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Nursing Interventions for the Prevention of Surgical Wound Infections – A Descriptive Literature Review

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<p>Surgical wound infection is common but avoidable complication after surgical operation. Surgical wound infection impacts negatively on patient's health and increases financial costs. Therefore, nurses have an essential responsibility in quarantining patient safety by prevention of surgical wound infections.</p> <p>The purpose of this bachelor's thesis was to describe nursing interventions that prevent surgical wound infections. The aim of this bachelor's thesis was to collect evidence-based information on how nurses can correctly prevent surgical wound infections. The research questions of this bachelor's thesis were: 1) Which nursing interventions prevent surgical wound infections? 2) What are the challenges of nurses when practicing nursing interventions whilst preventing surgical wound infections?</p> <p>The bachelor's thesis is a descriptive literature review. Eight research articles were analysed, which were selected as a result of a systematic search from PubMed and CINAHL databases. An inductive content analysis was performed on the studies to answer the research questions of the bachelor's thesis.</p> <p>Based on the analysis, six nursing interventions were results to prevent surgical wound infections. These nursing interventions are preparation of a surgical site, an aseptic technique, maintaining patient's vital signs, wound care, communication, and pharmaceutical interventions. However, nurses face challenges in clinical practice, due to which nursing interventions are not always implemented or are implemented to a limited extend. These challenges are often caused by nurse's lack of competence or issues with workplace practice.</p> <p>Nursing interventions which prevent surgical wound infections have been widely researched and there is clear evidence of their benefits. The challenges of nurses when practicing nursing interventions resulted in this bachelor's thesis are crucial from the point of view of patient safety. Therefore, further research on how these challenges experienced by nurses could be reduced is necessary.</p>	
Keywords	Surgical wound, infection, nursing intervention

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<p>Kirurginen haavainfektio on yleinen, mutta ehkäistävissä oleva kirurgisen toimenpiteen jälkeinen komplikaatio. Se heikentää potilaan terveyttä ja lisää hoitokustannuksia. Tästä johtuen sairaanhoitajalla on suuri vastuu taata potilasturvallisuus ehkäisemällä kirurgista haavainfektioita.</p> <p>Tämän opinnäytetyön tarkoituksena oli kuvailla hoitotoimenpiteitä, joilla sairaanhoitajat pyrkivät estämään kirurgisen haavainfektion syntymistä. Tämän opinnäytetyön tavoite oli kerätä tutkittua tietoa siitä, kuinka sairaanhoitajat voivat estää haavainfektion syntymistä. Opinnäytetyömme tutkimuskysymykset olivat: 1) Mitkä hoitotoimet estävät kirurgisia haavainfektioita? Ja 2) Mitä haasteita sairaanhoitajat kohtaavat, kun he toteuttavat haavainfektioita estäviä hoitotoimia.</p> <p>Opinnäytetyö toteutettiin kuvailevana kirjallisuuskatsauksena. Kirjallisuuskatsauksessa on analysoituna kahdeksan tutkimusta, jotka valikoituivat systemaattisen haun tuloksena PubMed- ja CINAHL- tietokannoista. Tutkimuksista tehtiin induktiivinen sisällönanalyysi vastaamaan opinnäytetyön tutkimuskysymyksiin.</p> <p>Analyysin pohjalta selvisi kuusi hoitotoimenpidettä, jotka estävät kirurgista haavainfektioita. Nämä hoitotoimenpiteet ovat toimenpidealueen valmistaminen, aseptinen tekniikka, potilaan elintoimintojen tarkkailu, haavanhoito, kommunikaatio ja lääkehoito. Sairaanhoitajat kuitenkin kohtaavat hoitotyössään esteitä, joiden takia hoitotoimia ei aina toteuteta tai niitä toteutetaan rajoitetusti. Nämä esteet monesti aiheutuvat sairaanhoitajan puutteellisen pätevyyden ja työpaikan ongelmien takia.</p> <p>Kirurgista haavainfektioita ehkäiseviä hoitotoimia on tutkittu laajalti ja niiden hyödyistä on selvää näyttöä. Opinnäytetyössä esille nousseet esteet, jotka rajoittavat sairaanhoitajia toteuttamasta tärkeitä kirurgisen haavainfektion ehkäiseviä hoitotoimia, ovat potilasturvallisuuden kannalta olennaisia. Tämän vuoksi tutkimus siitä miten näitä sairaanhoitajien kokeimia haasteita pystyttäisiin vähentämään, on tarpeen.</p>	
Avainsanat	Kirurginen haava, infektio, hoitotoimenpide

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1 Introduction

The protection and maintenance of the skin is fundamental in nursing. Still, managing wounds create many challenges in clinical practice. (Mitchell & Llumigusin 2020: 6.) Wounds are a significant challenge for nurses because of their prevalence in community (Lelapi et al. 2022). Nurses have an increasing responsibility in caring for the wounds and therefore they have a key role in securing patient safety with correct clinical care including preventing surgical wound infections. (Annesley 2019: 290).

Surgical wound infections are a menace to millions of patients in an annual basis (World Health Organization 2018.) Major challenges and burden are caused for patients and economy when surgical wounds get infected. Surgical wound infections increase financial costs and impact negatively on patients' health. (Badia et al. 2017: 2.) Patients with surgical wound infection, financial cost is three times as much as to care patients who do not develop infection. Also, patients with surgical wound infection stay in hospital almost seven days more than patients who do not develop infection. (World Health Organization 2018:29.)

Caring for wounds is supposed to be based on evidence, but there is not enough reliable evidence and studies done to support best practices. Evidence-based practice includes research evidence, patient experience, and nurse's education. To provide the most effective care, it is fundamental for nurses to have knowledge about wound healing and ensure patient-oriented treatment. (Annesley 2019: 290.) Research shows competence is limited among the nurses and nursing students. They do not have enough education for wound care, and they don't feel prepared for doing it. (Kielo-Viljamaa & Viljamaa & Suhonen & Salminen & Stolt 2022; Lelapi et al. 2022: 674.) Because surgical wound infections are common but preventable complications with symptoms that can lead to a life-threatening condition (Zabaglo & Sharman 2017; Centers for Disease Control and Prevention. 2021: 1-3.) it is essential to do research on this topic.

The purpose of this bachelor's thesis is to describe nursing interventions that prevent surgical wound infection, and the aim is to collect evidence-based information on how nurses can correctly prevent surgical wound infections.

2 Background

2.1 Surgical wound

The skin with its great variety of different functions is the body's largest organ. It regulates the body temperature, protects from external factors such as bacteria, acts as a sensory organ, and produces vitamin D. The skin has three layers: epidermis, dermis, and hypodermis. (Juutilainen & Hietanen 2018: 16-17.) A wound is described as any damage or injury on the layers of skin (Annesley 2019: 290).

Wounds are caused by external factors or internal diseases. Wounds can be classified as either acute or chronic based on the appearance of the wound and the mechanism of the tissue injury. (Juutilainen & Hietanen 2018: 12, 27.) Wound is considered chronic when the healing is delayed because the wound does not follow the normal phases of healing (Welsh 2018: 53). Typically, an acute wound is a result from trauma, injury, or surgery (Stuart 2020: 58). Acute wounds heal within an expected timescale without complications through a systematic and reparative process. Acute wounds can be further divided into two subcategories: surgical and traumatic. (Juutilainen & Hietanen 2018: 27.) In this bachelor's thesis the focus is only on the surgical aspect of acute wounds.

Surgical wound or incision is purposefully and necessarily made by healthcare professionals (Juutilainen & Hietanen 2018: 27). It is an act aiming on preventing or repairing damage appearing in the tissue. The procedure of surgical wound means an invasive mechanical operation executed by making an incision to the skin, mucus membrane or through a natural cavity of the body. Nowadays with the help of evolving technology, it is possible to perform large number of surgeries through small incisions rather than large incision wounds. The right incision type is chosen individually by the healthcare professional. (Sarpel 2021: 7.) By making a skin incision, healthcare professionals can access the tissues below skin and reach the issue causing the tissue damage. Reasons for a tissue damage can be for example hypoxia of a body organ, mechanical or thermal damage, invasion of tumour cells, inflammatory or degenerative changes. These tissue damages can be local, but they can also cause a systematic impact for the organ. (Leppäniemi 2017.)

2.2 Wound healing process

Wound healing is a process which consists of four phases: hemostasis, inflammation, proliferation, and remodeling. Hemostasis lasts for minutes, and its function is both to prevent massive blood loss and protect the loss of organ function. Inflammatory phase lasts for 4-5 days, and it aims to destroy bacteria and create barrier to bacterial contamination. Proliferation phase lasts for 3-24 days, and its main function is to re-establish the tissue. Maturation lasts for 21 days onwards, and it aims to wound closure and scar creation. (Mitchell & Llumigusin 2020: 6; Wynn 2021: 28-30.) Optimal wound healing requires these phases to be in right order, at a specific time and continue for a certain duration. Each of the phases have an important role and function on wounds to heal precisely. Complications and prolongation in wound healing are usually results of inadequate treatment of wounds or deficiency in one or more phases in the healing process. (Mitchell & Llumigusin 2020: 6; Wynn 2021: 28-30.)

There are many factors that can delay wound healing. These factors delay wound healing by minimizing the oxygen and nutrients on the wound area which are required for the energy-demanding process. Oxygen and nutrients are provided to the wound area via blood circulation. For this reason, monitoring patient's vital signs is crucial. Vital signs include oxygen saturation, temperature, respiratory rate, blood pressure and pulse. Pain and smoking can inhibit wound healing by constricting blood vessels which impairs the efficiency of blood circulation. (Karppinen & Heljasvaara & Pihlajaniemi & Lagus & Järveläinen 2020; Brekke & Puntervoll & Pedersen & Kellett & Brabrand 2019.) Infection is one typical reason for delayed wound healing (Koskivuo & Brück & Veräjänkorva 2019: 1847). Numerous diseases and medications delay or stop wound healing. The most common disease impairing wound healing is diabetes. Diabetes does not only delay wound healing but also makes wounds turn chronic. (Karppinen et al. 2020.)

Some promoting factors in wound healing are nutrition and hydration. A balanced diet is indispensable to offer necessary nutrients required for wound healing. On the other hand, a balanced diet helps preventing and managing obesity which is a risk for wound healing. (Stuart 2020: 58.)

The whole wound healing process is complex causing many challenges both in public health and national economy (Stuart 2020: 61). International research shows that caring for the patients with wounds take 2-5,5% from the budget for health care. Wound

healing does not only bring enormous financial cost but also affects overall wellbeing of patients, meaning physical and mental wellbeing. (Kallio & Lagus & Isoherranen & Matikainen 2020: 1702.) Wounds as a major concern for healthcare services, individuals, and as a reason for increased costs makes wound care a significant area for nursing (Lelapi et al. 2022).

2.3 Surgical wound infection

Surgical wound infection is defined by the European Centre for Disease Prevention (ECDC) and the Centre for Disease Control and Prevention (CDC) as postoperative infection meaning infection which takes place within 30 days of a surgical operation or within one year if the operation required implants to be placed (Badia et al. 2017: 2; Boga 2019: 1229). According to Martins et al., (2020: 2), surgical wound infections are among the leading post-operative complications. They can appear in all kinds of procedures that involve surgical or incisional approach regardless of the size or location. (Martins et al. 2020: 2.)

Surgical wound infections are a menace to millions of patients in an annual basis. (World Health Organization 2018.) They are common but preventable complications, representing the leading factors causing morbidity, extended hospitalization, and mortality, and can be a life-threatening condition; therefore, it is essential to assess surgical wounds and notice the signs of infection. (Zabaglo & Sharman 2017; Centers for Disease Control and Prevention. 2021: 1-3.)

Typically, patients have surgical wound infection symptoms in 3-7 days from the operation. Signs of an infection in a wound are profuse secretion discharge, swelling, pain on the wound site, redness, delayed healing of the wound or bad smell. Patients usually complain pain, discharge, and feeling unwell. If surgical wound infection is suspected, dressings should be changed, and a microbiology sample be taken. (Juutilainen & Hietanen 2018: 110-111; Zabaglo & Sharman 2017.)

There are multiple elements influencing surgical wound healing and the potential to develop surgical wound infection. The elements having a predisposing effect to surgical wound infections can be divided into intrinsic and extrinsic elements. Intrinsic elements are for example age, life habits and pathogens. Extrinsic elements are for example surgical techniques and procedures applied. (Martins et al. 2020: 2-3). Patients with diabetes or other metabolic syndromes, elderly, patients who smoke, and patients with

weakened immune system have higher risk for developing surgical wound infections. Also, patients with a long operation have a higher risk for developing a surgical wound infection. (Zabaglo & Sharman 2022.)

Developing a surgical wound infection begins with microbial contamination meaning unintentionally introducing bacteria that enter patients' body through surgical wound. Bacteria through contamination may come through operation room, air, staff, instruments, and materials. Staphylococcus aureus (*S. aureus*), Enterococcus, coagulase-negative staphylococci, and Escherichia coli are bacterium commonly causing surgical wound infections. Presence of bacteria in tissue, injures the tissue and prolongs the wound healing. (Wynn 2021: 26; World Health Organization 2018; Zabaglo & Sharman 2022.)

An important part of nurses' responsibilities is taking care of asepsis meaning something is without bacteria or other microorganisms. This is a way to prevent the spread of bacteria that cause infections. Aseptic practices mean practices such as hand hygiene, using personal protective equipment, preparing the patient, and keeping the doors of operation room closed. (Parnikh & Kalantari & Abnavi & Hasanshahi & Gheysari 2022.) A major part of aseptic practices is taking care of sterility meaning that something is without bacteria or other microorganisms. Nurses can take care of sterility by checking the instruments, the packing of instruments, and preparing the operation field. Part of infection prevention is taking care of the operation room's cleanliness. (World Health Organization 2018: 54-55.)

2.4 Nursing interventions

Nursing intervention can be defined as a purposeful action completed by a nurse with the objective of promoting the overall health and well-being of a patient or a client. These actions are taken, and they are based on the nurse's clinical judgement and knowledge. Nursing interventions are indented to produce positive outcomes by taking into consideration the patient's individual need. By performing nursing interventions nurses can enhance the condition of a patient and to promote the healing process. (Butcher et al. 2018: 49.) There are various types of nursing interventions that can be divided based on their function, implementation, site of application or location and provider. However, all these interventions aim to achieve the same overarching goals,

which are to promote the holistic empowerment of the patient, address health problems, improve and maintain optimal health status of the patient. (Butcher et al. 2018: 49.)

Managing wounds is a necessary part of daily practice for nurses (Lelabi et al. 2022). According to a recent research, nurses working in hospitals use approximately of 27-50% of their work to caring for wounds (Vains & Finlayson 2021: 112). Nurses play an essential role in caring for all types of wounds especially as they care for patients with surgical wounds. During patient's recovery nurses strive to enhance wound healing and prevent infections and delayed wound healing. Managing and preventing wounds require comprehensive competence consisting of knowledge, skills, performance, values, and attitudes. (Kielo-Viljamaa & Viljamaa & Suhonen & Salminen & Stolt 2022; Lelapi et al. 2022: 674.)

Nurses working in perioperative units have a major role in preventing patients' perioperative complications, and it is one of the most important areas in perioperative care. Patients ongoing to surgeries are vulnerable and their needs must be heard by health care personnel. To be able to provide high-level care, nurses need to pursue cognitive, interpersonal, and clinical skills. (Jabur et al. 2022: 77-80.) Perioperative care process consists of three phases, which take place before, during and after the surgery of a patient. These are called preoperative, intraoperative, and postoperative phases. Preoperative phase means care between the decision to have the operation and patient arriving to the operation room. Intraoperative phase means care during the surgery. It starts when patient arrives to the operation room, and it ends when patient leaves the operation room. Postoperative phase means time immediately following the operation. It means the care needed for the patient to recover from anesthesia and operation. (Aura. 2022: 23.) Prevention of surgical wound infection is required during each of these phases, but the focus of this bachelor's thesis is on the intraoperative phase.

The participation of the whole team of perioperative nurses is meaningful and should also include analyzing and identifying preventive measures and the predisposing factors to infections. Given that most of the risk factors increasing proneness to surgical wound infections can be prevented by actions of care, only underlines the responsibility of the nursing team providing care to patients. Being aware of which actions and approaches increase, and the ones that prevent the risk of acquiring surgical infection, and following these recommendations, is crucial for a nurse. (Martins et al. 2020: 2-3.)

3 Purpose, aim and research questions

The purpose of this bachelor's thesis is to describe nursing interventions that prevent surgical wound infection, and the aim is to collect evidence-based information on how nurses can correctly prevent surgical wound infections.

The research questions of this bachelor's thesis are:

1. Which nursing interventions prevent surgical wound infection?
2. What challenges do nurses face when practicing nursing interventions whilst preventing surgical wound infection?

4 Methodology and Methods

Qualitative research can be described as a method which pursues to comprehensively describe and establish a certain subject or phenomena. This method is utilized to understand and measure the quality and features of a specific action or event, and to create a theoretical framework to some phenomena. (Tuomi & Sarajärvi 2018: 98.)

The data which qualitative research methodology depends on, is typically empirical theory and is gathered through questionnaire, interview, observation, or information collected from different sources. These data gathering methods can be executed in variable ways depending on what kind of information is wanted. Examples for different data collection approaches could be verbal methods, such as theme interview, dialogical discussion or open discussion, or non-verbal written expressions which can be divided into two groups. The first group includes private documents, such as letters, diaries, memoirs, or other written documents, whereas the second group includes newspapers, magazines, radio- and tv-programmes. The data included in qualitative research approach is rarely statistical or numerical. (Tuomi & Sarajärvi 2018: 84-96.) Aspers and Corte (2019: 139-160) have pondered in an article the questions revolving around the features of a qualitative research and they have described qualitative research with four concepts: distinctions, iterative process, closeness, and improved understanding.

4.1 Data collection method

This bachelor's thesis was executed as a descriptive literature review. It means that the topic and the research questions addressed in this bachelor's thesis were used to find evidence based academic research based on the topic. These findings were used to illustrate the current academic investigated evidence. A descriptive literature review does not only demonstrate the amount of information that has been researched, but also reports of the quality of the research and indicates possible lack of research on the specific field of study. It consists of a process part, at which point the material for the review is collected, a synthesis of the text section usually represented in tabular form, and an analysis part to indicate the reliability and significance of the existing research. Descriptive literature review characteristically concentrates on observing published scientific research and principally focuses on peer reviewed studies. The giving of query in descriptive literature review is commonly expansive but can vary entirely and can contain various limitations. Descriptive literature review does not point out the reliability or the selection of the material used in the review, which is considered one of the issues in literature review of this kind. (Stolt & Axelin & Suhonen 2016: 7-10.)

4.2 Data search and selection

PICo is utilized in systematic research to plan the search and to define the study questions used in the research. It helps to create a valid data searching plan to find specific answers through the scoping, when using set of three or four elements. (Frandsen & Nielsen & Lindhardt & Eriksen 2020: 1-3.)

The PICo used for this bachelor's thesis included three stages. These are 1) P, population which is nurses 2) I, interest which is wound infection prevention by nursing interventions and 3) Co, context, in which is patients with surgical wound.

Table 1. The pico created for this bachelor's thesis.

P	Population	Nurses
I	Interest	Wound infection prevention by nursing interventions
Co	Context	Patients with surgical wounds

The data used in this bachelor's thesis was systematically collected from databases by utilising various terms and keywords to search for research results. To find specific information more efficiently, Boolean techniques were used, which included the operators AND and OR. Other tools which were used in the search are truncation, to include all forms of the searched word in a search, and phrases, which tie binomial words together. (Stolt et al. 2016: 36-41.)

Our search sentence was:

surg* AND (infection* OR "wound infection*") AND nurs* AND (intervention* OR strategies OR "best practice*") AND wound*

The search sentence was used to find data from two databases, CINAHL and PubMed. The database search on CINAHL resulted in total of n=120 hits, from which n=56 articles were included based on the article's title. These n=56 articles were screened on the abstract level which led to n=24 articles to be chosen by reading the abstract. Finally, n=4 articles were included after reading the whole text of the articles. The database search on PubMed resulted in total of n=261 hits, from which n=38 articles were selected based on the title. These n=38 articles were read on the abstract level which led to n=9 articles to be chosen by reading the abstract. Finally, n=1 article was included after reading the whole text of the articles from PubMed. After selecting these five articles from the databases of CINAHL and Pubmed, the reference lists were screened, and three additional articles were identified and chosen from these sources. The total amount of articles selected for this bachelor's thesis was eventually n=8.

Exclusion criteria and limiters are used to leave out unnecessary information from the search results (Stolt & Axelin & Suhonen 2016: 57). Precisely set exclusion and inclusion criteria increases the validity of the literature review, as the criteria narrows the number of studies that might be irrelevant for the systematic review. (Mikkonen & Kääriäinen 2020: 106.)

Articles published more than five years ago were excluded from this bachelor's thesis. Instead, articles published from 2017 to 2022 were included. Articles published in languages other than English or Finnish were excluded from this bachelor's thesis. As mentioned above, this research is about preventing wound infection, but this bachelor's thesis focuses only on surgical wound perspective. Therefore, articles which focus on acute traumatic wounds or chronic wounds were excluded. Also, articles which focused on pediatric patients were excluded meaning that only articles focusing on adult patients were included. Articles which were reviews, not nursing scientific, or not peer-reviewed were excluded in the data selection. Below can be seen the inclusion and exclusion criteria used in this bachelor's thesis in a table form.

Table 2. Inclusion and exclusion criteria.

Inclusion criteria	Exclusion criteria
English or Finnish language studies	Non-English and Non-Finnish language studies
Studies from 2017 to 2022	Studies published before 2017
Adult patients	Pediatric patients and adolescent patients
Surgical wound	Traumatic wound
Primary studies, Nursing scientific studies, peer-reviewed studies	Reviews, non-nursing scientific studies, non-peer-reviewed studies, literature reviews, other thesis/pro gradu
Concerns or includes nursing interventions	Does not include concern or include nursing interventions

PRISMA is a tool that is used to report the progression of a systematic data choosing process. The name is an abbreviation which comes from the words Preferred Reporting Items for Systematic Reviews and Meta-Analyses. It includes a cluster of components which describes the data selection precisely step by step. PRISMA is an evidence-based instrument that helps the author to complete the reporting of a systematic review. The PRISMA flow chart includes four stages, which are identification, screening, eligibility, and inclusion. (Prisma-statement 2023; Stolt & Axelin & Suhonen 2016: 61-63.) Below can be seen the PRISMA flow chart which reports the data selection used in this bachelor's thesis.

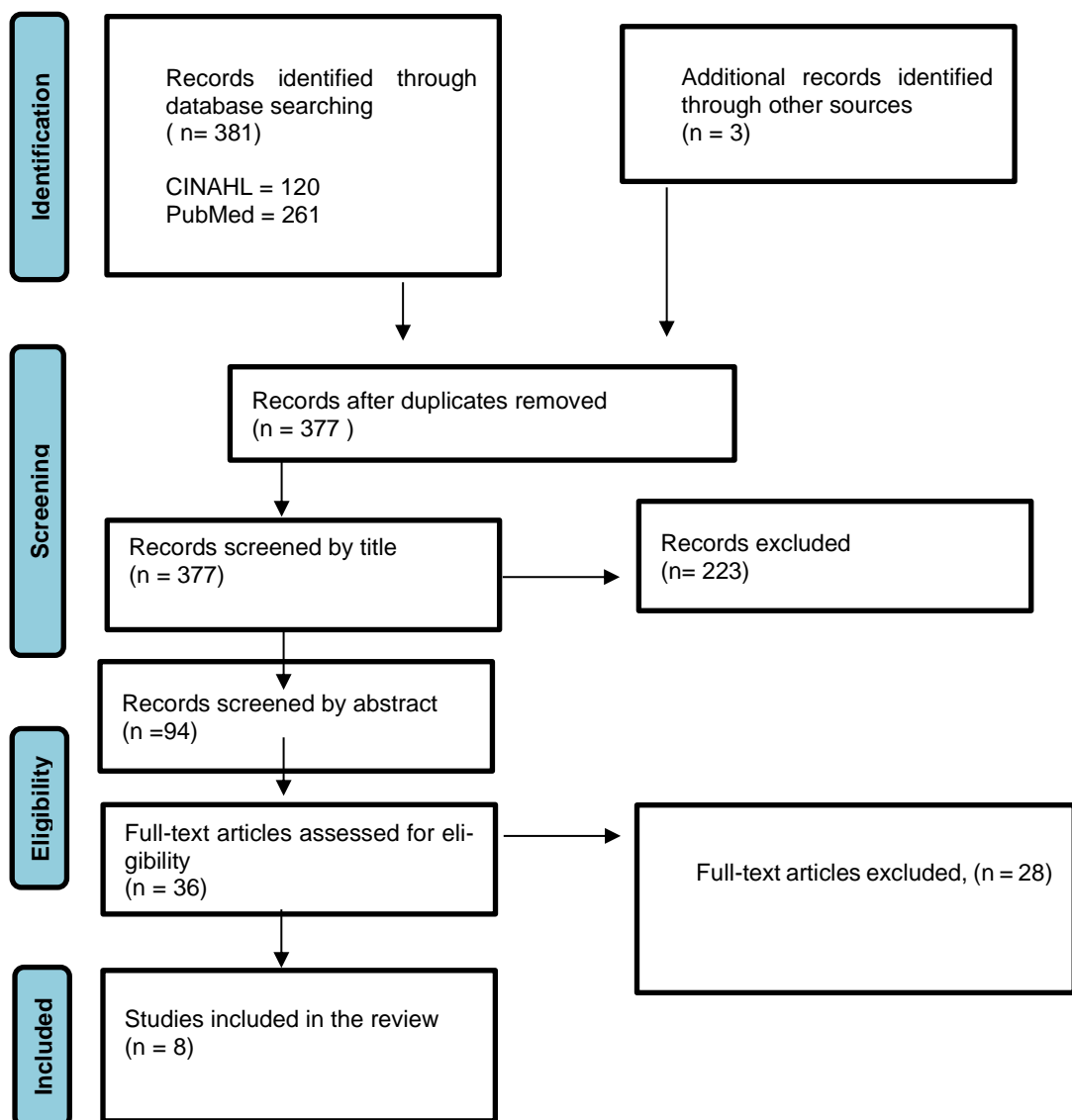


Figure 1. Prisma flow chart.

4.3 Data analysis method

The qualitative analysis can be divided into two groups: one group's analysis is controlled by theory, examples of which are grounded theory or phenomenological analysis, and in the other group are included all the forms of analysis which are not theory-driven. Content analysis, which is part of the second group, is an analysis method that can be and is traditionally used when conducting qualitative research. (Tuomi & Sarajärvi. 2018:103.) Content analysis enables the researchers to interpret research framework objectively and makes systematic theoretical level inspection possible. Analyzing methods can be used to analyze different kinds of documents and often are utilized to construct various concepts, categories, and themes. These groups can be expanded to generate models, conceptual structures, or maps. (Kyngäs 2020: 13.)

Qualitative analysis can also be divided into inductive and deductive analysis. The ideology behind this division is so called logical inference, that can appear from individual to general (inductive) or from general to individual (deductive). This categorization does have a practical issue though, as it does not leave space for the third scientific logical inference category, abductive inference. (Tuomi & Sarajärvi. 2018:107.)

The articles chosen for this bachelor's thesis were analysed using the inductive content analysis method. According to Cambridge Dictionary (2022), inductive as a word means the following: "Using a particular set of facts or ideas to form a general principle".

Inductive content analysis is described as a material-oriented content analysis method, rather than theory oriented (Tuomi & Sarajärvi 2018:122). The main ideology in inductive content analysis is to organize and summarize the results of the chosen articles (Stolt & Axelin & Suhonen 2016: 30). Inductive content analysis is applied usually when a study is started with an inductive starting point. This kind of studies normally are qualitative studies. (Kyngäs 2020: 14.)

The stages of inductive content analysis are 1) reduction of material, in which the information to be analyzed is explicated understandable and unnecessary data is removed, 2) grouping of material, at which data received from the material are scoped precisely to find concepts describing similarities, differences or similar phenomena, which are then divided into sub-categories and categories and lastly 3) creating theoretical concepts, in which relevant information is sorted from the data created before, and that is

again used to create theoretical concepts as the name indicates. In the beginning of this material-oriented content analysis, an analysis component must be defined. This could be one word, sentence or extended phrase describing an idea. Interpreting and writing out the results to create a coherent whole, synthesis, to support the understanding is part of content analysis. (Tuomi & Sarajärvi 2018: 117-127; Stolt & Axelin & Suhonen 2016: 30-31.) In the figure 2 can be seen an example of the inductive content analysis which was used to analyze the research articles used in this bachelor's thesis.

Meaning unit	Coding	Sub-category	Generic category	Main category
"Perioperative normothermia, glucose control and hyperoxia are used in 84.3%, 65.9% and 23.3% of cases, respectively. "	Maintaining patient's normothermia	Keeping patient warm	Maintaining patient's vital signs	Prevention of surgical wound infection
	Maintaining patient's glucose levels	Glucose control	Maintaining patient's vital signs	Prevention of surgical wound infection
	Hyperoxia is used respectively.	Saturation control	Maintaining patient's vital signs	Prevention of surgical wound infection
"Nurses were observed to set up aseptic fields and sterile wound dressing kits were used."	Nurses set up aseptic fields	Maintaining Sterile area	Preparing surgical site	Preventing surgical wound infection
	Nurses use sterile wound dressings.	Wound care products	Wound care	Preventing surgical wound infection

Figure 2. Example of the inductive content analysis.

5 Results

In this bachelor's thesis, eight research articles were used to answer the research questions: "Which nursing interventions prevent surgical wound infection?" and "What are the challenges of nurses when practicing nursing interventions whilst preventing surgical wound infection?". In the research of chosen articles, two studies used qualitative methods, three studies used quantitative, and three used mixed method. Four (n=4) articles from the total of eight articles were from Europe, in which three (n=3) were from Sweden and one (n=1) was from Spain. Two (n=2) articles were from Australia, one (n=1) was from the United States of America and one (n=1) from Saudi Arabia. These articles were analysed using inductive content analysis. Subsequently, 34 sub-categories, 8 generic categories, and two main categories were created in the inductive analysis. Two main categories are 1) Nursing interventions for surgical wound infection prevention which resulted from six generic categories and 24 sub-categories and 2) Limitations of nursing interventions for the prevention of surgical wound infection, which was created from two generic categories and 10 sub-categories. These categories and results can be seen below in the Figure 3.

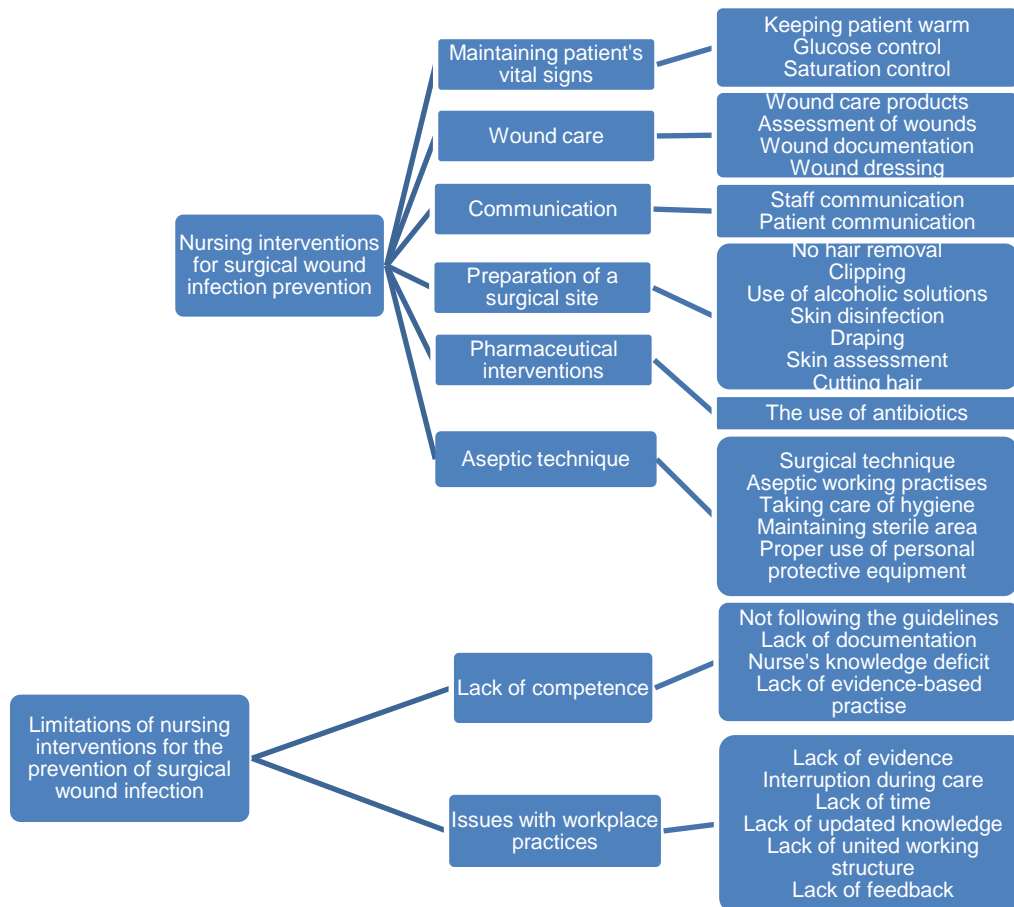


Figure 1. Categorization used in the inductive content analysis.

5.1 Preventing surgical wound infection

Based on the analyzed data nursing interventions such as aseptic technique, preparation of a surgical site, maintaining a patient's vital signs, wound care, communication, and pharmacological interventions are commonly used to prevent surgical wound infections. These interventions are explained below.

5.1.1 Aseptic technique

As mentioned above asepsis means a state of freedom from bacteria. Maintaining aseptic practices and an aseptic environment is researched to prevent surgical wound infection by preventing the spread of bacteria. Nurses are accountable for the implementation of hygiene to prevent infections. Maintaining hand hygiene is an essential practice to prevent spreading of bacteria but it is important to remember the correct technique. Hand hygiene is maintained by performing disinfection and washing of hands and forearms with water and soap preoperatively. (Wistrand & Falk-Brynhildsen & Nilsson 2018: 438-442; Qvistgaard & Lovebo & Almerus-Österberg 2019: 2.) Proper hand hygiene is essential when caring for surgical wounds. Before applying and changing dressings, it is important to remember to disinfect hands. Research shows variations in practice whether hands should be washed in addition to disinfection. (Ding & Lin & Marshall & Gillespie 2017: 31.)

Nurses wear and change clothes daily which are designed to prevent a spread of bacteria. A double glove method reduces the risk of infection. Outer gloves are changed for example if the gloves have punctured, or the procedures take for a long time. Sterile gowns and gloves are used in sterile area to maintain sterility by preventing the risk of contamination. (Wistrand & Falk-Brynhildsen & Nilsson 2018: 442.)

Aseptic technique means that the nurse is aware of the environment and potential sources of contamination. For example, it is good to have a good balance of what equipment, people and machines are in the operation area. In operations that require aseptic conditions, it is good to minimize sources of contamination, for example by moving them further away. (Ding & Lin & Marshall & Gillespie 2017: 31.)

5.1.2 Preparation of a surgical site

Preparation of patients' skin before a surgical operation aims to prevent surgical wound infection by bringing bacteria to minimum and hindering the growth of bacteria. Research emphasizes the importance of disinfecting the patient's skin preoperatively meaning prior to surgery. Disinfection prevents bacteria from entering the surgical wound. The duration of disinfection and the use of different disinfection solutions vary. (Wistrand & Falk-Brynhildsen & Nilsson 2018: 440; Qvistgaard & Lovebo & Almerud-Österberg 2019: 1.) When disinfecting the patient's skin, it is important to consider the size of the area disinfected to be large enough, and the disinfecting technique to have a sufficient pressure and duration. Disinfection should be careful and follow the guidelines.

Before disinfection, patients' skin should be assessed for example that patients do not have open wounds. Before a surgical operation it is common to remove hair from the operation area of the body. There are different guidelines whether patients' hair should be removed or not. Hair removal can damage skin which increases the risk for patient to develop surgical wound infection. There are guidelines supporting hair removal and against it with suggestions to practice hair removal with clipping only. Clipping means (Wistrand & Falk-Brynhildsen & Sundqvist 2021: 1051.)

After disinfection patient is being draped with sterile draping. The main reason for draping of the patient is to delineate sterile area to prevent contamination. Draping should be supervised throughout the surgery to be sure that it will stay in place and attached to patient's skin. Adhesive plastic drapes are also one way to prevent bacteria from entering the surgical wound. (Wistrand & Falk-Brynhildsen & Nilsson 2018: 440.)

5.1.3 Maintaining patient's vital signs

One key element in reducing the risk of surgical wound infection is maintaining patient's vital signs. Vital signs include body temperature, pulse rate, respiration, blood pressure, and glucose level control. Preservation of normal body temperature is a significant way of maintaining patient's vital signs. Patient's body temperature can be maintained by controlling the operating room temperature. Warm blankets and mattresses are widely used to keep patients warm during the surgery. Liquids such as skin disinfection solution for the use in the incision area can be heated. Methods for heating

liquids are hot water, warming cupboard, and microwave oven. (Wistrand & Falk-Brynhildsen & Nilsson 2018: 438, 442.)

5.1.4 Wound care

Basis for managing surgical wounds is possessing aseptic practices. As mentioned in the chapter 5.1.1, nurses are responsible for implementing hygiene which includes hand hygiene. The importance of hand hygiene cannot be emphasized enough when performing wound care, and attention should be paid to making sure hand hygiene protocols are followed before and after each wound care occasion. (Din & Lin & Marshall & Gillespie 2017: 31–32.)

By setting up a sterile area and by using sterile wound care products, aseptic approach can be ensured. The contamination of a surgical incision wound must be avoided, for which reason the correct use of gloves is highly important. When using medical factory clean gloves, nurses should make sure to use a non-touch technique which means avoiding touching the wound to prevent the wound from contamination. When using sterile gloves, attention should be paid on keeping the gloves sterile by not touching intentionally or unintentionally an area which is considered unsterile, to prevent the bacteria to spread through the gloves. (Din & Lin & Marshall & Gillespie 2017: 31–32.)

Assessing of a wound should happen as regular occasions, including visual observation. Any signs of infections such as pain, fever, swelling and redness are important to notice at early stage. Effective wound care period also consists of sufficient documenting, and it should include all the wound care periods in the hospital, the length of these and the timeline of the wound including the appearance date and time of the wound, as well as the time when the wound care period has ended. Also, recording the signs of healing, appearance, wound site pain, possible foreign bodies, and instructions on how to take care of the wound after discharge should be all included in the wound care documentation. By implementing a strict wound care documentation protocol, possible signs of infection can be detected at an early stage, ensuring that patients receive the necessary care. (Din & Lin & Marshall & Gillespie 2017: 31–32.)

5.1.5 Communication

Patients can themselves influence on the prevention of the wound infection, for which reason well given patient education is important. When good level of patient education

is provided to the patient, they can take part in their own care. This increases the experience of empowerment and independency, which as well is an important aspect of care. Communication should be clear and coherent, to ensure that the patient has an adequate level of understanding of the care. The patient should be provided with enough of patient counselling to receive necessary information and skills to carry out care on their own if needed. If the guidance is insufficient or is lacking completely, some aspects of infection prevention may remain unaddressed and the risk of acquiring wound infection increases. (Lin et al. 2018: 1649; Lin et al. 2020: 197.) The results as well highlight the importance of the communication of surgical team, which is an essential factor in preventing surgical site infections (Qvistgaard 2019: 1053).

5.1.6 Pharmaceutical interventions

The use of pharmaceutical interventions plays a crucial role in preventing surgical wound infections among patients. Specifically, the administration of antibiotics as a pre-operative nursing intervention has been shown to be effective in reducing the risk of surgical wound infections. Therefore, the proper use of pharmaceutical interventions is essential in promoting positive patient care and minimizing the risks related with surgical procedures. The results also showed that appropriate timing of administering antibiotic treatment can have a vital part in reducing the prevalence of surgical wound infections. In addition, by administering a proper dosage of antibiotics helps to reach and maintain adequate level of pharmaceutical treatment to decrease the risk of surgical wound infections. (Al Salmi et al. 2019: 3496.)

5.2 Challenges of surgical wound infection prevention

Based on the analyzed data nurses have challenges such as lack of competence and issues with workplace practice whilst preventing surgical wound infection. These challenges are explained below.

5.2.1 Lack of competence

The results indicated that adherence to the current wound care guidelines by nurses may not be always consistent (Badia et al. 2020: 234). Moreover, Lin et al. (2018:1646) presented that nurses' defeat to refer to the most recent and updated guidelines documentation may contribute to the variance in adherence. Badia et al. (2020: 234) further reported in their study, that the clinical practices of nurses sometimes do not conform

to the established guidelines. Lack of evidence for the clinical practise may lead to nurses having uncertainties and doubts, which has a negative effect on the work. (Qvistgaard & Lovebo & Almerud-Österberg 2019: 3).

The findings suggest that a significant proportion of nurses responsible for post-operative patient care did not adhere to the protocol for hand hygiene. Less than half of the nurses in one study group completed the required hand hygiene measures. (Ding & Lin & Marshall & Gillespie 2017: 31.) Additionally, there was evidence that some nurses did not complete pre-operative hand wash prior to surgery (Wistrand & Falk-Brynhildsen & Nilsson 2018: 440). The analysis conducted in one of the articles indicated that there is a gap in the knowledge and understanding of asepsis principles and aseptic techniques among nurses (Lin et al. 2018: 1646).

The results also identified issues with the proper use of gloves and sterile gloves, as well as compliance with glove use guidelines. Sterile gloves were not used when required, and the aseptic approach was not always maintained during glove usage. (Ding & Lin & Marshall & Gillespie 2017: 31.) These same outcomes were found by Lin et al. (2018: 1646). Additionally, the results indicated that there was non-compliance with the guideline for the non-touch technique, indicating a lack of adherence to proper aseptic procedures. (Ding & Lin & Marshall & Gillespie 2017: 1648).

According to the analysis, nurses who were responsible for wound care in surgical settings faced a challenge when it came to documenting their work. The study conducted by Ding et al. (2017: 32) revealed that this issue arose because the nurses documented very little or not at all the care provided. Moreover, the documentation of possible foreign bodies in the wound was also found to be inadequate. Lin et al. (2018:1648) presented in their article, that some of the reasons for the challenges in the documentation, were nurses' uncertainties on how to correctly record the care periods, and where to locate these recordings.

5.2.2 Issues with workplace practice

The results showed that the issues structuring work was a challenge for surgical wound prevention. Nurses experienced interruptions during care as a challenge for the workflow, and issues related to time affected negatively to wound care. (Lin et al. 2018: 1647.) Nurses face challenges in performing their duties effectively when they are over-

whelmed with a heavy workload resulting in difficulties of taking care of wounds coherently. (Lin et al. 2020:197.) Another issue related to work organization and structuring that hindered nurses from performing wound care was related to the availability of information. Wound care guidelines were often outdated or irrelevant, lacked essential information, or were difficult to locate. (Lin et al. 2018: 1648.)

Sometimes nurses did not follow guidelines unitedly, which could be seen as disagreements in the care of the patient, especially in the timing of patient education (Lin et al. 2018). In the results of a study from Lin et al. it was presented, that nurses would have been able to perform wound care more effectively if they had access to more instruction or if the work was more structured. Furthermore, insecurities regarding responsibilities, as well as diving these were both identified as challenges to wound care. (Lin et al. 2020: 1649).

In addition, Qvistgaard et al. (2019: 3) discovered in their study that the absence of feedback presents a challenge for nurses in enhancing their skills in wound care and preventing surgical wound infections. This is because receiving feedback is essential for improvement and the lack of it makes it difficult for nurses to increase their competence in this area. (Qvistgaard et al. 2019: 3.)

6 Discussion

Our research aimed to determine nursing interventions that prevent surgical wound infections. Our results point out six interventions that are significantly used among nurses trying to prevent surgical wound infections. These six nursing interventions are preparation of a surgical site, aseptic technique, maintaining patient's vital signs, wound care, communication, and pharmacological interventions. Results of this literature review also point out challenges that nurses face while they practice nursing interventions for the prevention of surgical wound infections. These challenges are linked to lack of competence and issues with workplace practise.

Aseptic technique means maintaining aseptic practices through hand hygiene, wearing personal protective equipment such as clothing, gowns, and gloves. Preparation of a surgical site includes nurses disinfecting patient's skin considering the size of the area and disinfection technique. Draping of patient is used to delineate sterile area to prevent contamination during surgery. Maintaining patient's vital signs include glucose

level control, oxygen level control, and patient's body temperature. Wound care covers wound assessment, checking the signs of infection, choosing, and applying dressings. Communication between the team and patient is essential as it promotes the positive outcome of care. Pharmacological interventions cover administering medications. These six interventions are widely used practices in infection prevention, and they have a great effect on patient's health, and decreased costs.

Nurses' lack of competence and the issues in workplace practice are shown in many ways as mentioned above. Some nurses do not follow given guidelines or follow just some of them.

6.1 Discussion of ethics and validity

According to TENK (2021: 5-6), good and ethical scientific practice includes honesty, general responsibility, precision in research work, reporting, documenting, and presenting of results and assessing of these. As qualitative research often is composed of subjects which require research, that is happening in the presence of individuals in person, it is extremely important to know the importance of ethicality. Researchers should respect the dignity and self-determination of the people investigated and make sure that no harm is caused for the investigated during research. Nature and its diversity should be respected, as well as cultural heritage. (TENK 2021: 5-6.)

Actions that are considered as malpractice in scientific research, are for instance disrespecting other researchers by giving a disparaging statement of another, insufficient referencing to previous studies, or insufficient or negligent reporting, presenting, or documenting of research results. In addition, using already reported and presented research results again, falsifying results or acquiring results using a dishonest practice, are all actions considered as malpractice in research. (Tuomi & Sarajärvi 2018: 150–151.)

Before, it was common to assume that creating scientific knowledge on any possible topic using every available method would be beneficial for the society, and that science is only a method used to create knowledge. No sort of ethical issues was associated with this way of thinking. Nowadays, when science has been merged together with economic growth and national level of interest, it has become an instrument of authority. It is seen as a method that instead of discovering answers to significant truths, creates results on a practical level. Through this phenomenon it was noticed that the science

can have disadvantages when it is used as an asset of society. (Tuomi & Sarajärvi 2018: 152.)

Validity is a fundamental factor when conducting a systematic literature review. Validity expresses how precisely the methodology used in the review measures the variable factor that is wanted to measure. This can be ensured by using reliable and consistent methodology. Validity of a literature review can be determined with examination that is aiming to indicate how well the results of research corresponds with the existing ideas or with other recognized theories. (Ahmed & Ishtiaq 2021: 2401-2402.)

The validity of this bachelor's thesis was ensured by using a consistent and coherent methodology and research plan. The validity of the articles chosen for this bachelor's thesis were actualized by only using peer reviewed articles. The articles were searched from CINAHL and PubMed databases, which were recommended by Metropolia and the Library. This alone does not offer validity for the articles, for what reason Publication Forum website was used to verify that the articles were published in peer reviewed journals. In addition, both writers of this bachelor's thesis read and evaluated the chosen articles, and it has been ensured that the sources used in this bachelor's thesis were current.

As some of the sources used for this bachelor's thesis were in the language of Finnish, the writers of this bachelor's thesis carefully used these sources to ensure adequate level of validity. Source references were marked correctly according to Metropolia's Guidelines for Written Assignment, to show preciseness and ensure the validity on the reference part. The conductor of this bachelor's thesis was persistently carried out the Research Proposal and planning phase, as well as the implementation phase and reporting of thesis. This way it was ensured that there was enough time and resources to compose a valid and ethical literature review.

6.2 Conclusion

Research of this bachelor's thesis clearly shows that nursing interventions which prevent surgical wound infections have been widely researched and there is clear evidence of their benefits. Aseptic practices are crucial in infection prevention as was mentioned in the background. Asepsis is the foundation of the perioperative nursing

care when preventing surgical wound infection. As mentioned in the background, monitoring vital signs is mandatory to be able to provide the best possible care in the perioperative setting. This ensures the safety of the patient.

The studies indicate various evidence-based practice, on how to prevent surgical wound infections in the most effective way. Still, some of the articles had contradictory views about nursing care for example whether hair should be removed or not prior surgery. But this only shows that continual research is needed.

The challenges of nurses when practicing nursing interventions resulted in this bachelor's thesis are crucial from the point of view of patient safety. Therefore, further research on how these challenges experienced by nurses could be reduced would be beneficial if not necessary.

References

- Ahmed, I. & Ishtiaq, S. 2021. Reliability and validity: importance in medical research. *J PAK Medical Association* 71 (10). 2401-2402.
- Al Salmi, H. & Elmahrouk, A. & A Arafat, A. & Edrees, A. & Alshehri, M. & Wali, G. & Zabani, I. & A Mahdi, N. & Jamjoom, A. 2019. Implementation of an evidence-based practice to decrease surgical site infection after coronary artery bypass grafting. *Journal of international Medical Research*. 47 (8). 2491-3501.
- Annesley, S. 2019. Current thinking on caring for patients with a wound: a practical approach. *British Journal of Nursing* 28 (5). 290-292.
- Aspers, P. & Corte, U. 2019. What is Qualitative in Qualitative Research. *Qualitative Sociology* 42. Switzerland: Springer. 139-160.
- Aura, S. & Kinnunen, T. 2022. Perioperatiivinen hoitotyö. Helsinki: Sanoma Pro Oy. 7.
- Badia, J.M. & Casey, A.L. & Petrosillo, N. & Hudson, P.M & Mitchell, S.A & Crosby, C. 2017. Impact of surgical site infection on healthcare costs and patient outcomes: a systematic review in six European countries. *Journal of Hospital Infection* 96. 2.
- Badia, J. & Rubio-Perez, I. & López-Menéndez, J. & Diez, C. & Bolaños, B. & Ocaña-Guaita, J. & Meijome, X. & Chamorro-Pons, M. & Calderón-Nájera, R. & Ortega-Perez, G. & Paredes-Esteban, R. & Sánchez-Viguera, C. & Vilallonga, R. & Picardo, A. & Bravo-Brañas, E. & Espin, E. & Balibrea, J. 2020. The persistent breach between evidence and practice in the prevention of surgical site infection. Qualitative study. *International Journal of Surgery*. 82. Granollers, Spain: Elsevier. 231-239.
- Boga, S. 2019. Nursing Practices in the Prevention of Post-Operative Wound Infection in Accordance with Evidence-Based Approach. *International Journal of Caring Sciences*. 12 (2). 1229.
- Brekke, I. & Puntervoll, L. & Pedersen P. & Kellett J. & Brabrand M. 2019. The value of vital sign trends in predicting and monitoring clinical deterioration: Systematic review. *PLoS One* 14 (1).
- Cambridge Dictionary. 2022. <<https://dictionary.cambridge.org/dictionary/english/inductive>>. Accessed 17 November 2022.
- Ding, S. & Lin, F. & Marshall, A.P. & Gillespie, B.M. 2017. Nurses' practice in preventing postoperative wound infections: an observational study. *Journal of Wound Care*. 26 (1). Queensland: MA Healthcare. 28-37.
- Fransen, TF. & Nielsen, MF. & Lindhardt, CL. & Eriksen, MB. 2020. Using the full PICO model as a search tool for systematic reviews will result in lower recall for some PICO elements.

Butcher, H. & Bulechek, G. & Dochterman, J. & Wagner, C. 2018. Nursing Interventions Classification. United States: Elsevier. 9.

Jabur, A. & Kadhim, A. & Hussein, G. & Hussein, G. & Hider, G. & Mansour, A. 2022. Assessment of the nurse's knowledge about post-operative nursing care in Al-Hillah teaching hospitals. *HIV Nursing*. 22 (1). 77-80.

Juutilainen, V. & Hietanen, H. 2018. Haavanhoidon periaatteet. E-book. Helsinki: Sanoma Pro Oy. 16–17, 27. Accessed 20 November 2022.

Kallio, M. & Lagus, H. & Isoherranen, K. & Matikainen, N. 2020. Yhteistyö haavanhoidossa: mahdollisuus parantaa laatua ja vähentää kustannuksia. *Duodecim*. 136. 1702.

Karppinen, S. & Heljasvaara, R. & Pihlajaniemi, T. & Lagus, H. & Järveläinen, H. 2020. Haavan paraneminen – diabetes sekä muut esteet ja hidasteet. *Lääketieteellinen aikakauskirja Duodecim* 136 (15). 1717–1725.

Kielo-Viljamaa, E. & Viljamaa, J. & Suhonen, R. & Salminen, L. & Stolt, M. 2022. Learning goals and content for wound care education in Finnish nursing education – A Delphi study. *Nurse Education Today* 110.

Koskivuo, I. & Brück, N. & Veräjänkorva, E. 2019. Kun leikkaushaava ei parane. *Lääketieteellinen aikakauskirja* 135 (19). 1847.

Kyngäs, H. 2020. The application of content analysis in nursing science research. Inductive content analysis. Switzerland: Springer. 13–17.

Lelapi, N. & Costa, D. & Peluso, A. & Nobile, C. & Venditti, V. & Bevacqua, E. & Andreucci, M. & Bracale, U. & Serra, R. 2022. Wound Care Self-Efficacy Assessment of Italian Registered Nurses and Wound Care Education in Italian Nursing Education System: A Cross-Sectional Study. *Nursing Reports* 2022 (12). 674.

Leppäniemi, A. 2017. Kirurgia. Mitä on kirurgia? E-book. Kustannus Oy Duodecim. <<https://www.oppiportti.fi/op/kia20332/do>> Accessed 10 January 2023.

Lin, F. & Gillespie, B. & Chaboyer, W. & Li, Y. & Whitelock, K. & Morley, N. & Morrissey, S. & O'Callaghan, F. & Marshall, A. 2018. Preventing surgical site infections: Facilitators and barriers to nurses' adherence to clinical practice guidelines – a qualitative study. *Journal of clinical nursing*. 28. Australia: John Wiley & Sons. 1643-1652.

Lin, F. & Marshall, A. & Gillespie, B. & Li, Y. & O'Callaghan, F. & Morrissey, S. & Whitelock, K. & Morley, N. & Chaboyer, W. Evaluating the implementation of a multi-component intervention to prevent surgical site infection and promote evidence-based practice. 2020. *Worldviews of Evidence Based Nursing*. 17 (3). Sigma Theta Tau International. 193-201.

Martins, T. & Amante, L. & Vicente, C. & Maciel de Sousa, G. & Caurio, E. & Guanilo, M. & Girondi, J. 2020. Nursing interventions to reduce surgical site infection in potentially contaminated surgeries. Sao Paulo: Revista Estima.

Mikkonen, K & Kääriäinen, M. 2020. Content analysis in systematic reviews. Systematic reviews in nursing science. 105-110.

Mitchell, A. & Llumigusin, D. 2020. The assessment and management of hypergranulation. *British Journal of Nursing* 30 (5). 6.

Parnikh, H. & Kalantari, R. & Abnavi, S. & Hasanshahi, M. & Gheysari, S. 2022. Assessment of Circulating Nurses' Aseptic Practices in Orthopedic and General Surgeries of Public Hospitals in Shiraz, Iran. <<https://brieflands.com/articles/iji-123759.html>> Accessed 22 April 2023

Prisma-Statement. 2023. <<http://www.prisma-statement.org>> Accessed 23 February 2023.

Qvistgaard, M. & Lovebo, J. & Almerud-Österberg, S. 2019. Intraoperative prevention of surgical site infections as experienced by operating room nurses. *International journal of qualitative studies on health and well-being*. 14. Informa UK limited. 1-7.

Sarpel, U. 2021. *Surgery. An introductory guide for medical students*. Switzerland: Springer. 7.

Stolt, M. & Axelin, A. & Suhonen R. 2016. Kirjallisuuskatsaus hoitotieteessä. Turku: University of Turku. 7–31.

Stuart, E. 2020. Nutrition and wound care: what community nurses should know. *Journal of Community Nursing* 34 (6). 58.

Tuomi, J. & Sarajärvi, A. 2018. *Laadullinen tutkimus ja sisällönanalyysi*. Helsinki: Tammi.

TENK 2019. Tutkimuseettinen neuvottelukunta. Ihmiseen kohdistuvan tutkimuksen eettiset periaatteet ja ihmistieteiden eettinen ennakoarviointi Suomessa. Tutkimuseettisen neuvottelukunnan ohje. 1–23.

Vains, A. & Finlayson, K. 2021. How generalist nurses inform their clinical decision-making in wound management: a scoping review. *Wound Practice and Research*. 112.

Welsh, L. 2018. Wound care evidence, knowledge and education amongst nurses: a semi-systematic literature review. *International Wound Journal* 15. 23.

Wistrand, C. & Falk-Brynhildsen, K & Nilsson, U. 2018. National survey of operating room nurses' aseptic techniques and interventions for patient preparation to reduce surgical site infections. *Surgical Infections*. 19 (4). Sweden. 438-445.

Wistrand, C. & Falk-Brynhildsen, K. & Sundqvist, A. 2021. Important interventions in the operating room to prevent bacterial contamination and surgical site infections. *American Journal of Infection Control*. 50. Sweden: Elsevier. 1049-1054.

World Health Organization. 2018. Global guidelines for the prevention of surgical site infection, 2nd ed.

Wynn, M. 2021. The impact of infection on the four stages of acute wound healing: an overview. *Wounds UK* 17 (2). 26, 28-30.

Appendix 1
Database search

Database	Search terms	Number of Hits	Included based on title	Included based on abstract	Included based on the whole text
CINAHL	surg* AND (infection* OR "wound infection*") AND nurs* AND (intervention* OR strategies OR "best practice*") AND wound*	n=120	n=56	n=24	n=4
PUBMED	surg* AND (infection* OR "wound infection*") AND nurs* AND (intervention* OR strategies OR "best practice*") AND wound*	n=261	n=38	n=9	n=1
Additional records identified through other sources. Reference lists of the 5 articles selected from CINAHL and PubMed were screened, and three articles were chosen from there.					n=3
		Total n= 381	Total n= 94	Total n= 33	Total n= 8

Appendix 2
Summary of chosen articles

Author, year, Country	Topic/Title	Methodology & Methods	Participants	Main Outcomes
1. Badia et al. 2020 Spain	The persistent breach between evidence and practice in the prevention of surgical site infection. Qualitative study	Qualitative, web-based survey	Nurses and surgeons = 1105	About half of the nurses and surgeons are aware of recommended procedures. About half of them doesn't get feed-back of SSI rate.
2. Ding et al. 2017 Australia	Nurses' practice in preventing postoperative wound infections: an observational study	Quantitative, Cross-sectional prospective study, Observation	Nurses n= 60	There are guidelines for the prevention of surgical wound infection, but still there is lack of following the guidelines. There are nurses not practicing aseptic technique, patient education and documentation.
3. Lin et al. 2018 Australia	Preventing surgical site infections: Facilitators and barriers to nurses' adherence to clinical practice guidelines – A qualitative study	Qualitativ, Semi-structured individual interviews and focus group, examination	Nurses n=20	Aseptic technique, knowledge and information seeking, documenting wound care and educating and involving patients in wound care were highlighted. Nurse's competence, lack of information and time were barriers for the prevention of wounds.

Appendix 2
Summary of chosen articles

<p>4. Lin et al. 2020 USA</p>	<p>Evaluating the implementation of a multi-component intervention to prevent surgical site infection and promote evidence-based practice</p>	<p>Mixed method, Audit / Observation, group/ individual interviews, statistical analyses</p>	<p>Nurses participated in observations n = 20 Nurses participated in group interviews n = 17 Nurses participated in individual interviews n = 2</p>	<p>Nurses can work more efficiently with more instructions and structure. Educational tools increase the understanding in how to proceed wound care interventions.</p>
<p>5. Qvistgaard et al. 2019 Sweden</p>	<p>Intraoperative prevention of surgical site infections as experienced by operating room nurses</p>	<p>Reflective Lifeworld Research (RLR)</p>	<p>Nurses n=15</p>	<p>Preventing surgical wound infection requires well organized working structure. Traditional patterns and hierarchical traditions can be barriers for infection prevention.</p>
<p>6. Wistrand et al. 2018 Sweden</p>	<p>National Survey of Operating Room Nurses' Aseptic Techniques and Interventions for</p>	<p>Cross-sectional, Web-</p>	<p>Nurses n=967</p>	<p>Nurses practice the national guidelines for prevention of infections. However, when there is a lack of guidelines, practices differ.</p>

Appendix 2
Summary of chosen articles

	Patient Preparation to Reduce Surgical Site Infections.	based questionnaire		
7. Wistrand et al. 2021 Sweden	Important interventions in the operating room to prevent bacterial contamination and surgical site infections	Cross-sectional survey, Open-ended questions	Nurses n=967	Twelve interventions were described. Nurses considered skin disinfection to be the most important what comes to preventing surgical wound infection.
8. Al Salmi et al. 2019. Saudi Arabia	Implementation of an evidence-based practice to decrease surgical site infection after coronary artery bypass grafting.	Quantitative, Data collected from medical records	Patients n=244	Surgical site infections can be reduced when an evidence-based interventions together with structured problem-solving is used to detect possible risks. Giving patient a chlorhexidine gluconate showers prior to operation do have a reducing effect on reduction of surgical site infections.