surgical mask that fully covers the mouth and nose when entering the operating room if an operation is about to begin or already under way, or if sterile instruments are exposed. They wear the mask throughout the operation (Figure 4.33). There are still

1. Wear a surgical mask that fully covers the mouth and nose when entering the operating room, if an operation is about to begin or already under way, or if sterile instruments are exposed. Wear the mask throughout the operation.
(5%) of the participants that did not adhere to the best-recommended practices.

2. The majority 61 (89%) of the participants did wear a cap or hood to fully cover the hair on the head and face when entering the operating room (Figure 4.34); while the remaining (11%) did not wear a cap or hood when entering the operating room. This is not in accordance with the best-recommended practice.

3. The data revealed that of the 68 participants, only 12 (18%) did practice according to the recommended practice of not wearing shoe covers for the prevention of SSI (Figure 4.35). 76% of the professional nurses did wear shoe covers for the prevention of SSI.

4. The data revealed that of the 68 participants, 55 (80%) did wear sterile gloves when a scrubbed surgical team member, putting on gloves after putting on a sterile gown (Figure 4.36). While (20%) of the participants did not adhere to the best-recommended practices, which might be detrimental to the care of the surgical patient.

5. According to Figure (4.37), 63 (92%) of the participants did use surgical gowns and drapes that are effective barriers when wet (i.e., materials that resist liquid penetration), while (8%) of the participants did not.

6. 64 (94%) of the professional nurses did change scrub suits that are visibly soiled, contaminated and/or penetrated by blood or other potentially infectious

<p>| | |</p>
<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>2. Wear a cap or hood to fully cover the hair on the head and face when entering the operating room.</td>
<td>2. Wear a cap or hood to fully cover the hair on the head and face when entering the operating room.</td>
</tr>
<tr>
<td>3. Do not wear shoe covers for the prevention of SSI.</td>
<td>3. Do not wear shoe covers for the prevention of SSI.</td>
</tr>
<tr>
<td>4. Wear sterile gloves if a scrubbed surgical team member. Put on gloves after putting on a sterile gown.</td>
<td>4. Wear sterile gloves if a scrubbed surgical team member. Put on gloves after putting on a sterile gown.</td>
</tr>
<tr>
<td>5. Use surgical gowns and drapes that are effective barriers when wet (i.e., materials that resist liquid penetration).</td>
<td>5. Use surgical gowns and drapes that are effective barriers when wet (i.e., materials that resist liquid penetration).</td>
</tr>
<tr>
<td>6. Change scrub suits that are visibly soiled, contaminated and/or penetrated by blood or other</td>
<td>6. Change scrub suits that are visibly soiled, contaminated and/or penetrated by blood or other</td>
</tr>
</tbody>
</table>
potentially infectious materials.

7. No recommendations on how or where to launder scrub suits, on restricting the use of scrub suits to the operating suite, or for covering scrub suits when out of the operating suite.

F. ASEPSIS AND SURGICAL TECHNIQUE

1. Adhere to principles of asepsis when placing intravascular devices (e.g., central venous catheters), spinal or epidural anaesthesia catheters, or when dispensing and administering intravenous drugs.

5.4 LIMITATIONS OF THE STUDY

The following limitations of the study were identified:

- The study was conducted in the Nelson Mandela Bay Municipality, which included only public hospitals. The study, therefore, does not include the current infection control practices for surgical site infections in the private health-care hospitals’ operating rooms.
- The sample size was 68 from all three hospitals; and, therefore, generalizability cannot be assumed. However, the statistician indicated that the sample size of 68 participants was adequate for the results to be interpreted as statistically valid. For the scope of the study, the sample size
was validated. An observational study would be more meaningful to observe the actual practices of professional nurses, rather than just the reported data.

At the time of the study, there was no newer guideline that included all the aspects of topic under this discussion. There was only the one developed by the CDC in 1999.

5.5 RECOMMENDATIONS

Based on the findings of the study, the following recommendations are made regarding nursing practice, nursing education and nursing research.

5.5.1 NURSING PRACTICE

The following recommendations were made from the research study that relate to nursing practice.

- The guidelines that were formulated by the CDC in 1999 may be used to upgrade the current guidelines for infection control in the operating room, in order to improve the practices of the professional nurses working in the operating room, regarding current infection control practices for surgical site infections in the operating room.
- The evidence-based practices can be used for the implementation of infection control practices, in order to prevent surgical site infections in the operating rooms of public health-care sectors in the Nelson Mandela Bay Municipality.
- Workshops should be held to make the professional nurses more vigilant about infection control practices for the prevention of surgical site infections in the operating room.
- A clinical facilitator should come and do assessment rounds in the operating room, in order to observe whether the professional nurses are implementing the guidelines, and to guide them where necessary. The professional nurses could ask the educator questions if there is uncertainty about any particular practices.
- Professional nurses could be encouraged to attend short learning programmes on infection control practices for the prevention of surgical site infections in the operating room, in order to create a greater awareness for making clinical decisions that are based on the best available evidence.
In-service education can be done to explain the infection control practices for the prevention of surgical site infections in the operating room to the staff – in order to train them in the usage thereof.

5.5.2 NURSING EDUCATION

The following recommendations from the research study relate to nursing education.

- The guidelines that were formulated to upgrade the current guidelines for infection control practices for the prevention of surgical site infections in the operating room could assist the professional nurses in becoming more educated than before on the current infection control practices for surgical site infections in the operating room.
- It is also recommended that the professional nurses in the operating room attend any congresses that are held, such as the South African Theatre Sisters’ (SATS) congress, where new developments and findings are discussed and explained, as well as discussions on evidence-based practices.
- Professional nurses that do not have any additional training related to operating room nursing must be encouraged to undergo a formal course (post-basic qualification) in operating-room technique, because the training could give them a theoretical background pertaining to microbiology and infections, such as nosocomial infections. This would serve to make them aware of the importance of implementing infection control practices for the prevention of surgical site infections in the operating room.

5.5.3 NURSING RESEARCH

The following recommendations are made with regard to future research.

- The study could be done again in the same operating room, in order to investigate whether there is any improvement in the level of compliance of the professional nurses after the revised guidelines have been implemented. This could be done by using an observational study.
• The study was limited to only professional nurses in the operating room. Owing to the presence of other sterile team members, such as the surgeon and the assistant, it would also be advisable to conduct a research study which included them, because they are in direct contact with the patient during surgery; and there could also be a risk of a patient developing an infection post-operatively.
• A study could be done by observing the professional nurses and/or medical practitioners during surgical procedures to determine their aseptic techniques.
• Further research could be done to develop the contents of a competency-based assessment programme to establish whether the practices are done according to the best-practice recommendations.
• A systematic review could be conducted on infection control practices in the prevention of SSIs, which could be used as a basis for drawing up guidelines.

5.5.4 To make recommendations for the implementation of infection control practices, in order to prevent surgical site infections in the operating room

The researcher’s findings from the current practices in the operating room were compared with the evidenced-based practice, as developed by the CDC in 1999, and it was confirmed that there is still a need for changes in the current practice in the operating room. According to the results gathered in Chapter 4, it was revealed that there would be a need for the implementation of strategies for the facilitation of evidence-based practices in the prevention of surgical site infections; and this could only be achieved by:

• Educating the professional nurses involved in surgical procedures about surgical site infections, and the importance of prevention, which must be a part of the individual’s job responsibilities.
• There should be constant education and assessment of the nursing practices among the professional nurses in the operating room.
• Educating the patients, and their families as needed, who are undergoing a surgical procedure on the importance of surgical site infection prevention.
• Implementing of practice changes, from the current practice to the evidence-based practice, for example, adding a discussion on the importance of adhering to the evidence-based practices in the prevention of surgical site infections in the operating room. This can only be achieved by using the evidence of patient discomfort (report of increased rate of SSIs) to prompt practice changes.

• Setting up and implementing the best-infection control practices in the prevention of surgical site infection, which involves negotiating and developing a shared understanding about the benefits, disadvantages, risks and losses of the evidence-based practice guideline rather than the current practice.

• Implementing policies and procedures aimed at reducing the risk of surgical site infections: These policies and procedures must meet regulatory requirements; and they should be aligned with the evidence-based guidelines (for example, the Centres for Disease Control and Prevention [CDC]).

• As part of the facilitation effort to reduce surgical site infections:

  (1) Periodic risk assessments must be conducted for surgical site infections in a time-frame determined by the hospital.

  (2) Surgical site infection measures, using best-practices or evidence-based guidelines, must be selected.

  (3) Professional nurses' compliance with best practices or evidence-based guidelines should be monitored, in order to evaluate the effectiveness of any prevention efforts.

Although the implementation of a strategy, as stated above, is not the focus of this research study, there would nevertheless be a need for further research on the implementation of the above facilitation in the operating rooms.

5.6 SUMMARY OF THE CHAPTER

The research study has explored and described the current infection control practices for the prevention of surgical site infections in the operating room; and for
the need to compare these practices with selected evidence-based practice guidelines.

The guidelines that were developed for the changes to be made to the current guidelines will be distributed to the three particular hospitals, where the study was conducted, in order to make the professional nurses aware of the findings, and of what they should do to improve their infection control practices for the prevention of surgical site infections in the operating room.

It is further suggested that increased compliance with the infection control guidelines for the prevention of surgical site infections in operating rooms would facilitate the provision of best-practice and evidence-based care. There is a need for further research to determine why there is a difference between what is practised and what the guidelines indicate should be practised.
REFERENCE LIST


ANNEXURE A: PARTICIPANT’S LETTER

Faculty of Health Sciences
Department of Nursing Science
NMMU
Tel: +27 (0) 713705202

Dear Participant,

RE: REQUEST FOR PERMISSION TO CONDUCT A RESEARCH STUDY

Contact person: Ms O. Opadotun

I am currently conducting a research study on the infection control practices related to the prevention of surgical site infections in the operating room in fulfilment of my degree, Magister Curationis, in the Faculty of Health Sciences at the Nelson Mandela Metropolitan University.

You have been selected as part of a sample of registered nurses in the operating room to participate in this study. By participating in this research you will assist the researcher to gather useful information on the prevention of surgical site infections by registered nurses in the operating room. The data collected and analysed should enhance the quality of patient care rendered in the operating rooms.

This research is confidential, which means that the researcher will not reveal any personal information, and only group data will be reported. Your identity will not be revealed at any time. Participation in this study is entirely voluntary. There are no foreseeable risks or costs to the persons who participate in this research study. You may withdraw at any stage from this study.

Your contribution will be valuable in conducting this study; and you will be requested to complete a questionnaire. If you have any questions about this study or concerns about your participation, please contact Olukemi Opadotun (researcher) at 0713705202.

Kind regards,

Olukemi Opadotun (Researcher).
### RESEARCHER’S DETAILS

| Title of the research project | Infection control for the Prevention of Surgical site Infections in the operating room |
| Reference number |  |
| Principal investigator | Olukemi Opadotun |
| Address | Faculty of Health Sciences, Department of Nursing Science. NMMU |
| Postal Code | 6001 |
| Contact telephone number (private numbers not advisable) | 0713705202 |

### A. DECLARATION BY OR ON BEHALF OF PARTICIPANT

| I, the participant and the undersigned | (full names) |
| ID number |  |
| OR |  |
| I, in my capacity as | (parent or guardian) |
| of the participant | (full names) |
| ID number |  |
| Address (of participant) |  |

#### A.1 HEREBY CONFIRM AS FOLLOWS:

| I, the participant, was invited to participate in the above-mentioned research project that is being undertaken by | Olukemi Opadotun |
| From | Department of Nursing Science |
| of the Nelson Mandela Metropolitan University. |  |
### Aim:
The purpose of this study is to explore and describe the current infection control practices for surgical site infections (SSIs) in the operating room, and to compare these practices in evidence-based practice guidelines in a public health care sector in the Nelson Mandela Bay Municipality.

### Procedures:
I understand that there are no procedures to be implemented that would impact on my safety or privacy in participating in the study.

### Risks:
There will be no risk associated in participating in the study.

### Possible benefits:
As a result of my participation in this study, nursing care rendered to the surgical patient in the operating room would be enhanced.

### Confidentiality:
My identity will not be revealed in any discussion, description or scientific publications by the researcher.

### Access to findings:
Any new information or benefit that develops during the course of the study will be shared as follows:

<table>
<thead>
<tr>
<th>Voluntary participation / refusal / discontinuation:</th>
<th>My participation is voluntary</th>
<th>YES</th>
<th>NO</th>
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<tr>
<td></td>
<td>My decision whether or not to participate will in no way affect my present or future care / employment / lifestyle</td>
<td>TRUE</td>
<td>FALSE</td>
</tr>
</tbody>
</table>

### The Information Above Was Explained to Me/the Participant By:

<table>
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<tr>
<th>(name of relevant person)</th>
<th>In</th>
<th>Afrikaans</th>
<th>English</th>
<th>Xhosa</th>
<th>Other</th>
</tr>
</thead>
</table>

and I am in command of this language, or it was satisfactorily translated to me by

| (name of translator) | | | | |
|----------------------| | | | |

I was given the opportunity to ask questions and all these questions were answered satisfactorily.

4. No pressure was exerted on me to consent to participation; and I understand that I may withdraw at any stage without penalisation.

5. Participation in this study will not result in any additional cost to myself.

### A.2 I HEREBY VOLUNTARILY CONSENT TO PARTICIPATE IN THE ABOVE-MENTIONED PROJECT:
**B. STATEMENT BY OR ON BEHALF OF INVESTIGATOR(S)**

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<tbody>
<tr>
<td>1.</td>
<td>I have explained the information given in this document to (name of patient/participant) and / or his / her representative (name of representative)</td>
<td>declare that:</td>
</tr>
<tr>
<td>2.</td>
<td>He / she was encouraged and given ample time to ask me any questions;</td>
<td></td>
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<tr>
<td>3.</td>
<td>This conversation was conducted in <strong>Afrikaans</strong> <strong>English</strong> <strong>Xhosa</strong> <strong>Other</strong></td>
<td>by (name of translator)</td>
</tr>
<tr>
<td>4.</td>
<td>I have detached Section D and handed it to the participant <strong>YES</strong> <strong>NO</strong></td>
<td></td>
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</tbody>
</table>

Signed/confirmed at **On** 20

**I hereby declare that all information acquired by me for the purposes of this study will be kept confidential.**

**C. IMPORTANT MESSAGE TO PATIENT/REPRESENTATIVE OF PARTICIPANT**

Dear participant/representative of the participant

Thank you for your/the participant's participation in this study. Should there, at any time during the study:
- an emergency arise as a result of the research, or
- you require any further information with regard to the study,

Kindly contact Oluwemimo Opadotun at telephone number 0713705202
ANNEXURE C: PERMISSION TO CONDUCT RESEARCH

Faculty of Health Sciences
Department of Nursing Science
NMMU
Tel: +27 (0) 713705202

ATT: Nursing manager

REQUEST FOR PERMISSION TO CONDUCT RESEARCH IN THE OPERATING ROOM

Dear Sir/Madam,

My name is Olukemi Opadotun and I am a M.CUR student at the Nelson Mandela Metropolitan University in Port Elizabeth. The research I wish to conduct for my Master’s (Dissertation) is on the infection control principles related to the prevention of surgical site infections in an operating room. The research will be conducted by using a self-administered questionnaire. The questionnaire takes minimal time to complete; and no significant interference with the participants’ work schedule is anticipated. Permission to conduct the study will be obtained from the Faculty of Research, Technology and Innovation Committee (FRTI). This project will be conducted under the supervision of Dr P. Jordan (NMMU, South Africa) and Mrs S. Jardien-Baboo (NMMU, South Africa).

I am hereby requesting your consent to conduct research at your institution. Upon completion of the study, I undertake to provide the Hospital with a bound copy of the full research report. If you require any further information, please do not hesitate to contact me on 0713705202. Thank you for your time and consideration in this matter.

Yours sincerely,

Olukemi O. Opadotun (Researcher)
ANNEXURE D: REQUEST FOR PERMISSION TO CONDUCT RESEARCH IN THE OPERATING ROOM.

Faculty of Health Sciences
Department of Nursing Science
NMMU
Tel: +27 (0) 713705202.

Attn: Operating-room manager
Nelson Mandela Metropolitan Hospitals
Port Elizabeth
6001

REQUEST FOR PERMISSION TO CONDUCT RESEARCH IN THE OPERATING ROOM

Dear Sir/Madam,

My name is Olukemi Opadotun, and I am a M.CUR student at the Nelson Mandela Metropolitan University in Port Elizabeth. The research I wish to conduct for my Master's research (Dissertation) is entitled: Infection control practices related to the prevention of surgical site infections in the operating room. This study will be conducted under the supervision of Dr P. Jordan (NMMU, South Africa). The participants will be required to complete questionnaires.

I am hereby requesting your consent to conduct this research in the operating room. Upon completion of the study, I undertake to provide the hospital with a bound copy of the full research report. If you require any further information, please do not hesitate to contact me on 0713705202. Thank you for your time and consideration in this matter.

Yours sincerely,

Ms O.O. Opadotun
Dear Sir/Madam,

My name is Olukemi Opadotun, and I am a M.CUR student at the Nelson Mandela Metropolitan University in Port Elizabeth. The research I wish to conduct for my Master's research (dissertation) is entitled: Infection control practices related to the prevention of surgical site infections in an operating room. This study will be conducted under the supervision of Dr P. Jordan (NMMU, South Africa).

I am hereby requesting your consent to conduct research in the operating room. Upon completion of the study, I undertake to provide the hospital with a bound copy of the full research report. If you require any further information, please do not hesitate to contact me on 0713705202. Thank you for your time and consideration in this matter.

Yours sincerely,

Ms O.O. Opadotun (Researcher)
ANNEXURE F: QUESTIONNAIRE

QUESTIONNAIRE ON INFECTION CONTROL PRACTICES FOR THE PREVENTION OF SURGICAL SITE INFECTIONS IN THE OPERATING ROOM OF PUBLIC HOSPITALS

Please complete the following questionnaire on the infection control practices for the prevention of surgical site infections in the operating room of public hospitals. Where indicated, please make a cross next to the relevant answer to indicate your responses, for example:

X

You may choose more than one answer; and therefore, more than one cross may be made at a question, as shown above. If a question has the following section, for example, “Other, please specify” then use the dotted line: .......................................................... If you are able to answer a specific question.

THANK YOU FOR YOUR TIME AND CO-OPERATION.

Olukemi Opadotun
M.Cur student
Department of Nursing Science
Nelson Mandela Metropolitan University
0713705202
**SECTION A: DEMOGRAPHIC DATA**

Read each item below and make a cross in the block to indicate your response.

1. **Gender**
   - Male
   - Female

2. **Age**
   - 22-29 years
   - 30-34 years
   - 35-40 years
   - 41-50 years
   - 51-60 years

3. **How long have you been working in the operating room?**
   - Less than a year
   - 1-2 years
   - 3-4 years
   - 5-10 years
   - 11 years or more

4. **Basic qualifications in nursing**
   - Four year diploma
   - Four year degree
   - Bridging course
   - Other, specify

5. **Post-registration qualifications**
   - Yes
   - No

6a. **If yes, indicate the qualification.**
   - Operating room nursing
   - Other

6b. **If other, please specify.**

7. **Indicate the surgical discipline(s) in which you are currently working in the operating room complex.**
   - Orthopaedic surgery
   - Neurosurgery
   - Gynaecological surgery
| General surgery |  |
| Urological surgery |  |
| Otorhinolaryngological |  |
| Thoracic |  |
| Reconstructive |  |
| Ophthalmology |  |
| Endoscopic |  |

**SECTION B: INFECTION CONTROL PRACTICES RELATED TO THE PREVENTION OF SURGICAL SITE INFECTIONS IN THE OPERATING ROOM**

Indicate the correct answer below by choosing the most appropriate answer.

**Indicate your actions as a professional:**

<table>
<thead>
<tr>
<th>8. During pre-operative Preparation of the patient</th>
<th>Always</th>
<th>Often</th>
<th>Seldom</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.1. Do not remove hair pre-operatively unless the hair at or around the incision site will interfere with the operation</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
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<tr>
<td>8.2. Do remove hair immediately before the operation</td>
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<tr>
<td>8.3. Do require patients to shower or bathe with an antiseptic agent on at least the night before the operative day</td>
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<tr>
<td>8.4. Ensure thorough washing and cleaning at and around the incision site to remove gross contamination before performing antiseptic skin preparation</td>
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<tr>
<td>8.5. Use an appropriate antiseptic agent for skin preparation</td>
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<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>9. During hand/forearm antisepsis for Surgical procedure</th>
<th>Always</th>
<th>Often</th>
<th>Seldom</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.1. Do keep nails short, and do not wear artificial nails</td>
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<tr>
<td>9.2. Perform a pre-operative surgical scrub for at least 5 to 7 minutes using an appropriate antiseptic for the first scrub of the day</td>
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<tr>
<td>9.3. Perform a pre-operative surgical scrub for at least 3 to 5 minutes using an appropriate antiseptic for the rest of the scrubs for the day</td>
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<tr>
<td>9.4. Clean underneath each fingernail prior to performing the first surgical scrub of the day</td>
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<tr>
<td>9.5. After performing the surgical scrub, keep hands up and away from the body (elbows in flexed position), so that water runs from the tips of the fingers towards the elbows.</td>
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<tr>
<td>9.6. Do wear hand or arm jewellery (e.g: rings, bangles)</td>
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</tbody>
</table>
To what extent do you as a professional nurse agree with the following statements:

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>10. <strong>In Management of infected or Colonized surgical personnel</strong></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>10.1. Educate surgical personnel who have signs and symptoms of a transmissible infectious illness to report conditions promptly to their supervisory personnel.</td>
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<tr>
<td>10.2. Develop well-defined policies concerning patient-care responsibilities when personnel have potentially transmissible infectious conditions.</td>
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<tr>
<td>10.3. Obtain appropriate cultures from, and exclude from duty, surgical personnel who have draining skin lesions until infection has been ruled out, or personnel have received adequate therapy and infection has been resolved.</td>
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<tr>
<td>10.4. Adhering to the principles of aseptic technique is core in the operating room</td>
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</table>

11. **Intra-operative preparation / Ventilation**

11.1. Maintain positive-pressure ventilation in the operating room with respect to the corridors and adjacent area

11.2. Maintain a minimum of 15 air changes per hour, of which at least 3 should be fresh air

11.3. Introduce all air at the ceiling, and exhaust near the floor

11.4. Keep operating-room doors closed, except when needed for the passage of equipment, personnel, and the patient

11.5. Limit the number of personnel entering the operating room to necessary personnel during surgical procedures

11.6. Equipment should be used without checking for sterility indicators

11.7. A sterile package wrapped in a previously woven material drops to the floor, but it may be used in case of emergency

11.8. Protective wear, for instance, aprons, gloves and masks should be worn at all times in the operating room

12. **Cleaning and disinfection of environmental surfaces**

12.1. The operating room floor must be cleaned before each operation

12.2. When visible soiling or contamination with blood or other body fluids of surfaces or equipment occurs during an operation, use an EPA-approved hospital disinfectant to clean the affected areas before the next operation
12.3. Do not perform special cleaning or closing of operating rooms after contaminated or dirty operations

12.4. Wet vacuum the operating-room floor after the last operation of the day or night with an EPA-approved hospital disinfectant

12.5. No recommendation on disinfecting environmental surfaces or equipment used in operating rooms between operations in the absence of visible soiling

13. **Microbiological sampling**

13.1. Do not perform routine environmental sampling of the operating room. Perform microbiological sampling of operating-room environmental surfaces or air only as part of an epidemiological investigation

14. **Sterilization of surgical instruments**

14.1. Perform flash sterilization only for patient-care items that will be used immediately.

14.2. Do not use flash sterilization for reasons of convenience, as an alternative to purchasing additional instrument sets, or to save time

15. **Surgical attire and drapes**

15.1. Wear a surgical mask that fully covers the mouth and nose when entering the operating room if an operation is about to begin, or is already under way, or if sterile instruments are exposed.

15.2. Wear a cap or hood to fully cover hair on the head and face when entering the operating room

15.3. Do not wear shoe covers for the prevention of surgical site infections

15.4. Wear sterile gloves if a scrubbed surgical team member. Put on gloves after donning a sterile gown

15.5. Use surgical gowns and drapes that are effective barriers when wet (i.e., materials that resist liquid penetration)

15.6. Change scrub suits that are visibly soiled, contaminated, and/or penetrated by blood or other potentially infectious materials

15.7. No recommendations on how or where to launder scrub suits, on restricting the use of scrub suits to the operating suite, or for covering scrub suits when out of the operating suite

Thank you for your time in completing the questionnaire
ANNEXURE G: APPLICATION FOR APPROVAL

APPLICATION FOR APPROVAL
NMMU RESEARCH ETHICS COMMITTEE (HUMAN)

<table>
<thead>
<tr>
<th>1. GENERAL PARTICULARS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TITLE OF STUDY</strong></td>
</tr>
<tr>
<td>a) Concise descriptive title of study (must contain key words that best describe the study): INFECTION CONTROL PRACTICES FOR THE PREVENTION OF SURGICAL SITE INFECTIONS IN THE OPERATING ROOM</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PRIMARY RESPONSIBLE PERSON (PRP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>b) Name of PRP (must be member of permanent staff. Usually the supervisor in the case of students): <strong>DR JORDAN</strong></td>
</tr>
<tr>
<td>c) Contact number/s of PRP: 0415044501</td>
</tr>
<tr>
<td>d) Affiliation of PRP: Faculty Select Faculty HEALTH SCIENCES Department (or equivalent): DEPARTMENT OF NURSING</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PRINCIPLE INVESTIGATORS AND CO-WORKERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>e) Name and affiliation of principal investigator (PI) / researcher (may be same as PRP): <strong>OLUKEMI O. OPADOTUN</strong> Gender: Female</td>
</tr>
<tr>
<td>f) Name(s) and affiliation(s) of all co workers (e.g. co-investigator/assistant researchers/supervisor/co-supervisor/promotor/co-promoter). If names are not yet known, state the affiliations of the groups they will be drawn from, e.g. Interns/M-students, etc. and the number of persons involved: Co-Supervisor: Ms. S. Jardien-Baboo.</td>
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<table>
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<tr>
<th>STUDY DETAILS</th>
</tr>
</thead>
<tbody>
<tr>
<td>g) Scope of study: Local</td>
</tr>
<tr>
<td>i) Funding: NMMU Research Grant Additional information (e.g. source of funds or how combined funding is split) Not applicable</td>
</tr>
<tr>
<td>j) Are there any restrictions or conditions attached to publication and/or presentation of the study results? No If YES, elaborate (Any restrictions or conditions contained in contracts must be made available to the Committee): Not applicable</td>
</tr>
<tr>
<td>k) Date of commencement of data collection: 2013/08/12 Anticipated date of completion of study: APRIL 2014</td>
</tr>
<tr>
<td>l) Objectives of the study (the major objective(s) / Grand Tour questions are to be stated briefly and clearly): To explore and describe the current infection control practices for surgical site infections in the operating room in the public hospitals in the Nelson Mandela</td>
</tr>
</tbody>
</table>
Bay Municipality, and to compare these practices against evidence-based practice guidelines. **QUESTION:** What is the current infection control practices related to the prevention of surgical site infections in the operating room in the public health-care sector in the Nelson Mandela Bay Municipality?

m) **Rationale for this study:** briefly (300 words or less) describe the background to this study i.e. why are you doing this particular piece of work. A few (no more than 5) key scientific references may be included:

Infections are a major source cause of morbidity and mortality during the post-operative phase of patients. Wound infections are the second most commonly encountered type of surgical site infection (Nichols, 2007:8). Owing to the fact that wound infections may be introduced by not applying infection control and sterile technique principles in the operating room complex, it is imperative to implement infection control principles, and to apply sterile technique principles ( Williams, 2008:274). According to the World Health Organization (WHO) report, surgical site infection accounts for about 15% of all health-care associated infections and about 37% of the hospital-acquired infections of surgical patients worldwide. Two thirds of surgical infections are incisional; and one third is confined to the organ space. In western countries, the frequency of such infections is 15–20% of all cases, with an incidence of 2–15% being in general surgery. Surgical site infections lead to an average increase in the length of hospital stay of 4–7 days. Patients who sustained surgical site infections are twice as likely to die, twice as likely to spend time in an intensive care unit, and five times more likely to be readmitted after discharge (WHO, 2009:43). It will help the researcher to know if the professional nurses are adhering to the current infection control practices for surgical site infections (SSIs) in the operating room, and to compare these practices against evidence-based practice guidelines.

**METHODOLOGY**

n) Briefly state the methodology (specifically the procedure in which human subjects will be participating) (the full protocol is to be included as Appendix 1):

The research design will be quantitative, explorative, descriptive, comparative descriptive and contextual in nature. The sample will consist of all the professional nurses, in the operating room complex. The data will be collected by means of a self-administered questionnaire consisting of three sections. The research method will be focusing on the research population which are the professional nurses working in the operating room, the sampling method will include 80 professional nurses, the data collection will be through questionnaire and the statistician will assist in the analysis of the data by way of descriptive and inferential statistics. Once analysed, the data will be presented by means of tables, bar graphs and/or histograms .

o) State the minimum and maximum number of participants involved (Minimum number should reflect the number of participants necessary to make the study viable)

**Min:** 65  **Max:** 80

2. **RISKS AND BENEFITS OF THIS STUDY**

a) Is there any risk of harm, embarrassment or offence, however slight or temporary, to the participant, third parties or to the community at large? **No**

If YES, state each risk, and for each risk state i) whether the risk is reversible, ii) whether there
are alternative procedures available and iii) whether there are remedial measures available. Not applicable

<table>
<thead>
<tr>
<th>b) Has the person administering the project previous experience with the particular risk factors involved?</th>
<th>No</th>
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<tbody>
<tr>
<td>If YES, please specify:</td>
<td>Not applicable</td>
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<table>
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<tr>
<th>c) Are any benefits expected to accrue to the participant (e.g. improved health, mental state, financial etc.)?</th>
<th>Yes</th>
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<tbody>
<tr>
<td>If YES, please specify the benefits:</td>
<td>it will improve their professional practices</td>
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<tr>
<th>d) Will you be using equipment of any sort?</th>
<th>No</th>
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<tr>
<td>If YES, please specify:</td>
<td>Not applicable</td>
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<tr>
<th>e) Will any article of property, personal or cultural be collected in the course of the project?</th>
<th>No</th>
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<tbody>
<tr>
<td>If YES, please specify:</td>
<td>Not applicable</td>
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</table>

### 3. TARGET PARTICIPANT GROUP

<table>
<thead>
<tr>
<th>a) If particular characteristics of any kind are required in the target group (e.g. age, cultural derivation, background, physical characteristics, disease status etc.) please specify:</th>
<th>Not applicable</th>
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<table>
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<tr>
<th>b) Are participants drawn from NMMU students?</th>
<th>No</th>
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</table>

<table>
<thead>
<tr>
<th>c) If participants are drawn from specific groups of NMMU students, please specify:</th>
<th>Not applicable</th>
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<tr>
<th>d) Are participants drawn from a school population?</th>
<th>No</th>
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<tbody>
<tr>
<td>If YES, please specify:</td>
<td>Not applicable</td>
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<tr>
<th>e) If participants are drawn from an institutional population (e.g. hospital, prison, mental institution), please specify:</th>
<th>PUBLIC HOSPITAL</th>
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<tr>
<th>f) If any records will be consulted for information, please specify the source of records:</th>
<th>INFECTION CONTROL UNIT REPORTS</th>
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<table>
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<tr>
<th>g) Will each individual participant know his/her records are being consulted?</th>
<th>No</th>
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</thead>
<tbody>
<tr>
<td>If YES, state how these records will be obtained:</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

<table>
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<tr>
<th>h) Are all participants over 18 years of age?</th>
<th>Yes</th>
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</thead>
<tbody>
<tr>
<td>If NO, state justification for inclusion of minors in study:</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

### 4. CONSENT OF PARTICIPANTS

<table>
<thead>
<tr>
<th>a) Is consent to be given in writing?</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>If YES, include the consent form with this application [Appendix 2].</td>
<td>Type response here</td>
</tr>
<tr>
<td>If NO, state reasons why written consent is not appropriate in this study.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>b) Are any participant(s) subject to legal restrictions preventing them from giving effective informed consent?</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>If YES, please justify:</td>
<td>Not applicable</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>c) Do any participant(s) operate in an institutional environment, which may cast doubt on the voluntary aspect of consent?</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>If YES, state what special precautions will be taken to obtain a legally effective informed consent:</td>
<td>Not applicable</td>
</tr>
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</table>

| d) Will participants receive remuneration for their participation? | No |
If YES, justify and state on what basis the remuneration is calculated, and how the veracity of the information can be guaranteed. **Not applicable**

e) Which gatekeeper will be approached for initial permission to gain access to the target group? (e.g. principal, nursing manager, chairperson of school governing body) **NURSING MANAGER**

f) Do you require consent of an institutional authority for this study? (e.g. Department of Education, Department of Health) **Yes**
If YES, specify: **DEPARTMENT OF HEALTH, EASTERN CAPE**

## 5. INFORMATION TO PARTICIPANTS

<table>
<thead>
<tr>
<th>a)</th>
<th>What information will be offered to the participant before he/she consents to participate? (Attach written information given as [Appendix 3] and any oral information given as [Appendix 4])</th>
</tr>
</thead>
<tbody>
<tr>
<td>b)</td>
<td>Who will provide this information to the participant? (Give name and role) <strong>OLUKEMI O. OPADOTUN  THE RESEARCHER</strong></td>
</tr>
</tbody>
</table>
| c) | Will the information provided be complete and accurate? **Yes**
If NO, describe the nature and extent of the deception involved and explain the rationale for the necessity of this deception: **Not applicable** |

## 6. PRIVACY, ANONYMITY AND CONFIDENTIALITY OF DATA

| a) | Will the participant be identified by name in your research? **No**
If YES, justify: **Not applicable** |
| b) | Are provisions made to protect participant’s rights to privacy and anonymity and to preserve confidentiality with respect to data? **Yes**
If NO, justify. If YES, specify: The researcher will explain the confidentiality to the participants at the time of distribution of the consent forms. The researcher will explain to the participants that they are not forced to participate in the study; but voluntary consent has to be given beforehand |
| c) | If mechanical methods of observation are to be used (e.g. one-way mirrors, recordings, videos etc.), will participant’s consent to such methods be obtained? **Yes**
If NO, justify: **Not applicable** |
| d) | Will data collected be stored in any way? **Yes**
If YES, please specify: (i) By whom? (ii) How many copies? (iii) For how long? (iv) For what reasons? (v) How will participant’s anonymity be protected? The data results from this study will be included in the main study, and the data collected will be stored by the researcher. The researcher will prepare an article for publishing in a suitable peer-reviewed nursing journal. A copy of the completed research study will be given to the relevant health authorities and to the library of the local university, and will be kept for up to five years. |
| e) | Will stored data be made available for re-use? **Yes**
If YES, how will participant’s consent be obtained for such re-usage? **The researcher will explain to the participant on the important of pass data** |
| f) | Will any part of the project be conducted on private property (including shopping centres)? **No**
If YES, specify and state how consent of property owner is to be obtained: **Not applicable** |
| g) | Are there any contractual secrecy or confidentiality constraints on this data? **No** |
### 7. FEEDBACK

a) Will feedback be given to participants? **Yes**
   If YES, specify whether feedback will be written, oral or by other means and describe how this is to be given (e.g. to each individual immediately after participation, to each participant after the entire project is completed, to all participants in a group setting, etc.): **To all participants in a group setting after the entire project is completed**

b) If you are working in a school or other institutional setting, will you be providing teachers, school authorities or equivalent a copy of your results? **Yes**
   If YES, specify, if NO, motivate: **The Department of Health Eastern Cape will be giving a summerised report on the findings**

### 8. ETHICAL AND LEGAL ASPECTS

The Declaration of Helsinki (2000) or the Belmont Report will be included in the references: **Yes**
If NO, motivate: **Not applicable**

a) I would like the REC-H to take note of the following additional information: **None**

### 9. DECLARATION

If any changes are made to the above arrangements or procedures, I will bring these to the attention of the Research Ethics Committee (Human). I have read, understood and will comply with the **Guidelines for Ethical Conduct in Research and Education at the Nelson Mandela Metropolitan University** and have taken cognisance of the availability (on-line) of the Medical Research Council Guidelines on Ethics for Research ([http://www.sahealthinfo.org/ethics/](http://www.sahealthinfo.org/ethics/)).
All participants are aware of any potential health hazards or risks associated with this study. **I SELECT AN ITEM** aware of potential conflict(s) of interest which should be considered by the Committee.
If affirmative, specify: **Not applicable**

---

**SIGNATURE: DR JORDAN** (Primary Responsible Person)  
**Date: 24 March 2014**

**SIGNATURE: OLUKEMI .O.OPADOTUN** (Principal Investigator/Researcher)  
**Date: 24 March 2014**

### 10. SCRUTINY BY FACULTY AND INTRA-FACULTY ACADEMIC UNIT

This study has been discussed, and is supported, at Faculty and Departmental (or equivalent) level. This is attested to by the signature below of a Faculty (e.g. RTI) and Departmental (e.g. HOD) representative, neither of whom may be a previous signature.
11. APPENDICES

In order to expedite the processing of this application, please ensure that all the required information, as specified below, is attached to your application. Examples of some of these documents can be found on the Research Ethics webpage (http://www.nmmu.ac.za/default.asp?id=4619&bhcp=1). You are not compelled to use the documents which have been provided as examples – they are made available as a convenience to those who do not already have them available.

**APPENDIX 1: Research methodology**

Attach the full protocol and methodology to this application, as "Appendix 1" and include the data collection instrument e.g. questionnaire if applicable.

**APPENDIX 2: Informed consent form**

If no written consent is required, motivate at 4a). The intention is that you make sure you have covered all the aspects of informed consent as applicable to your work.

**APPENDIX 3: Written information given to participant prior to participation**

Attach as "Appendix 3". The intention is that you make sure you have covered all the aspects of written information to be supplied to participants, as applicable to your work.

**APPENDIX 4: Oral information given to participant prior to participation**

If applicable, attach the required information to your application, as "Appendix 4".

**APPENDIX 5, 6, 7: Institutional permissions**

Attach any institutional permissions required to carry out the research e.g. Department of Education permission for research carried out in schools.
ANNEXURE H: PERMISSION LETTER FROM THE DEPARTMENT OF HEALTH

From: To:0415042816 14/08/2013 14:01 #150 P. 001/001

Eastern Cape Department of Health

Enquiries: Zonwabele Merile Tel No: 083 378 1202
Date: 05 August 2013 e-mail address: zonwabele.merile@hmo.equipment.gov.za
Fax No: 043 642 1409

Dear Ms Opadotun

Re: Infection control practices for the prevention of surgical site infections in the operating room

The Department of Health would like to inform you that your application for conducting a research on the abovementioned topic has been approved based on the following conditions:

1. During your study, you will follow the submitted protocol with ethical approval and can only deviate from it after having a written approval from the Department of Health in writing.

2. You will observe and respect the rights and culture of your research participants and maintain confidentiality of their identities and shall remove or not collect any information which can be used to link the participants. You will not impose or force individuals or possible research participants to participate in your study. Research participants have a right to withdraw anytime they want to.

3. The Department of Health expects you to provide a progress on your study every 3 months (from date you received this letter) in writing.

4. At the end of your study, you will be expected to send a full written report with your findings and implementable recommendations to the Epidemiological Research & Surveillance Management. You may be invited to the department to come and present your research findings with your implementable recommendations.

5. Your results on the Eastern Cape will not be presented anywhere unless you have shared them with the Department of Health as indicated above.

Your compliance in this regard will be highly appreciated.

[Signature]

DEPUTY DIRECTOR: EPIDEMIOLOGICAL RESEARCH & SURVEILLANCE MANAGEMENT
ANNEXURE I: ACCEPTANCE LETTER

Copies to:
Supervisor: Dr P Jordan
Co-supervisor/s: Ms S Jardien-Baboo

Summerstrand South
Faculty of Health Sciences
Tel. +27 (0)41 5042121 Fax. +27 (0)41 5042854
Nouwaal.Isaacs@nmmu.ac.za

Student number: 209002023
Contact person: Ms N Isaacs

16 July 2013
Ms O Opadotun
PO Box 651
Govan Mbeki Avenue
Port Elizabeth
6000

FINAL RESEARCH/PROJECT PROPOSAL: MCUR RESEARCH
DISSERTATION TITLE: INFECTION CONTROL PRACTICES FOR THE PREVENTION OF SURGICAL SITE INFECTIONS IN THE OPERATING ROOM

Please be advised that your final research project was approved by the Faculty Research, Technology and Innovation Committee, subject to the following amendments/recommendations being made to the satisfaction of your Supervisors:

FRTI grants ethics approval. FRTI committee reference number: H13-HEA-NUR-008.

Please be informed that this is a summary of deliberations that you must discuss with your Supervisors.

Please forward an electronic copy of your proposal and all appendices to the FRTI secretariat.

Kind regards

Ms N Isaacs
Manager: Faculty Administration
Faculty of Health Sciences