

# Surgical site infection Report During The Covid-19 Pandemic: ABibliometric Analysis

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## Abstract

**Background:** Surgical site infection (SSI) is still a problem for surgeons. SSI can increase morbidity, mortality, and the cost of treatment due to the length of treatment and the presence of other complications. The expenses of these SSIs can be significant both financially and socially. However, the trend of research on SSI during the COVID-19 pandemic is still unknown.

**Purpose:** This research aims to map out the research breakthroughs on surgical site infection during the COVID-19 pandemic.

**Methods:** This study uses a bibliometric analysis with a qualitative literature review. The reanalysis included various software tools, such as VOSviewer and Nvivo 12 Plus.

**Results:** In total, 124 publications reviewed the surgical site infection during the COVID-19 pandemic. The United States then became the country with the most research publications. Following 2020 and 2021 are the years with the highest number of research publications on surgical site infections during the COVID-19 pandemic. The highest citation is from Chick *et al.* in 2020, who, in their research, studied the use of technology during the COVID-19 pandemic. In 2020, research investigated the use of technology in handling COVID-19 patient operations and the actions of medical staff. In 2021, the focus was on the treatment, but in 2022, the focus was more on the impact of the COVID-19 virus on the human body. The keywords adult, pandemic, COVID-19 betacoronavirus, and pneumonia have a very dense density. Another finding from this study indicates that the network based on keywords grows stronger in the cluster of hospital operating facilities.

**Conclusion:** The conclusion of this research shows that the publication trend with the theme of surgical site infection during the COVID-19 pandemic has significantly improved in the last two years, and the United States of America became the most contributing research publication about these themes.

**Keywords:** Bibliometric, Covid-19 Pandemic, Indonesia, Surgical Site Infection

## Introduction

Currently, Surgical Site Infection (SSI) is still a problem for surgeons (Alkaaki et al., 2019; Phelan et al., 2020; Verberk et al., 2022; Zhou et al., 2020). SSI can increase morbidity, mortality, and medical costs due to the length of treatment and the presence of other complications (Zhou et al., 2020). Despite advances in prophylactic antibiotics, better anesthetics, advanced equipment, and increased post-surgery vigilance, SSI remains common (Zhou et al., 2020). According to WHO, more than one in ten people in developing countries who undergo surgery are affected by SSI, while in developed countries, it occurs in 500,000 people per year. In America, SSI occurs in about 1% of patients undergoing surgery (WHO, 2016). In Morocco, the incidence of surgical site infection was 6.3% (Flouchi et al., 2022). Data on SSI in Indonesia is 5.1%-8.9% (Duerink et al., 2006).

Forrester et al. (2020) report that developing an easy-to-follow decision tree algorithm for the interventional platform teams can ensure optimal healthcare worker safety despite COVID-19 being a new threat. A report by Weiner-Lastinger et al. (2022) provides a national view of the increases in HAI incidence in 2020. These data highlight the need to return to conventional infection prevention and control practices and build resiliency in these programs to withstand future pandemics. This report does not specifically mention the increase in surgical site infection. Losurdo et al. (2020) evaluate how the scrupulous hygiene rules and the restriction of human contacts during the COVID-19 Pandemic affected the SSIs rate of the General Surgery Department of a tertiary center (Trieste, Italy). Losurdo et al. (Losurdo et al., 2020) found that Simple and easily viable precautions such as wearing surgical masks and restriction of visitors emerged as promising tools for the reduction of SSIs risk. Similar to Losurdo, Evan et al. (2020) found that A

safe pathway to offer standard high-quality surgery to colorectal cancer patients during the COVID-19 Pandemic is feasible.

Several previous studies examined Surgical site infection during the COVID-19 Pandemic, including; (Pantvaidya et al., 2022), evaluate whether strengthening hand hygiene, universal masking, and social distancing as part of pandemic prevention leads to a decrease in the incidence of surgical site infection (SSI) in major oncology resection. These findings confirm that increased adherence to hand hygiene, near-universal mask use, and social distancing during the COVID-19 Pandemic likely led to a 23% reduction in the likelihood of SSI in major oncology resection. Extending this low-cost intervention in the post-pandemic era could lower SSI-related morbidity in cancer surgery. Next (Dursun et al., 2020) reported perioperative outcomes of 200 patients with gynecologic cancer who underwent surgery during the Novel Coronavirus Disease (COVID-19) pandemic and the safety of surgical approaches. This finding is considered that gynecological cancer surgery should be continued during the COVID-19 Pandemic while still complying with such measures. Delayed or non-surgical management should only be considered in patients with documented infection. Then (Dedeilia et al., 2020) reviewed Pediatric surgery during the COVID-19 Pandemic. The study found that operating ethics are required, all staff should use appropriate personnel protective equipment, and high-risk practices, such as aerosol-generating devices or procedures, should be avoided where possible. Furthermore, carefully designed organizational protocols should be established to minimize transmission while ensuring uninterrupted operation of the pediatric surgical unit

From the several studies above, it can be concluded that research on SSI during the Covid-19 Pandemic found ways or procedures to reduce the incidence of SSI, although there was one study (Weiner-Lastinger et al., 2022) that reported an increase in the incidence of HAIs. Based on

the explanation of the background above, the purpose of this study is to analyze SSI during covid19. As for the novelty in this study, the author mapped previous research on the Surgical site infection Report During The Covid-19 Pandemic, and specifically, no one has studied surgical siteinfection during the Pandemic. This is based on references to previous research from 2020-2022 taken from the Scopus journal database. Therefore, this research contributes to complement existing research and can be follow-up research in the future.

## **Research Methods**

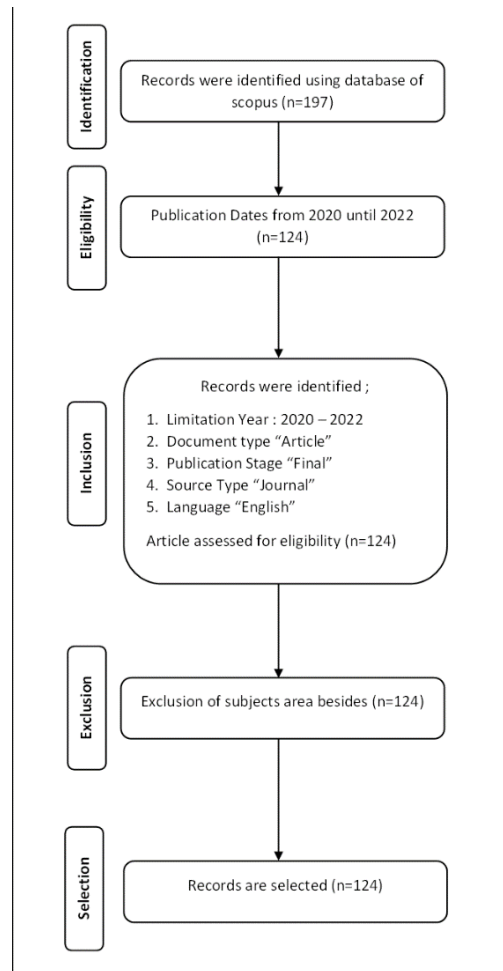
### **1.1 Materials**

This review uses a bibliometric analysis tool to analyze surgical site infection during the Covid-19 Pandemic. To evaluate academic and individual journals' effectiveness and performance, undergraduate bibliometric analysis can be applied to journal citations, authors, or others (Zhao &Strotmann, 2015). Citations can represent the relationship between individual authors and subject,topic, methodology, and co-authors. According to (Zhao & Strotmann, 2015), scholars can use citation analysis to (i) map study areas to investigate their intellectual structure, (ii) assess academic implications and evaluate sources of information, (iii) track the spread of ideas and knowledge flow, (iv) aid information retrieval, organization, and representation, and (v) investigating the user and utilization of academic literature.

### **Research strategy and selection criteria**

This research approach was developed among all Scopus databases since Elsevier's abstractand citation database, Scopus, has the most comprehensive peer-reviewed investigations related tothe study topic. The authors distinguished articles published from 2020 until 2022 that reviewed surgical site infection in various countries during the COVID-19 Pandemic through a systematic search of the Scopus database. Each retrieved article with English language constraints was

subjected to snowball sampling via reference list search and citation tracking. The following searchterms were then used: ("surgical site infection" AND "covid-19"). From the data searches and datascreening results, 124 documents were analyzed.



**Figure 1: Steps in Collecting Article**

## Data extraction

The following data were retrieved from each article with keywords and year. Secondly, data were limited based on the subject area. Then data were limited based on the final article, and to make it easier to read and analyze, the data were limited based on the English language.

## **Analysis of data**

Data analysis in this study utilized the NVivo 12 Plus software and the Vosviewer Software. The NVivo software was used to test the correlation between indicators, variables, and keywords used by previous studies. One finding was then drawn to serve as further research from this correlation. Furthermore, VOSviewer software was employed to map the most dominant keywords when studying surgical site infection.

## **Results and discussion**

### **1.2 Developments in Research on Surgical site infections during the Covid-19 Pandemic**

In total, 124 publications reviewed the surgical site infection during the COVID-19 Pandemic. The data were taken from the relevant articles and published in 2020 until now. The highest number of publications was in 2020, followed by the years 2021 and 2022. As known that 2021 is the peak of the Pandemic, many elective surgeries have been postponed due to covid-19. So that the reporting of surgical site infections decreases. This has been confirmed in D'Oria et al.(2023) research with 194 patients samples. From that, 60 patients undergo an operation from 1 April 2018 until 30 June 2018, 83 patients from 1 April 2019 until 30 June 2019, and 51 patients from 1 April 2020 until 30 June 2020. A patient who operated in the COVID-19 era was less likely to develop SSI (10% vs. 28%;  $P = 0,008$ ), including inside SSI (4% vs. 13%;  $P = 0,04$ ) and superficial SSI (6% vs. 15%;  $P = 0,05$ ) (D'Oria et al., 2023). The dilemma of providing surgery services to patients during this Pandemic has been global. Strict measures and guidelines can help to overcome the COVID pandemic time (Sultania et al., 2020). This is also conveyed in Chacón- Quesada et al. (2021) research that found the SSI level decreased drastically during COVID-19 Pandemic (Chacón-Quesada et al., 2021). Effective reduction of post-surgery SSI as a result of implementing strict hygiene measures put in place after the start of the COVID-19

Pandemic. Phenomena surgical site infections have become special attention these past two years. It is mainly due to the COVID-19 Pandemic, which makes the human body become abnormal. Therefore, researchers in this field of study identify this as a phenomenon that needs to be studied in more depth. Thus, the publication of articles on this topic is increasingly being studied in the period 2020-2022. The data in figure 1 shows the article published about Surgical site infections during the Covid-19 Pandemic from 2020-2022.

**Table 1.** Number of Publication by Year of Surgical site infection Report During The Covid-19 Pandemic

| Year | Document |
|------|----------|
| 2020 | 37       |
| 2021 | 39       |
| 2022 | 48       |

The data from table 1 shows the highest number of research publications about Surgical site infections during the COVID-19 Pandemic in 2020. In that year, research about surgical site infection during the COVID-19 Pandemic investigated the use of technology in handling COVID-19 patient operations and the actions of medical staff. In 2020, because the COVID-19 case is still new in global health, the understanding of this virus is still low and requires in-depth study. Furthermore, in 2021, the focus of research that year centered more on the treatment of patients

affected by the COVID-19 virus. Meanwhile, in 2022, the research focused more on the impact of the COVID-19 virus on the human body. Moreover, table 1 shows the highest publication based on the citation about Surgical site infections during the COVID-19 Pandemic that was indexed in Scopus.

**Table 2.** Identification of published documents on Surgical site infections during the Covid-19 Pandemic

| No | Document title                                                                                                                                                      | Authors                             | Year | Cited by |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|------|----------|
| 1. | Using Technology to Maintain the Education of Residents During the COVID-19 Pandemic                                                                                | (Chick et al., 2020)                | 2020 | 475      |
| 2. | Precautions for Operating Room Team Members During the COVID-19 Pandemic                                                                                            | (Forrester et al., 2020)            | 2020 | 115      |
| 3. | Mucormycosis after Coronavirus disease 2019 infection in a heart transplant recipient – Case report and review of literature                                        | (Khatri et al., 2021)               | 2021 | 60       |
| 4. | The onset of occupational hand eczema among healthcare workers during the SARS-CoV-2 Pandemic: Comparing a single surgical site with a COVID-19 intensive care unit | (Guertler et al., 2020)             | 2020 | 59       |
| 5. | Validation of a digital pathology system, including remote review during the COVID-19 Pandemic                                                                      | (Hanna et al., 2020)                | 2020 | 58       |
| 6. | Demonstration and Mitigation of Aerosol and Particle Dispersion During Mastoidectomy Relevant to the COVID-19 Era                                                   | (Chen et al., 2020)                 | 2020 | 50       |
| 7. | The management of adult appendicitis during the COVID-19 Pandemic: an interim analysis of a UK cohort study                                                         | (Javanmard-Emamghissi et al., 2021) | 2021 | 48       |
| 8. | The impact of coronavirus disease 2019 (COVID-19) on healthcare-Associated infections in 2020: A summary of data reported to the National Healthcare Safety Network | (Weiner-Lastinger et al., 2022)     | 2022 | 45       |

|     |                                                                                                                                     |                              |      |    |
|-----|-------------------------------------------------------------------------------------------------------------------------------------|------------------------------|------|----|
| 9.  | SARS-CoV-2 detection in formalin-fixed paraffin-embedded tissue specimens from surgical resection of tongue squamous cell carcinoma | (Guerini-Rocco et al., 2020) | 2020 | 29 |
| 10. | Head and neck cancer surgery during the COVID-19 Pandemic: An international, multicenter, observational cohort study                | (Collaborative et al., 2021) | 2021 | 27 |

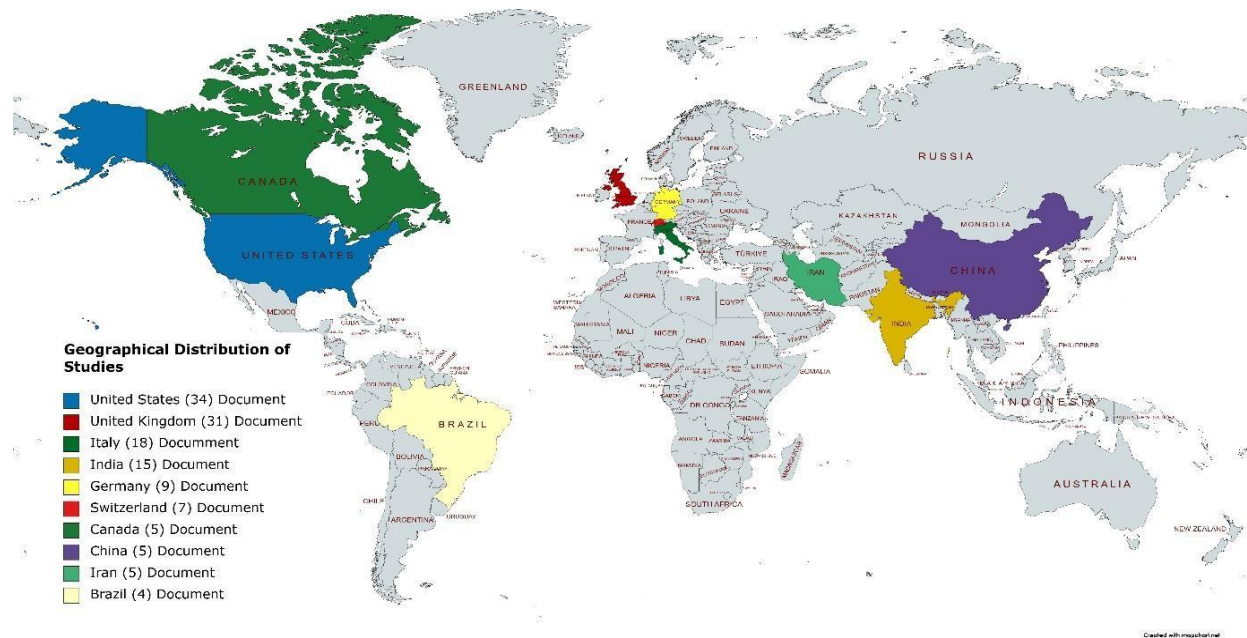
According to table 1, the highest citation is from Chick et al. (2020), which in the research studied the use of technology during the COVID-19 Pandemic. Due to restrictions recommended by the Centers for Disease Control and Prevention and other organizations, the educational landscape for surgical residents is changing rapidly. In addition, the timeframe for this change cannot be determined. The findings explain some innovative solutions, including flipped classroom model, an online exercise, teleconference as the substitute for face-to-face lectures, involving residents in telemedicine clinics, procedural simulation, and facilitated use of surgical videos. Even though nothing can replace hands-on learning through hands-on surgical and patient care experiences, it can be a way to reduce the loss of exposure to past learning.

The second highest citation is research from Forrester et al. in 2020 that explains the background of the problem of a new coronavirus, SARS-CoV-2 (COVID-19), which can infect medical staff. Hence, this research further develops institutional algorithms to protect operating room team members during the COVID-19 Pandemic and rationally conserve personal protective equipment (PPE). Another thing from this research explains that a decision tree algorithm describing our institutional guidelines for precautions for members of the operating room team was created. This algorithm is based on the urgency of the operation. The algorithm is based on the urgency of the operation. The algorithm is based on the urgency of the operation, anticipated

virus load at the surgical site, procedural opportunities to aerate the virus, and the possibility patients can be infected based on the symptoms and testing.

Then the third highest citation is research from Khatri et al. (2021), which explains the background of the problem that Mucormycosis is an invasive fungal infection (IFI) caused by several species of saprophytic fungi occurring in patients with underlying comorbidities (including organ transplantation). During the Coronavirus Disease 2019 (COVID-19) pandemic, there have been increasing reports of bacterial and fungal co-infection occurring in COVID-19 patients, including COVID-19-associated pulmonary aspergillosis (CAPA). Thus, this research describes the Mucormycosis case that happened after COVID-19 in someone who has recently received a heart transplant for severe heart failure. This finding reveals doctors need to be cautious in evaluating Mucormycosis in patients that are infected with COVID-19. Further research is needed to evaluate the potential connection between these two infections.

Hereafter, the research from Guertler et al. (2020) is ranked fourth with 59 citations alongside findings that improved hand sanitation during the COVID-19 Pandemic damaged the skin of the hands of all healthcare workers, regardless of direct intensive care of affected patients. Furthermore, figure 2 below is to find out the distribution map of the Surgical site infections study during the COVID-19 Pandemic from 2020-2022 in several countries.



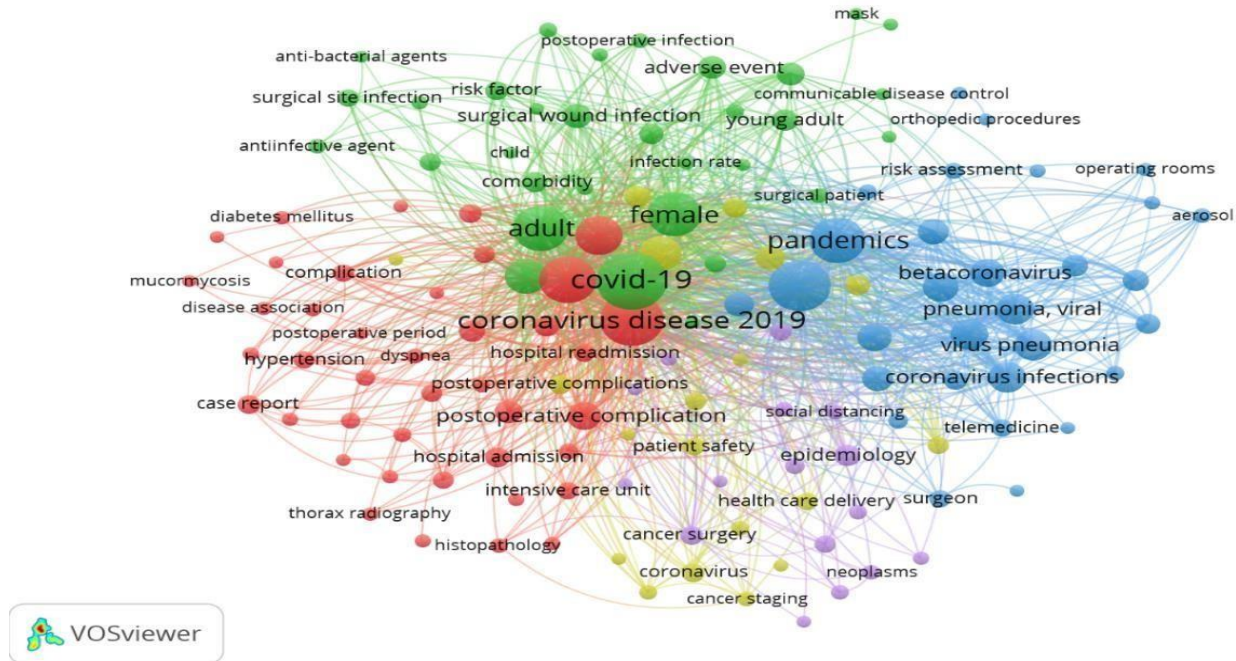
**Figure 2.** Scientific Productions by Country (mapchart.net)

Figure 1 it is showing the most contributed countries in publications about Surgical site infections during the COVID-19 Pandemic from 2020-2022 that are indexed in Scopus. The United States of America became the country that most contributed country in the research of surgical site infections during COVID-19. In the context related to COVID-19, the finding was strengthened by the fact that the US government cooperated with pharmacies, biotech, and scholarsto support the development of new vaccines, viral immunology, structural biology, and protein engineering research, as well as with clinical trial operations expertise. This was done to enable the rapid development, evaluation, manufacture, and deployment of successful vaccines. The impact is that in less than 1 year since the identification of the COVID-19 virus, several vaccines have received EUA from the US Food and Drug Administration (FDA), making this possible for the widespread administration of vaccines when a public health emergency occurs. (Fkm.unair.ac.id, 2020).

Investigations of otologic operations involving high-speed drilling equipment, such as mastoidectomies, which are thought to be aerosol-generating procedures, have been prompted by concerns regarding the transfer of viruses. Mastoidectomy with a high-speed drill is an aerosol-generating procedure, a designation that connotes a potentially high risk of viral transmission and the need for greater personal protective equipment. Simple barrier curtains significantly decrease the particulate dispersion in this research and can become a strategy for effective mitigation besides suitable personal protective equipment.

### **3.1 Bibliometrics Mapping Of Studies On Surgical site infections During The Covid-19 Pandemic**

The picture below shows 138 identified keywords that can be classified into five clusters. The color indicates the group, while the picture label indicates the keywords or terms that frequently appear. Clusters are used to obtain insight or images about the bibliometric grouping, while image mapping is used to get an overview of the bibliometric network (Yu et al., 2020). Cluster 1 is colored in red (29,7%), cluster 2 in green (23,2%), cluster 3 in blue (21,7%), cluster 4 in yellow (13,8%), and cluster 5 in purple (11,6%).



**Figure 3.** "Network Visualization by Keywords using VOSviewer"

Cluster 1, the red color, is a grouping of hospital facilities. The keyword in this grouping appears because the discussion about surgical site infection during COVID-19 Pandemic is very related to that. Surgical site infection during COVID-19 Pandemic discusses the hygiene of hospital facilities to prevent the transmission of the virus. Moreover, it is also related to the facilities that are used in surgery. Surgical Site Infection (SSI) is a common type of infection associated with healthcare and a frequent complication of hospitalization, which is responsible for extended hospital stays, increased hospitalizations in intensive care units, re-hospitalization after surgery, significantly increased costs, and delaying additional systemic therapy (De Simone, Sartelli, et al., 2020).

Surgical Site Infection (SSI) is a main complication in surgery that can increase morbidity, mortality, and hospitalization costs. SSI incidents in healthcare institutions reflect the quality of that institution (Hartati et al., 2020). Many interventions have been suggested and used during the

last few decades in an attempt to prevent surgical site infection. These included skin cleansing protocols, hair removal, maintaining intraoperative normothermia, administering preoperative antimicrobial prophylaxis, using adhesive plastic skin barriers, high-flow oxygen supplementation, wound protection, instrument sterilization, bowel preparation, incision length, and delayed primary incision closure (Liu & Dickter, 2020; Norman et al., 2022).

Then, Cluster 2 in green shows a grouping of the surgery patients. Keywords in this grouping indicate the research about surgical site infection during the covid-19 Pandemic discusses the patients as the objects that have a high potential to be infected. Therefore, the patient's point of view is important in this research with the evidence of keywords that appear in cluster 2. Surgical wound infections are infections that occur in post-surgery patients that occur in patients who are hospitalized for up to 30 days post-surgery. Surgical wound infections that are set by National Healthcare Safety Network (NHSN) for superficial incision should meet all these criteria: infection occurs 30 days after surgery and involves the skin and subcutaneous tissue during surgery. Symptoms that are experienced by the patients are purulent drainage (pus discharge) from superficial incisions, and there are specific organisms associated with superficial post-surgery wounds (as evidenced by bacterial culture) (Gomaa et al., 2021; Wloch et al., 2020).

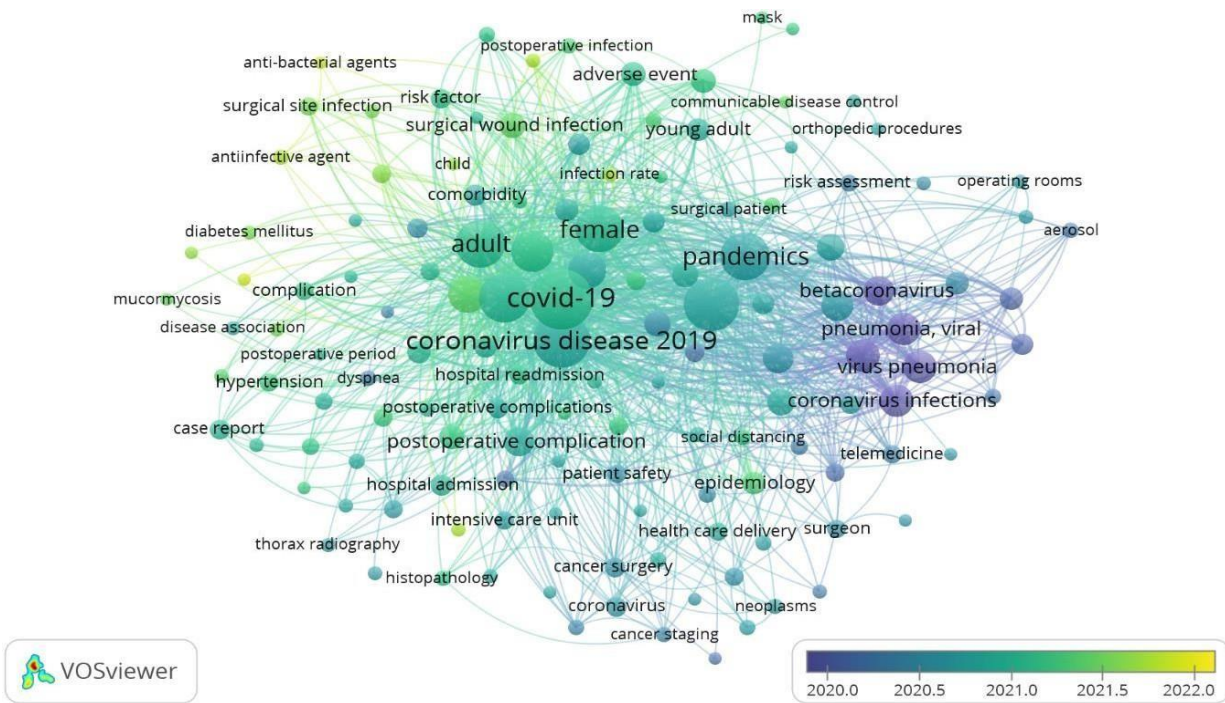
**Table 3.** The Clusters' Themes of Keywords Analysis

| Cluster                     | Item keyword                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Total |
|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 1<br>Hospital<br>Facilities | Artificial ventilation, C-reactive protein, case report, complication, computer-assisted tomography, coronavirus disease 2019, deep vein thrombosis, diabetes mellitus, disease association, disease severity, drug efficacy, dyspnea, emergency surgery, fever, histopathology, hospital admission, hospital discharge, hospital readmission, hospitalization, human tissue, hypertension, intensive care unit, length of stay, lung embolism, male, medical history, microbiology, mortality, mucormycosis, outcome assessment, pneumonia, polymerase chain reaction, postoperative complication, postoperative | 41    |

|                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |    |
|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
|                                  | period, sars-cov-2, surgical debridement, thorax radiography, treatment outcome, urinary tract infection, virology, wound infection                                                                                                                                                                                                                                                                                                                                                                                                                         |    |
| <b>2</b><br>Surgery<br>Patients  | Adolescent, adult, adverse event, age, antibacterial agents, antibiotic agent, antiinfective agent, appendicitis, body mass, child, clinical outcome, communicable disease, comorbidity, covid-19, female, general surgery, infection prevention, infection rate, infection risk, mask, masks, multicenter study, postoperative infection, risk factor, risks factor, risk reduction, surgical infection, surgical patient, surgical site infection, surgical wound infection, tertiary care center, young adult                                            | 32 |
| <b>3</b><br>Covid-19             | Aerosol, betacoronavirus, coronavirus infection, coronavirus infections, cross infection, disease transmission, emergency health service, epidemic, health care personnel, infection control, infectious disease trans, operating room. Operating rooms, orthopedic procedures, orthopedic surgery, Pandemic, pandemics, personal protective equipment, pneumonia viral, prevention and control, procedures, protective equipment, risk assessment, severe acute respiratory, surgeon, surgeons, surgery, telemedicine, virus pneumonia, virus transmission | 30 |
| <b>4</b><br>Surgery<br>Procedure | Abdominal surgery, aged 80 and over, cancer staging, colorectal surgery, coronavirus, covid-19 Pandemic, delivery of health care, diagnostic imaging, elective surgery, elective surgery procedure, health care delivery, laparoscopic surgery, laparoscopy, middle-aged, organization and management, pathology, patient safety, postoperative complication, very elderly                                                                                                                                                                                  | 19 |
| <b>5</b><br>Health<br>Protocol   | Cancer surgery, clinical protocol, epidemiology, follow-up, hand washing, neoplasm, neoplasms, oncology, operation duration, outpatient department, patient care, perioperative period, postoperative care, social distancing, surgical oncology, surgical procedures                                                                                                                                                                                                                                                                                       | 16 |

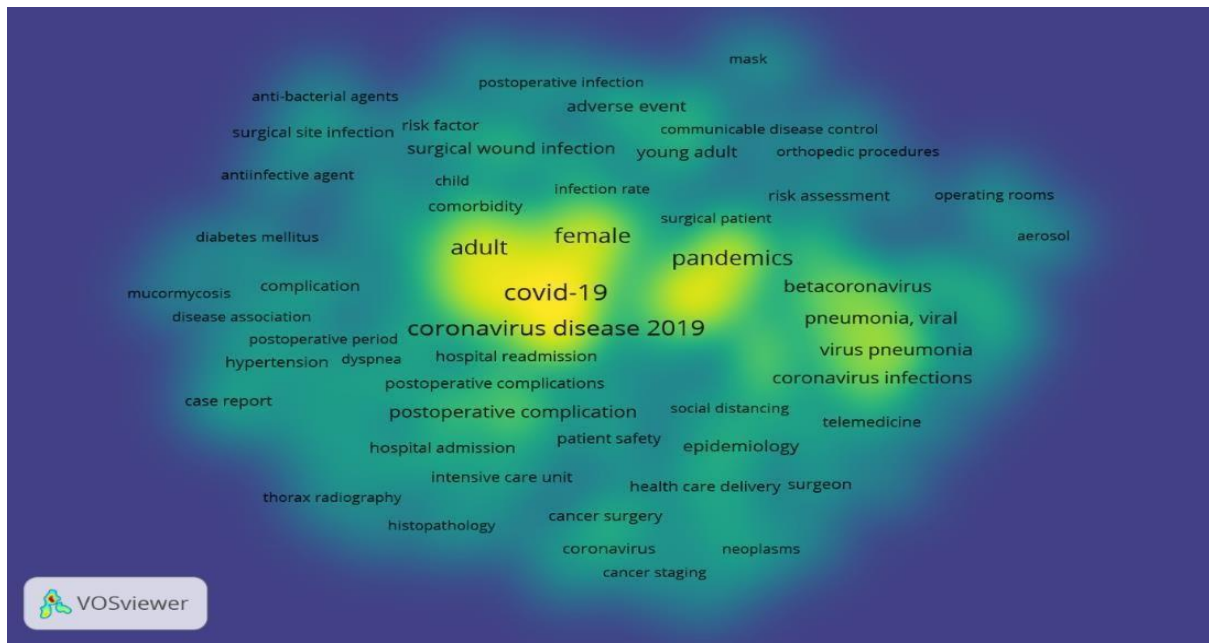
Cluster 3, the blue color, groups COVID-19. This keyword is related to the research topic. Then, cluster 4 in yellow is grouping about the surgery procedure during COVID-19 Pandemic. This became interesting because the research publications about surgical site infection that were indexed in Scopus from 2020-2022 have links with surgery procedures during COVID-19 Pandemic. Therefore, it can be said that the researcher has a research focus that discusses this matter with the major theme related to the surgical site infection during the COVID-19 Pandemic. From then on, cluster 5, which is in purple, grouped the health protocol during COVID-19

Pandemic. The keywords in this cluster have a connection with the topic of surgical site infection because the discussion is related to COVID-19.



**Figure 4.** The Keywords Trends of Surgical site infection Report During The Covid-19Pandemic by Year

Figure 5 displays research trend data on the topic of surgical site infection during the covid-19 Pandemic, which is indexed by Scopus. The yellow color indicates the new trend from research about surgical site infection during COVID-19 Pandemic. Because of that, figure 5 explains that the keywords antibacterial agent, antiinfective agent, post-surgery infection, health care, and infection rate become new points of view to research surgical site infection during COVID-19 Pandemic. This explains that research about health tourism in Indonesia has an updated viewpoint every year from researchers.



**Figure 5.** Novelty of Research in Surgical site infection Report During The Covid-19 Pandemic

As seen in figure 6 above shows the density of keywords from a research topic about surgical site infection during COVID-19 Pandemic that was published from 2020-2022 and indexed in Scopus. Density analysis from Vosviewer software has the advantage of displaying keywords that have been discussed and have not been discussed. Keywords density can be identified based on the yellow color, which means the more keywords surrounded by a yellow color, the more that keywords had been discussed. On the contrary, if there is only a slightly yellowcolor, then it means the keywords have not been widely discussed in the research. This can be used as a novelty in further research(van Eck & Waltman, 2017). Based on figure 8, it can be seen thatthe keywords adult, Pandemic, covid-19 betacoronavirus, and pneumonia have a very dense density. Therefore, the topic of study regarding surgical site infection during the covid-19Pandemic from the point of view of these keywords has been widely discussed or researched. Meanwhile, the keywords that could be investigated further in the future based on the findings of

this study include surgical patients, surgical wound infections, and so on. This is because the yellow color does not cover that keyword too much.

**Table 4.** Trending Topics of Keywords for Surgical site infection Report using NVivo 12

Plus

| <b>Word</b>   | <b>Length</b> | <b>Count</b> | <b>Word</b>   | <b>Length</b> | <b>Count</b> |
|---------------|---------------|--------------|---------------|---------------|--------------|
| Covid         | 5             | 1918         | Risk          | 5             | 270          |
| Surgery       | 7             | 1214         | Associated    | 10            | 219          |
| Surgical      | 8             | 887          | Accessed      | 8             | 217          |
| Infection     | 9             | 776          | Management    | 10            | 202          |
| Pandemic      | 8             | 716          | Acute         | 5             | 194          |
| care          | 4             | 619          | Elective      | 8             | 193          |
| Hospital      | 8             | 572          | Healthcare    | 10            | 186          |
| Disease       | 7             | 498          | Prevention    | 10            | 186          |
| Cancer        | 6             | 373          | Treatment     | 9             | 185          |
| Clinical      | 8             | 372          | Mortality     | 9             | 179          |
| Control       | 7             | 362          | Transmission  | 12            | 178          |
| Infections    | 10            | 310          | Procedures    | 10            | 176          |
| Site          | 4             | 300          | Postoperative | 13            | 169          |
| Infect        | 6             | 285          | Impact        | 6             | 162          |
| Medical       | 7             | 282          | Emergency     | 9             | 158          |
| Patient       | 7             | 279          | medicine      | 8             | 154          |
| Complications | 13            | 149          | Outcomes      | 8             | 152          |

Table 4 depicts the Narrative from Scopus-indexed research publications on surgical site infection during the period 2020-2022. The report of COVID-19 being the highest was accompanied by surgery in second place. This shows the Narrative in the research publications tells about what happened during COVID-19 Pandemic that affected the patient's surgery in the hospital. This is strengthened by findings from (Coccolini et al., 2020), who explained that it is mandatory to implement a well-established and appropriate plan to perform non-deferred and emergency surgical procedures in COVID-19-positive patients. Hospitals must prepare the appropriate internal protocol and arrange for adequate training of the personnel involved.

Access to the operation room is almost exclusively restricted to emergencies and oncology procedures. The use of laparoscopy in patients who are positive for COVID-19 should be considered with caution. The main risk lies in the presence of the virus in the pneumoperitoneum: aerosols that are released in the operating room can contaminate the staff and the environment. During the COVID-19 Pandemic, every effort should be made to assess the feasibility of postponing surgery until the patient is no longer considered potentially infectious or at risk for perioperative complications. If surgery is necessary, an emergency surgeon must minimize the risk of virus infection by involving a minimum number of medical staff and shortening the working time in the operating room. If no safety measures exist to allow safe laparoscopy, open surgery should be considered (De Simone, Chouillard, et al., 2020).

Moreover, the virus corona 2019 (COVID-19) had a considerable impact on surgeons and patients who require surgical treatment. Giving treatment to patients with the surgical disease requires a unique and intimate relationship between patient and surgeon, and this interaction and contact cannot be replaced by telehealth. Therefore, During the COVID-19 Pandemic, the surgical workforce faces different challenges than non-surgical specialties. Specific issues include the best approach to protecting healthcare workers and patients, the ability to organize surgical care delivery efficiently, adverse effects on surgical disease patients, the financial implications of the Pandemic for the healthcare system, surgical workforce shortage management, implications for education, research, and career development, and the emotional impact on all involved (Kibbe, 2020). Furthermore, this study provides some recommendations for further research by looking at the relationship between clusters.

**Table 5.** Thematic Map Period for Surgical site infection Report for future research

| O  | Words                   | C | Cluster_Label           | btw centrality | clos centrality | pagerank centrality |
|----|-------------------------|---|-------------------------|----------------|-----------------|---------------------|
| 33 | covid-19                | 1 | covid-19                | 4451.843091    | 0.005747126     | 0.114613851         |
| 8  | coronavirus             | 1 | covid-19                | 621.8661685    | 0.003816794     | 0.033054455         |
| 7  | pandemic                | 1 | covid-19                | 591.3244582    | 0.003731343     | 0.030570409         |
| 7  | surgery                 | 1 | covid-19                | 587.3610756    | 0.003921569     | 0.029723366         |
| 6  | sars-cov-2              | 1 | covid-19                | 409.0921126    | 0.003773585     | 0.025920224         |
| 5  | mortality               | 1 | covid-19                | 726.8265521    | 0.003731343     | 0.020573251         |
| 2  | morbidity               | 1 | covid-19                | 10.34135623    | 0.003389831     | 0.009506371         |
| 2  | surgical oncology       | 1 | covid-19                | 20.37858045    | 0.003412969     | 0.009043726         |
| 3  | appendicectomy          | 2 | appendicectomy          | 7.693198203    | 0.002849003     | 0.009987765         |
| 3  | emergency surgery       | 2 | appendicectomy          | 98.63891963    | 0.002857143     | 0.009532499         |
| 2  | covid-19                | 2 | appendicectomy          | 157.0267045    | 0.002932551     | 0.006836364         |
| 2  | laparoscopy             | 2 | appendicectomy          | 0              | 0.002739726     | 0.006676779         |
| 3  | orthopedics             | 3 | orthopedics             | 120.8327995    | 0.003367003     | 0.0115228           |
| 2  | elective                | 3 | orthopedics             | 19.21908369    | 0.003184713     | 0.007432985         |
| 3  | surgical site infection | 4 | surgical site infection | 264.8290773    | 0.003215434     | 0.009750517         |
| 2  | colorectal surgery      | 4 | surgical site infection | 60.3866888     | 0.0025          | 0.005756902         |
| 2  | appendicitis            | 5 | appendicitis            | 36.7149853     | 0.003076923     | 0.007425902         |
| 2  | cancer                  | 6 | cancer                  | 28.51190476    | 0.003067485     | 0.006913104         |
| 2  | covid-19 pandemic       | 7 | covid-19 pandemic       | 116.8869635    | 0.00273224      | 0.008303022         |
| 2  | trauma                  | 8 | trauma                  | 49.64356237    | 0.003322259     | 0.007370938         |

The table 5 above shows the thematic map period for the surgical site infection report for future research. The above data confirm that emergency surgery for CA puts patients at relatively higher risk. This suggests that the risks associated with appendicectomy (EA) are significantly lower than other methods. This is confirmed in research (Yamada et al., 2021). The frequency of appendicectomy with clos centrality is 7.693198203 and btw centrality 0.002849003. The degree centrality of a node is simply the degree to which the number of sides it has. The higher the degree, the more central the node. This can be an effective measure, as many high-degree nodes also have high centrality with other sizes.

## Conclusion

The conclusion of this research shows that the publication trend with the theme of surgical site infection during the covid-19 Pandemic going through significant improvement in these last two years. Then, the United States of America became the most contributing research publication about these themes. Moreover, the network based on keywords strengthened the cluster of hospital operating facilities. This is proof that the keywords in the cluster are an important component in developing discussions about surgical site infection during the COVID-19 Pandemic. Then, research trends with those themes are more interesting to pick from the healthcare point of view. Meanwhile, surgical patients and surgical wound infections may become emerging research topics with the theme of surgical site infection during the COVID-19 Pandemic. Hereafter, the phrases COVID-19 and surgery are mentioned in the Narrative of the study article with the theme of surgical site infection during the COVID-19 Pandemic.

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