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Surgical site infections (SSI) rates, risk factors and post discharge surveillance (PDS) methods: A narrative review

Mohammed Alsabri [1], Athena Vallejo [2], Gamil Ghaleb Alrubaiee [3], Mohamed Sylla [2], Tabrikah Mohammed Ali [4], Sameer A Alkubati [5], Khaled Mohammed Al-Sayaghi [6], Mahmoud M Hassanein [7]*

ABSTRACT

Introduction

One of the most challenging outcomes after surgery is site infection, the consequences of which include the cost burden on hospitals, contributions to patient morbidity and readmissions. A shift to shorter hospital stays requires closer monitoring of surgical site infections (SSI) after discharge. This paper reviews post-discharge surveillance (PDS) methods on SSI identification, a comparison of some of these methods, SSI rates during and after hospitalization, and associated risk factors for SSI.

Methods

Literature published from September 2000–October 2020 was selected through PubMed using keywords regarding SSI pre- and post-discharge. The studies did not involve children. Data was compiled on the authors, country, study design, patient group, surveillance method, duration, response rate, SSI rate and outcomes.

Results

Of 96 returned articles, 12 met the inclusion criteria. An additional 20 articles were searched manually on Google, giving in total of 32 articles. Several types of post discharge surveillance (PDS) methods were reported, most commonly a telephone call. The studies compared different PDS methods with no uniformly preferred method, though most SSIs are observed after hospital discharge. Risk factors such as high BMI, hypertension, diabetes mellitus, emergent surgery and patient education were associated with higher SSI rates.

Conclusion

The use of telephone calls was commonly used but more research is needed as there is no single best method for PDS that can effectively be implemented in hospitals across the world. Other data surrounding SSIs such as the majority being identified after discharge and the associated comorbidity risk factors support the importance of further research into an effective low-cost PDS method to accurately measure SSI rates.

Keywords: Surgical infection, Surveillance, Risk factors, Review

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1 Department of Pediatrics, One Brooklyn Health, Brookdale University Hospital Medical Center, Brooklyn, NY, USA; 2 SUNY Downstate Health Sciences University College of Medicine, USA; 3 Department of Community Health, Faculty of Nursing, Ha'il University, Hail, KSA; 4 Infection Control Officer, National Rehabilitation Centre, UAE; 5 College of Nursing, University of Hail, Hail, Saudi Arabia; 6 Department of Medical Surgical Nursing, College of Nursing, Taibah University, Al-Madinah Al-Munawarah, KSA; 7 Pediatric Infectious Disease Specialist, One Brooklyn Health, Brookdale University Hospital Medical Center, Brooklyn, NY, USA

***Corresponding author** Mohammed Alsabri, Department of Pediatrics, One Brooklyn Health, Brookdale University Hospital Medical Center, Brooklyn, NY, USA, alsabri5000@gmail.com

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INTRODUCTION

According to the United States Centers for Disease Control and Prevention (CDC), Surgical site infection (SSI) is a common postoperative complication causing significant morbidity and mortality.[1] SSI refers to infections that occur in surgical incisions affecting tissues, organs and cavities manipulated during surgery. Diagnosis can occur up to 30 days after the procedure, or 90 days in cases involving prostheses.[1] Surveillance related to SSI allows us to review work processes, improving the quality of care offered to patients and reducing the cost of healthcare as well as the morbidity generated by the consequences of infections to patients' health. Many infections manifest in the post discharge period and are not detected by standard surveillance processes such as daily clinical rounds on surgical patients and microbiology report reviews, which include only patients with inpatient status.[2] Several studies have demonstrated that an accurate infection rate cannot be obtained unless some form of post discharge surveillance is performed.[2] Surveillance of SSIs is important because rates of SSI are viewed as a measure of hospital performance; however, accurate detection of SSIs post-hospital discharge is not straightforward. Studies that have performed surgical patient follow-up after discharge have used methods including variations of surgeon questionnaire, patient questionnaire, telephone interview and outpatient clinic follow-up; these estimate that 12%–84% of SSI's appear after discharge.[3] These rates are likely to be under-reported, since surveillance occurs exclusively during hospitalization.[4] Until post-discharge surveillance is included, SSI rates will continue to remain inaccurate and SSI surveillance will remain poor quality in infection control programmes.[5] Post-discharge SSI surveillance in low- and middle-income countries also needs to be improved.[6] Concurrent and post-discharge surveillance methods should be used to detect SSIs following inpatient operative procedures.[1] Surgeon or patient surveys, by mail or telephone, along with other methods identified by the facility that may help to capture all SSIs, or any combination of these, is acceptable for use.[1] To highlight the importance of performing post-discharge surgical patient surveillance, this study aimed to examine the applied PDS methods for SSI and to compare some methods with each other, to compare with the SSI rate during hospitalization with the rate post-discharge, and to determine the risk factors associated with increased SSI rates.

METHODS AND MATERIALS

The articles reviewed in this literature analysis were retrieved from the PubMed database. To capture all possible papers that met the criteria of this narrative review, a comprehensive technique was adopted. This search yielded 96 results with 12 articles matching the inclusion criteria, i.e. primary literature that described a method of post-discharge surveillance for surgical site infection or compared at least two methods of post-discharge surveillance for surgical site infection. The articles included also needed to use the definition of surgery as an invasive procedure using surgical tools, requiring operating room facilities, and not performed strictly as part of routine screening as per National Healthcare Safety Network. Studies exploring the impact of post discharge surveillance on SSI rates were also included.

SEARCH TERMS USED IN THE REVIEW

In the title, abstract, or key words, search terms included: ("surgical wound infection" [MeSH Terms] OR ("surgical"[All Fields] AND "wound"[All Fields] AND "infection"[All Fields]) OR "surgical wound infection"[All Fields] OR ("surgical"[All Fields] AND "site"[All Fields] AND "infection"[All Fields]) OR "surgical site infection"[All Fields]) AND ("post"[All Fields] AND ("discharges"[All Fields] OR "discharging"[All Fields] OR "patient discharge"[MeSH Terms] OR ("patient"[All Fields] AND "discharge"[All Fields]) OR "patient discharge"[All Fields] OR "discharge"[All Fields] OR "discharged"[All Fields])) AND (("surgical procedures, operative"[MeSH Terms] OR ("surgical"[All Fields] AND "procedures"[All Fields] AND "operative"[All Fields]) OR "operative surgical procedures"[All Fields] OR "surgical"[All Fields] OR "surgically"[All Fields] OR "surgicals"[All Fields]) AND ("infect"[All Fields] OR "infectability"[All Fields] OR "infectable"[All Fields] OR "infectant"[All Fields] OR "infectants"[All Fields] OR "infected"[All Fields] OR "infected"[All Fields] OR "infectibility"[All Fields] OR "infectible"[All Fields] OR "infecting"[All Fields] OR "infection s"[All Fields] OR "infections"[MeSH Terms] OR "infections"[All Fields] OR "infection"[All Fields] OR "infective"[All Fields] OR "infectiveness"[All Fields] OR "infectives"[All Fields] OR "infectivity"[All Fields] OR "infects"[All Fields] OR "pathogenicity"[MeSH Subheading] OR "pathogenicity"[All Fields] OR "infectivity"[All Fields])) AND ("post"[All Fields] AND ("discharges"[All Fields] OR "discharging"[All Fields] OR "patient discharge"[MeSH Terms] OR ("patient"[All Fields] AND "discharge"[All Fields]) OR "patient discharge"[All Fields] OR "discharge"[All Fields] OR "discharged"[All Fields]) AN6/15/22 "surveillance"[All Fields] OR "surveillance"[All Fields] OR "surveillances"[All Fields] OR "surveilled"[All Fields] OR "surveillance"[All Fields])))) AND (''2000/01/01'' [PDAT]: ''2021/06/08'' [PDAT]).

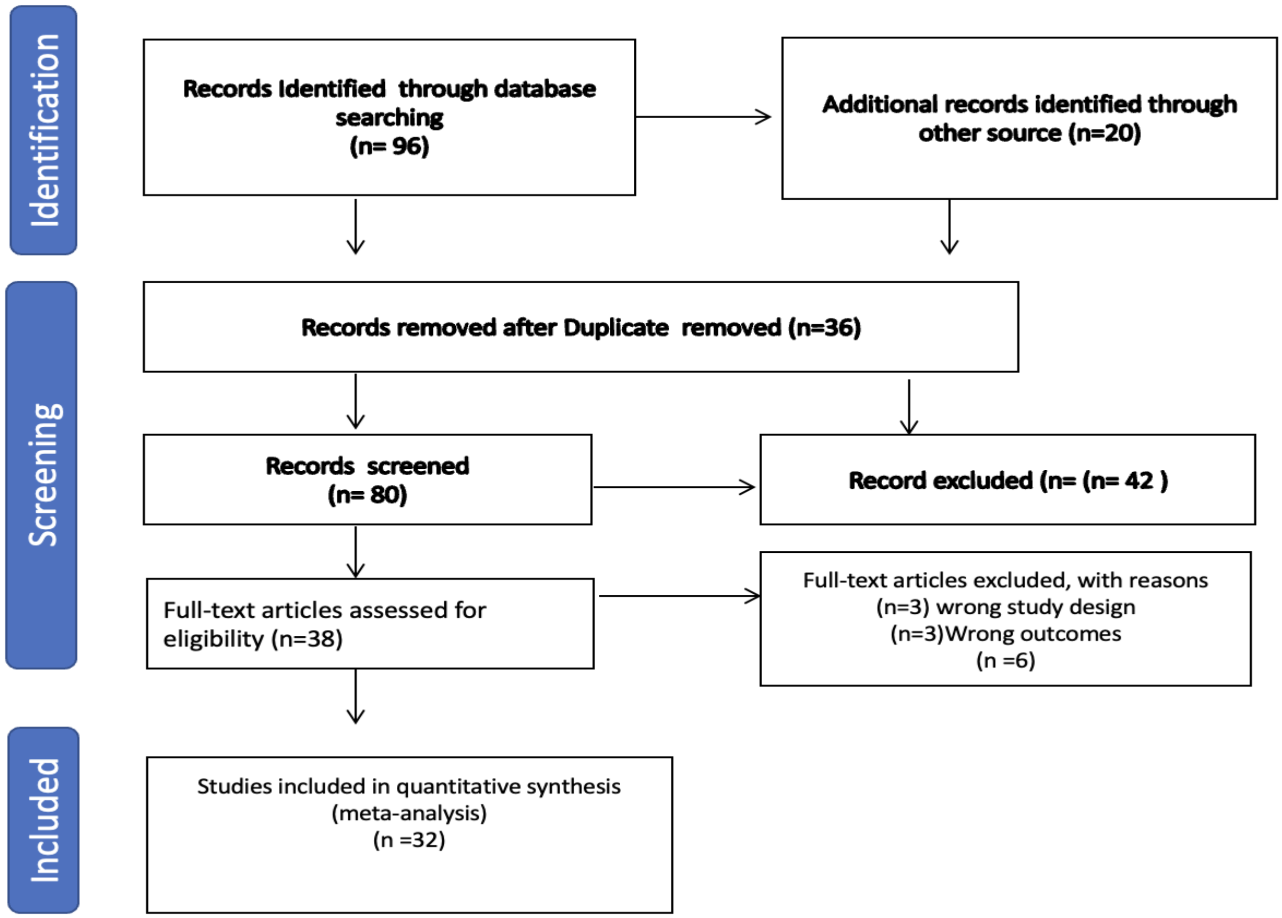

Fig 1 Articles included for final analysis

Studies were not required to report the duration of post-surgical monitoring or to adhere to the CDC-specified 30-day window for diagnosis, as the length of follow-up is a less important moderator of SSI incidence than other factors, including surveillance strategy. Exclusion criteria were any form of secondary or tertiary literature, such as meta-analyses and review articles. Surgical site infection in children, and articles that were published before 2000, were also excluded, as were studies that provided post-discharge surveillance with no clear methodology.

An additional 20 articles were found through manual searches through the Google search engine with the key words "Surgical Site infections", "Post discharge", "surveillance" and "Post discharge SSI". Data recorded from each paper included the paper's authors, year, country, study design, patient group, surveillance method, duration, response rate, SSIs rate, and outcomes (listed in Table 1, at end of paper).

RESULTS

Table 1 summarizes the findings from the articles included in this review. The table can also be found at this link: 10.13140/RG.2.2.25838.08002

Telephone calls and questionnaires as PDS method

Several studies[6-11] have looked at the impact of PDS on identifying SSI using only a questionnaire and telephone follow-up, comparing the number of SSIs identified by phone calls to a gold standard, or studying a different PDS method altogether. For example, Nguhuni et al[6] evaluated the reliability and validity of telephone calls as part of PDS for identifying SSIs after caesarean section at a Tanzanian tertiary hospital. Telephone-based SSI diagnoses were compared to the gold standard of a clinical review within 48 hours. The reliability of telephone-based SSI diagnosis was assessed using sensitivity and specificity. Two hundred seventy-four patients were successfully contacted by phone, and 484 paired observations (telephone call interviews and clinician reviews) were generated within 48 hours.

Clinical review identified 25 SSIs, 18 of which were identified over the phone. When compared to the gold standard, these findings showed that telephone interviews had a sensitivity and specificity of 72% (95% CI 50.6–87.9) and 100% (95% CI 99.2–100), respectively.

Cardoso Del Monte et al.[7] used questionnaires and phone calls to conduct a PDS at a public university teaching hospital in Brazil to assess the incidence of SSI and associated risk factors after caesarean section. In-hospital surveillance entailed filling out a form with information about risk factors for post-cesarean SSI. Along with phone calls, a structured questionnaire specifically designed to identify SSI symptoms and signs was used. Thirty-nine of the 42 cases (93%) were positively identified during the first telephone call, 15 days post operation.

Halwani et al[8] sought to assess the efficacy of post-discharge phone calls in detecting SSI after a caesarean section. Phone calls were made on postoperative days 7, 14 and 30. After discharge, patients were also given a standard question to record their SSI symptoms; 7% of the patients (14/193) developed SSI, according to in-hospital surveillance. A further five cases (10%) were reported through phone contacts. They also found that standard hospital surveillance alone has a sensitivity of 73% when compared to the gold standard method of phone calls.

Elbur et al.[9] sought to determine the suitability of telephone calls for post-discharge wound infection surveillance, as well as the patient and procedure characteristics associated with loss of follow-up after hospital discharge in Khartoum, Sudan. Wound infections were detected using two methods: bedside surveillance and post-discharge surveillance. PDS included a questionnaire as well as phone calls from an infection control nurse on postoperative days 7, 14, 21 and 28. One hundred and twenty-five (9%) of the 1,387 patients who successfully completed the follow-up developed wound infections, of which 110 infections, (88%) were identified after discharge.

Taylor et al.[10] investigated the role of phone calls in PDS of SSI in 3,150 patients in 32 Scottish hospitals. Patients undergoing groin hernia repair were asked to fill out a questionnaire upon their arrival. On days 10, 20 and 30 after surgery, phone calls were made by trained healthcare workers who had to complete and fax a 'Detail of infection' form, assessed SSI for patients describing wound issues. The follow-up was successfully completed by 2,665 patients. A total of 197 patients were evaluated, with SSI confirmed in 140. Nurses or General Practitioners confirmed 77% of the SSI, while surgical ward staff confirmed 47% of the SSI. The overall infection rate was found to be 5%.

Whitby et al 2002[11] used patient self-assessment during post-discharge surveillance to assess the reliability of SSI diagnosis. Trained nurses were asked to follow up on patients suspected of having SSI and to complete a standardized written assessment. The same written questionnaire was given to each patient. A third group of general practitioners, surgeons and infectious disease specialists were also asked to diagnose SSI based solely on photographs provided by the nurses. The gold standard (SSI diagnosed by nurses) identified an SSI rate of 48 (16%). The General Practitioner identified a 14.5% SSI rate. The Surgeon discovered a 37% SSI rate, while the ID physician discovered a 31% rate. The patient's ability to recall their response at week 2 compared to that at week 1.

Telephone-based PDS compared to other methods

Mannien et al[12] compared the number of identified SSI using three PDS methods. The first method involved recurrent visits to the outpatient setting with a special registration card, with the patient seen by a surgeon who added notes about clinical symptoms and whether the patient developed an SSI according to CDC criteria. The Dutch national surveillance network recommends this PDS method, known as PREZIES.

The second PDS method investigated is known as 'active PDS', and it consists of a questionnaire sent to patients and surgeons, as well as follow-up phone calls to patients. If no follow-up was performed and SSI was discovered by chance, this was referred to as 'passive' PDS (third method). The PREZIES method of PDS had the highest rate of SSI (43%), followed by active PDS (30%) and passive PDS (25%).

Aiken et al.[13] used the 'kappa statistic' to investigate the inter-observer consistency of surgical wound class (SWC) and American Society of Anesthesiologists (ASA) scores in Thika Hospital in Kenya. The sensitivity and specificity of telephone-based surveillance were also evaluated by calling patients after discharge and asking a standard series of objective questions about the clinical condition of their wounds. Postoperative patients were reviewed at every dressing change on day 3 and thereafter on alternate days during their postoperative inpatient stay. Patients were also followed up on 30 days after any eligible surgical procedures. The Surgery, Obstetrics and Gynaecology (O&G), and Anaesthetics departments at Thika Hospital scored the consistency test. For these case histories, all department members independently scored the SWC or ASA. To ensure inter-observer consistency, a second round of this exercise was performed with actual patients. It was carried out in the O&G and Anaesthetics departments, with various paper-based case histories. The gold standard of outpatient clinical diagnosis was used to compare all phone-based diagnoses.

Outpatient clinician reviews and phone interviews were completed in 89 pairs, and 23 patients were diagnosed with an SSI. Sixteen of these were diagnosed correctly over the phone. 66 patients were clinically diagnosed as not having SSI, and none were thought to have SSI based on phone calls. Phone calls were found to have a sensitivity of 67% [95% confidence interval (CI): 47.1–86.8%] and a specificity of 100% (95% CI: 95–100%).Reilly et al[14] studied the impact of PDS on SSI in acute care settings in Scotland. Data from 12,885 (59%) operations were collected from 32 acute care hospital databases. A questionnaire survey and a follow-up phone interview were used for in-hospital postoperative surveillance. As the method of SSI identification, passive PDS was checked for readmission. The SSI rate among the 8,825 operations that did not use PDS was 3% (95% CI, 2% -3%), compared to 6% (95% CI, 5.9% -6.8%) in 12,885 operations that did use PDS. Løwer et al.[15] investigated the impact of post-discharge surveillance duration and intensity on SSI after hip arthroplasty in Norway. They compared an active one-year PDS method using telephone conducted patient questionnaires to a passive PDS method relying on hospital readmission. SSIs were discovered in 233 patients, with 79% of SSIs discovered after discharge.

De Oliveira A. and Carvalho D.[4] investigated the SSI incidence during hospitalization and the impact of notification after discharge at two teaching hospitals in Sao Paulo, Brazil, using two methods. Hospital A had one outpatient clinic with set days and hours for patients to return after surgery, with telephone calls used for post-discharge follow-up. Patients at Hospital B were instructed by the surgeon to return to the clinic or other locations, and appointment times were not controlled by the institution. Here, the patient would be seen and evaluated for SSI during outpatient clinic visits. Hospital A had a rate of 7% (17/252) during hospitalization, while Hospital B had a rate of 4.5% (16/357). Post-discharge, Hospital A detected 27% (68/252) of SSI and Hospital B discovered a post-discharge rate of 13% (48/357). That equates to a global SSI rate of 34% and 18% for Hospitals A and B, respectively.

Other PDS methods used to identify SSI

In a prospective study, Friedman et al[16] used chart reviewing as a method of PDS at the University of Michigan Hospital and health centers. A total knee arthroplasty was performed on a subset of patients. A daily review of wound cultures indicating SSI was performed, as well as follow-up on patients with infections who were readmitted. In addition, after outpatient follow-ups at two and six weeks, six months, and one year, a patient's electronic chart was reviewed. Twenty-five post-surgery SSI were discovered among the 555 procedures performed over a four-year period. Among these, post-discharge electronic chart review surveillance assisted in the identification of 18 SSIs, which was significantly higher than the seven identified by traditional surveillance ($P < .001$).

The Bluebelle Study Group et al[17] sought to validate the Bluebelle Wound Healing Questionnaire (WHQ) for assessing SSI in closed primary wounds following hospital discharge. The questionnaire included eight questions about SSI signs and symptoms and eight about wound care interventions. Participants completed and returned the WHQ (self-assessment) within 30 days of surgery. The WHQ (observer assessment) was completed 4-8 weeks after surgery via phone or in person with the healthcare professionals caring for the patients. The test-retest reliability was evaluated, and 44 of 50 participants completed and returned a second WHQ, with a median time between assessments of five days. Inter-test agreement was high, with observed agreement >86%. There was high agreement between the majority of answered items when comparing self-assessment and observation, with a reliable statistic ranging between 0.4% and 0.74%. sensitivity and specificity were both high, with an area under the ROC curve of 0.91. The SSI rate identified post-discharge compared to that observed pre-discharge.

PDS has previously been used in several studies to identify post-discharge and pre-discharge SSIs. Alfouzan et al[18] investigated the trends and risk factors for SSI after caesarean section (CS) with the prevalence of SSIs being 2% (152 out of 7,235 patients) and 99% (149 out of 152) of these SSIs reported after discharge. Noy D. and Creedy D[5] compared SSI rates before and after discharge. They recorded 42 SSIs in 247 patients. SSI occurred at a rate of 17% overall with 14% occurring after discharge. Prospero et al[19] investigated post-discharge SSI development in 264 general surgery patients who had undergone a variety of invasive surgeries. According to the findings of this study, 28 (10.6%) of the 264 patients developed an SSI. 17 SSI diagnoses were made after hospital discharge, accounting for 60.2% of all SSI diagnoses. Cardoso Del Monte et al.[7] showed that 44 of the 187 women in their study developed an SSI, with the vast majority, 42 (95%), identified after discharge. Løwer et al.[15] also found that the majority of their SSIs, 79% of 233 patients, were diagnosed after discharge.

Avato et al.[20] found that 88 of 1,271 patients who successfully completed follow-up had SSIs, with 72% of these discovered after discharge. Ward et al.[21] examined 745 surgical wound problems and/or uterine infections, with 488 (65.5%) confirmed SSI cases. Only 78 (16%) of these were discovered during the hospital course. Gil et al.[22] discovered that 12 (2%) of the 525 patients had incisional infection with more than half, 58%, diagnosed after discharge.

Creedy D. and Noy D.[23] sought to assess a method of post-discharge surveillance and compare pre- and post-discharge SSI rates. 42 patients (17%) were diagnosed with SSIs post-discharge, with only seven of these identified prior to discharge. Raouf et al[24] reported that there were 57 SSIs (2.3%), 35 (61.4%) of which were discovered after discharge. Alnajjar et al[25] indicated that 11 SSIs were diagnosed among the 807 caesarean section patients they studied, with 100% of these discovered after discharge. Two studies[26,27] on the other hand, discovered lower SSI rates following discharge. Stockley et al.[26] described a five-year post-operative infection surveillance system, including post-discharge follow-up, in a district general hospital in the West Midlands, UK. 618 of the 667 patients were followed up on completely, with 77 developing an SSI and a little less than half, 48%, identified post-discharge. Tanner et al.[27] also investigated PDS as a means of identifying colorectal surgical site infection rates and associated costs discovering lower rates. Of the 105 patients who met the eligibility criteria and completed the 30-day follow-up, 29 (27%) developed SSI, with 17 diagnosed during hospitalization.

Identified Risk Factors Associations with SSI Rates:

1. Patient Education

A five-phase preventative programme in caesarean section patients aimed to improve hair removal practices in the weeks leading up to CS surgery[28]. It included instructing expecting mothers not to remove pubic hair, optimizing antibiotic prophylaxis, encouraging the use of lower-risk methods such as depilatory creams when hair removal was necessary, and using a 2% chlorhexidine gluconate/70% alcohol skin preparation during surgery. According to this study, 451 patients (6%) developed SSIs. The study concluded this form of PDS led to a 50% reduction in post C-section SSI rates. Using two different groups, Whitby et al[29] investigated whether patient education improves diagnostic reliability during PDS. The more highly educated group was given oral and visual instructions on the local and systemic signs of SSI, whereas the second group was told to contact their general practitioner if they had any questions or concerns about their wound healing. This study showed that there was no statistically significant difference in the rates of SSIs between the more highly educated and less educated groups. The educated group correctly identified 30/36 SSIs but incorrectly identified an additional 16 (44%). The uneducated group correctly identified 25 of 30 SSI but incorrectly identified an additional five wounds (17%).

2. Emergency versus elective mode of delivery

Four studies found an increased SSI rate associated with emergency mode of delivery surgeries. Creedy D. and Noy D.[23] found that of the 42 SSI they identified, there were 12 more patients with SSI following emergency caesarean procedures than in elective caesarean procedures (p=0.002). Emergency C-section was also identified as a risk factor by Alfouzan et al.[18] SSI was found in 25% of emergency C-sections and 8% of elective cases. This trend is most likely due to less available time for perioperative measures in emergency caesarean sections. Alnajjar et al[25] found that 100% of recorded SSIs were emergency caesarean cases, although the results were not significant (p=0.0920). In a study by Ward et al,[21] 128 out of 242 women who had emergency surgery developed SSI.

3. Patient comorbidities

Ward et al[21] reported a 70% increase in SSI risk with every 10 unit increase above the normal BMI (p=0.0001). Cardoso Del Monte et al[7] found arterial hypertension to be significantly associated with SSI in women who underwent C-section (RR, 2.47; 95% CI: 1.21-5.04). Gil et al[22] found DM to have an infection rate of 9% in their study; the overall surgical wound infection rate was 2% (58/525) of patients.

DISCUSSION

The purpose of this narrative review is to gather data on the applied PDS methods for SSI, the SSI rate during and after hospitalization, and the risk factors for SSI development. Throughout the 32 studies, the use of telephone calls was seen most commonly, often demonstrating perfect specificity and a moderate sensitivity[6,13] suggesting that it is intrinsically a good method for SSI evaluation. It is relatively inexpensive and cost-effective and thus can be implemented in hospitals across the world with limited resources.[30] In addition, some studies showed that when combined with another PDS method, telephone calls were found to be "acceptable, reliable and valid"[17] and preferred, compared to other methods.[31] One study combined telephone calls with the use of a follow-up card, and this was deemed to be more effective than a follow-up card alone.[3] Telephone calls can be used in general to enhance PDS in hospitals where another PDS method is already being implemented. More research is needed to see if telephone calls can be part of, if not the standard, PDS method.

With several studies showing most SSIs are identified after discharge, a PDS method during the follow-up period is extremely important.[18-20,23,24] The use of telephone calls during the post-discharge period can lead to improvements in patient adherence to follow-up care, easing the transition from the hospital to the home in an outside study by Balaban et al.[32] This is supported by another outside study by Crocker et al.[33] Not all SSIs require readmission and many can be addressed solely in the outpatient setting, potentially leading to fewer readmissions and less of a cost burden on hospitals. Two studies showed a minority of SSIs identified after discharge however, though several aspects of these studies are either unclear or not uniform, including the level of care patients received during their inpatient stay.[26,27]

In addition to PDS methods, several studies looked at risk factors that could affect SSI rates. Two studies used patient education as an intervention and aimed to see the effect, if any, this would have on SSI identification.[28,29] Of these, Whitby et al[29] found no statistically significant impact of patient education on diagnosing SSIs. In fact, the educated patient group overidentified SSIs compared to the less educated patient group, which questions whether this intervention is appropriate and whether other interventions should be explored instead.

A narrative study by Becker et al.[34] involving 19 trials from seven countries showed that patient education led to lower readmission rate as well as improved medical adherence during the post discharge period. This inconsistency could be explained by the type of patient education and health information shared, as there is no set patient education plan during discharge. Sanger et al[35] identified insufficient guidance in discharge education. Elbur et al[9] found an association between SSI and a patient BMI of >30 which is noteworthy considering the societal shift towards people having a higher BMI. Comorbidities such as hypertension and DM were noted as significant risk factors, which is important as these conditions are increasingly prevalent within in society. Another risk factor for higher rates of SSI is emergency surgeries[18,23] which is relevant in medical specialties where emergency surgeries such as C-sections or trauma surgeries are more commonplace.

Many of these studies chose to examine SSI rates in patients who had undergone caesarean sections, indicating a possible need for a standard PDS for caesarean section patients.[7,8,18,21,36] This type of surgery generally has a short hospital stay, which follows the general trend of surgical patients being kept in hospital for a shorter period. These risk factors can help physicians in the inpatient and outpatient setting to identify patients at a possibly higher than average risk for SSI after discharge, warranting stricter implementation of a PDS method. However, selecting a preferred method to accurately identify SSI rates, especially post-discharge, is still an area that requires further attention and research.

LIMITATIONS

As with virtually all studies, there are limitations to consider. The use of one database limited the article population from which to select for this narrative review. The patient population was adults only. In terms of the studies themselves, it was difficult to assess the availability of hospital staff and resources in different countries which could have affected the types of surveillance methods selected. It was also difficult to know the specific risk factors that may have predisposed patients to SSIs such as poor wound healing with age or smoking. The disposition of the patient; whether they were discharged home, to a rehabilitation centre, etc., could also play a role in SSI rates, which were not uniform among the studies reviewed. Strengths to consider in this narrative review are the inclusion of studies from different countries with different advancements in medicine as well as examining SSI rates from various types of surgeries. These could aid in providing a less biased interpretation of how PDS methods affect SSI rates.

CONCLUSION

Surgical site infection (SSI) is a major consideration to keep in mind when caring for patients postoperatively. The shift to shorter hospital stays almost requires a post-discharge surveillance (PDS) method. This review shows that there are various PDS methods currently being implemented and identifies SSIs surveillance via telephone calls to be a common method. However, it is difficult to fully conclude that any one method is preferred or superior to the rest. This review also found studies that have identified risk factors associated with higher SSI rate. Overall, further high-quality studies need to be performed in order to identify the preferred PDS method that can most accurately identify SSI rates. With more emphasis on researching PDS for SSI, hopefully a standard method can be established that is accurate, cost effective, and capable of being implemented in hospitals in most parts of the world.

Table 1 Summary and Description of the Studies Reviewed

No	Authors and Year	Country	Study design	Patient group	Surveillance method	duration	Response rate	SSIs rate	Outcomes
1	W. Alfouzan et al., 2019	Kuwait	Prospective study	C-section patientss	The National Health Surveillance System's (KNHSS) structured forms and phone calls were used.	30 days post discharge	Response rate was not specified; however, 7235 pregnant women underwent CS during the study period.	SSI was found in 152 women (2.1%), an increase from 1.7% in 2014 to 2.96% in 2016. SSI prevalence was not associated with operation type, duration of surgery, wound class, ASA, or risk score ($P > 0.05$). There were 14 (25%) SSI in the 54 patients who did not receive prophylaxis antibiotics, compared to 28 (28.5%) SSI in the patients who did.	The vast majority of SSI after CS are noticed after the patient has been discharged from the hospital. Emergency care and inadequate antibiotic prophylaxis are significant risk factors in the development of SSI, and given the proliferation of MDR organisms, a revised prophylactic antibiotic policy as part of antimicrobial stewardship is urgently needed to reduce infection rates. To gain a better understanding of the causes and progression of SSI, more research evaluating all potential risk factors is required.
2	D. Noy RN et al., 2002	Cambodia	Prospective study	C- section patients	A multi-method approach was used, which included a post-discharge questionnaire, telephone follow-up, and chart review.	30 days post discharge	The study included 277 women, with an 89% response rate.	The overall SSI rate is 17 % vs. 2.8 % at discharge. 31% of women who had a caesarean section and developed SSI were not given prophylactic antibiotics.	A patient questionnaire combined with follow-up phone interviews yielded a higher response rate than either method alone.

3	W. Ng et al., 2015	Canada, USA, United Kingdom	Prospective study	C- section patients	Active inpatient surveillance and intensive PDS using a standardized form.	6 weeks after discharge, for a total of 5.5 years.	With an 85% response rate, 7985 out of 9442 people were studied.	From baseline to phase 5, there was an incremental decrease (50%) in SSI. Non-elective surgery had higher SSI rates than elective. Time between membrane rupture and delivery increases risk of infection.	A multifaceted SSI prevention strategy with data feedback on a regular basis resulted in a significant reduction in SSI rates after cesarean section.
4	E. Prospero et al., 2006	Italy	Prospective study	General, surgical patients	Questionnaire or surgeon's observation and phone contact 30 days post operation for those who did not return for OP visits.	June to October of 2004	A response rate of 81.8 % was achieved (216/264).	SSI was found in 28 patients. That equates to 10.6 % of the patients studied. 60%, or 17 of these SSI cases, were detected after discharge.	The findings indicate that there is an urgent need to transition from generalized to National Nosocomial Infections Surveillance System (NNIS) operative category-directed post-discharge surveillance, at least for procedures deemed high-risk locally.
5	J. Reilly et al., 2006	Scotland	Prospective study	A variety of surgical patients (Breast surgery, Coronary artery bypass graft, C-section etc.)	For SSI PDS, the definitions and methods of the CDC NNIS system were used.	April 1, 2002 to June 4, 2004, (3 months).	Information was gathered from the chart review (21,710 cases).	SSI rate = 3% of the 8,825 cases without a post-discharge status. This is significantly lower than in PDS cases (6% of 12,885 PDS cases). No significant difference in the SSI rate between surgical procedures.	A procedure-specific approach to PDS was recommended, with direct observation of patients after breast surgery, caesarean section, and hysterectomy, all of which have a short length of stay. Most SSIs can be detected with readmission surveillance after orthopedic or vascular surgery, where the length of stay is typically longer.

6	H. Løwer et al., 2015	Norway	Prospective study	Surgical patients (hip arthro-plasty, total hip arthro-plasty and hemiarthro plasty)	Active PDS as determined by a patient questionnaire and confirmed by a physician, compared to passive PDS, determined by readmissions. Reminders sent to non-responders, and they were contacted by phone.	30 days PDS and 1-year PDS.	At 30 days, the response rate was 96%, and at one year, it was 87%.	After hospital discharge, 79% of all SSIs and 82% of deep SSIs were discovered. Deep SSIs were detected in 95% of cases within 90 days of surgery. 14% of deep SSIs were discovered after 30 days, and all patients were readmitted due to their SSI and thus could have been detected by passive PDS.	Deep SSIs were detected in 95% of cases within 90 days of surgery. All deep infections detected after 30 days could have been detected by passive PDS, indicating that passive surveillance after 30 days can replace active surveillance without reducing case finding sensitivity.
7	J. Avato et al., 2002	USA (Atlanta)	Prospective surveillance	Surgical patients (Coronary artery bypass graft)	Post discharge National Nosocomial Infections Surveillance (NNIS)	July 1st, 1996 to September 1st, 1998	Response rate of 96% (1271/1324)	Of 88 SSIs discovered, 28% were detected before discharge and 72% after discharge. Prior to discharge, more chest infections were identified than harvest-site infections (46% vs 11%), and in the outpatient setting, more harvest-site infections were identified than chest infections (42% vs 14%).	Hospitals that perform comprehensive post discharge surveillance after CABG procedures are more likely to have higher surgical-site infection rates than those that do not. It may also contribute to the disparity between risk index 2 and NNIS System rates.

8	M. Cardoso Del Monte et al., 2010	Brazil	Observation-al, longitudinal, cohort study	C-section patients	Post discharge phone interview (15 days after the C-section and 30 days after surgery), a structured questionnaire , and the patient's chart were used.	30 days post discharge	91.7%	SSI was found in 44/187 cases (23.5%). SSI appeared after discharge from the hospital in 42 (95%), within the first 15 days of surgery. Prenatal consultations and hypertension were both significantly associated with post-cesarean SSI. Only arterial hypertension remained significant in the multivariate analysis.	Post-discharge monitoring is critical for obtaining accurate estimates of post-cesarean section SSI. A 15-day post-discharge follow-up was found to be adequate. Hypertension was found to be a risk factor for SSI.
9	M. Halwani et al., 2015	USA	Prospective cohort study	C-section patients	A standard questionnaire was used, as well as routine surveillance using clinical databases and electronic patient records, as well as follow-up calls to patients at 7, 14, and 30 days after surgery.	Between April 22nd and August 22nd of 2010	193 patients were studied.	14 SSI (7%) were identified using hospital follow-up). Telephone follow-up identified five SSI patients (10%) who did not return to t hospital for further evaluation. Standard hospital surveillance has a sensitivity of 73.3% when using the gold standard.	Results suggest that follow-up telephone calls to patients following cesarean section identifies 26.3% of the total SSIs. Enhanced surveillance can provide more informed data to enhance performance and avoid underestimation of rates.

10	J. Stockley et al., 2001	UK	Prospective study	Surgical patients (total bowel hyster-ectomy, inguinal hernia repair etc.)	PDS was assessed using a combination of past medical worker questionnaires, phone checkups, and patient questionnaire	6 months with follow up inpatient and post discharge by audit nurses	The rate of follow-up was 92.7% (618 out of 667)	77 cases of SSI were recorded (12.5%). Of those cases, 37 (48%) were detected after discharge. Highest number of SSI was detected in Vascular surgery pts.	Healthcare worker questionnaire, a phone call, and a patient questionnaire ensured nearly complete post-discharge monitoring; however, a computer collation system will reduce the time required to perform such surveillance, allowing for more comprehensive coverage of surgical procedures performed.
11	V. Ward et al., 2010	East midlands	Prospective study	C- section patients	Optical mark recognition (OMR) software	After C-section to end of appointments with community midwife (15-day average)	88% (5563/6297)	13.3% (378/5563)	BMI, age, blood loss, wound closure method, and emergency surgery were all found to be significantly related to surgical site infection. Surveillance after a caesarean section necessitates the involvement of various healthcare personnel.
12	J. Tanner et al., 2009	UK	Prospective study	Colorectal surgery	Telephone interviews and home visits	From January until April 2008 (30 days PSD)	83% (105/126)	27.6% (29/105)	SSI surveillance after colorectal surgery is currently underestimating the incidence and cost of SSI. Primary care trusts must become more involved in the prevention and management of SSI. The only risk factor identified was body mass index.
13	V. Vilas-Boas et al., 2015	Brazil	Sequential multi-study w/instrument development, validation, and application	Hysteroscopy and/or gynecological laparoscopy	Telephone calls	72% of cases were 30-35 days after surgery, 25% were 36- 40 days; 3% were more >40.	88.2% (60/68)	0%	Surveillance method can be selected based on the resources available in the institution. Telephone interviews are considered to be cost-effective due to the high response rate.

14	M. Whitby et al 2002	Australia	Prospective study	Postoperat -ive patients	At-home visits, questionnaire at 4 weeks	6 weeks	In week four, 71.2 percent completed the questionnaire, and in week six, 60.1 percent completed a second questionnaire.	Overall infection rate identified by the nurse (Gold Standard) was 17%. Most (98%) were superficial. Patients readmitted within 6 weeks due to a deep/organ infection, accounted for 2% of patients.	The correlation between the patient's assessment of their wound and the ICN's diagnosis was poor (r=0.37), with a low positive predictive value (29%), but a high negative predictive value (98%). Patient recall of the GP's antibiotic prescription was the most closely related to the ICN's diagnosis (r=0.76). This proved as most efficient marker of SSI.
15	E. Taylor et al., 2003	Scotland	Prospective study	Groin hernia repair patients	Telephone calls	Telephone calls on days 10, 20, and 30 post-operation	93% (2938/3150)	Of 2,665 patients with complete data, 140 (5%) developed wound infection, and 57 (2%) thought their wound was infected but this was not confirmed.	Methods for identifying all patients who are eligible for surveillance must be improved. Patients seemed to appreciate the idea of making phone calls; this method of patient contact may be appropriate for PDS.
16	P. Gil et al., 2005	Spain	Prospective study	Patients with clean surgery	Questionnaire s and telephone calls after surgery	Follow-up for 30 days after surgery	100% (525 cases)	58% of infections were found after the patient had been discharged. The rate of SSIs was 2%. Patients with one or more risk factors had a 4% infection rate. Diabetes mellitus and malignancy were linked to infection rates of 9% and 8.2%, respectively.	At 30 days after surgery, this type of surveillance provides more accurate data on true infection rates. Diabetes mellitus, malignancy, and length of surgery were the most important factors associated with infection in this study.

17	C. Friedman et al., 2001	America	Prospective study.	knee arthro-plasty patients	After discharge, traditional surveillance methods as well as electronic chart review surveillance were used.	1-year post-operative follow-up.	100% (555 procedures)	25 post-op infections were detected. Traditional surveillance methods identified seven (1%), electronic chart review identified 18 (4.5%) – higher than traditional surveillance (p=0.01).	Post-discharge electronic chart review significantly improved case finding, resulting in a more accurate infection rate.
18	J. Mannien et al., 2006	The Netherlands	Retrospectiv-e study.	Patients after surgery	PREZIES method, active and passive PDS surveillance.	Between 1996 and 2004 - 8 years	92% (131,798/143,321)	Appendectomy has the highest infection rate (79%) followed by knee prosthesis (64%), mastec-tomy (61%), femoropopliteal or femorotibial bypass (53%), and hysterectomy (53%).	Most SSIs develop after patients are discharged. If no PDS is performed, the SSI rate will be underestimated. The return of patients to hospitals following surgical procedures may be appropriate for the use of SSIs PDS. Performing active PDS appeared extremely important for most surgical procedures.
19	M. Whitby et al 2007	Australia	RCT	Surgical patients	Home visit (patient self-assessment)	Four weeks follow-up post-operatively	81% (588/724)	66 patients with SSI were included in the study, five had deep/organ space infection. The more educated group had a significantly higher positive predictive value (65% vs 83%).	Pre-discharge education may cause patients to over diagnose clinical features of SSI and does not improve diagnosis validity. There was no significant difference between the groups in the proportion of SSI diagnosed by ICN. Increased number of reported SSI could be attributed to informing patients of the possibility of SSI.

20	Creedy D. and Noy D., 2001	Australia	Prospective study	C- section patients	Questionnaire and phone calls follow-up	12 months	89% (247/277)	Overall, the infection rate was 17%, compared to 3% at discharge. Telephone follow-up and chart review of patients with potential infections and non-responders showed 32% more post discharge infections (14/42).	PDS is required for an accurate SSI rate after c section, raising infection control awareness, and indicating the need for follow-up care. Women who have had a C-section should be informed about the risk of SSIs and its symptoms and signs.
21	A. Pagamisse et al., 2020	Brazil	Cross-sectional study	Surgical patients	Telephone calls, outpatient return visit, and email.	Follow-up for 30 days after surgery.	The phone response rate was 42.8%, with outpatient returns at 34.2%.	SSI was reported by 24 (96%) of patients during hospitalization, with a balance of clean surgery (11; 46%) and clean and clean-contaminated surgery (11; 46%). PDS, 21 (84%) SSI was reported after discharge.	Nurses play an important role in SSIs identification activities, and active search during hospitalization combined with post-discharge telephone surveillance were the preferred methods.
22	M. Raouf et al., 2020	Egypt	Prospective study	General surgical patients	Follow up examination visits and Post discharge questionnaire (PDQ)	Follow-up for 30-90 days after surgery	Out of a total of 3,642 patients, 70% had complete follow-up.	SSI was detected in 57 cases (2%), 61% of which were detected post discharge. Most cases detected at the OP clinic during follow up, then those detected using PDQ.	Despite the low SSI rates detected, the high incidence of AMR reported is concerning.

23	M. Alnajjar et al., 2020	UAE	Retrospectiv-e study.	C-section patients	Patient medical/nursi n-g records, and surgery clinic patient records.	Follow-up for 30 days after surgery	807 (100%) responses.	Eleven (100.0%) women were diagnosed post discharge, within 30 days after the operation date, and none (0%) were detected during hospital stay. Of these, nine (81.8%) were diagnosed as superficial SSIs and two (18.2%) developed deep SSI infections.	PDS must be performed concurrently with inpatient surveillance. Increased gestational age was found to be a reliable predictor of post-caesarean SSIs. This identified risk factor should be used to inform targeted health care policies aimed at lowering the rate of SSIs.
24	I. Ashraf et al., 2018	Pakistan	Prospective study	Total knee arthroplast -y patients	Inpatients along with post-discharge surveillance using SSI database	90 days postoperativ-ely.	100% (164 patients)	The overall SSI was found in two patients (1.2%). These two infected cases occurred after discharge from the hospital. The length of surgery was found to be a risk factor for developing SSIs.	The study emphasizes the importance of post-discharge surveillance and not limiting it to inpatients only. Furthermore, the SSI program could be useful in preventing postoperative wound infections.
25	Bluebelle Study Group (2019).	UK	A cohort and pilot RCT study	Abdomina-l general surgery or C-section	The Bluebelle Wound Healing Questionnaire (WHQ), self-assessment, telephone and face-to-face assessment by HCW.	Between four and eight weeks after surgery.	87%	23 patients were diagnosed with an SSI. Sixteen of these were diagnosed correctly over the phone.	Bluebelle WHQ is acceptable, reliable and valid with a single-scale structure for postdischarge patient or observer assessment of SSI in closed primary wounds.

26	P. Sanger, et al., 2014	USA	Mixed method design	Open colorectal or ventral hernia repair surgery	60–90 minute semi-structured interviews and surveys	1–2 weeks after discharge	76.5%	The number of SSIs was not tracked.	The findings reveal gaps in discharge education, wound self-monitoring at home, and provider communication.
27	J. Guerra et al., 2015	Cambodia	Prospective study.	Surgical patients	Follow-up card and telephone calls	30 days follow-up	87%.	The SSI rate ranged from 12%-29%. 31 patients reported by phone that "white liquid discharged from the surgical wound". Purulent drainages (12) were reported by a practitioner using a follow-up card.	The use of a follow-up card with phone calls for post-discharge surveillance was more effective than reviewing medical charts to identify SSIs during hospitalization.
28	A. Elbur et al., 2013	Sudan	Prospective cohort study.	General surgery patients (obstetrics & gynae-cology, and urology)	Bedside surveillance and post discharge Telephone interviews.	30 days surveillance post-operatively.	78.4%.	125 (9%) patients developed SSIs: 34 (27%) infected clean and 91 (73 %) infected clean-contaminated wounds. 15 (<1%) were during the hospital stay and 110 of the cases after discharge.	Most wound infections appeared after discharge. Telephone calls are appropriate and may be used as an alternative to clinic-based wound infection diagnosis, especially if the hospital has a mandatory surveillance program.
29	S. Srun et al., 2013	Cambodia	Retro-spective study	C-section patients	Assessments daily, day 5 to discharge. OP assessments days 15 and 30. Digital photos on postop days 5, 15, and 30.	30 days post-operatively.	176 out of 222 (79.3%) were monitored for 30 days.	11 cases were diagnosed with a SSI, an incidence rate of 6% (95% CI 3.2-10.9). Four (36%) were detected after discharge.	In resource-constrained settings, SSI surveillance proved feasible but difficult. Both hospital administration and the hospital's Infection Control Committee may be useful in implementing Surveillance activities.

30	A. Aiken, et al., 2013	Kenya	Prospective study	Major obstetric or gynaecological surgery (O&G)	Post-discharge telephone calls were evaluated against an outpatient clinician review	Follow-up surveillance for 30 days	1172 cases were studied.	For 23 patients diagnosed in outpatients by a clinician as having SSI, 16 of these had been judged to have SSI in their telephone interview.	Surveillance for post-discharge SSI using telephone calls is imperfect but provides a practical alternative to clinic-based diagnosis. In this context, surgical wound class (SWC) score was the only predictor of SSI risk in O&G surgery.
31	B. Nguhuni et al., 2017	Tanzania	Observation-al cohort study	C-section patients	A telephone call interview using a structured questionnaire followed by an out-patient review by a blinded clinician.	Follow-up for 30 days.	374 women were enrolled.	25 SSI were diagnosed (12%), including all 18 superficial SSI identified by phone, plus 7 additional (4 superficial, 2 deep, 1 organ/ space). Overall sensitivity and specificity of calls, compared to clinician evaluation, were 72 and 100%, respectively.	It was found that a combination of two phone calls at day 7 and day 14 would have detected almost 90% of SSI cases. Telephone detection may be a useful method for SSI surveillance in low-income settings because it may reduce follow-up loss and improve surveillance data quality, especially when the patient is unable to travel a long distance to return to hospitals.
32	A. de Oliveira et al., 2007	Brazil	Prospective study	Digestive system surgery	Patient forms, medical and nursing records, as well as direct surgical incision. PDS. by telephone contact and return visits to the OP clinic.	During hospitalizati-on, and between the 7th and 14th day post-discharge.	90% in Hospital A and 96.9% in Hospital B.	SSI incidence after discharge was 27% in hospital A and 13% in hospital B. Global SSI rate was 38% and 18% in hospitals A and B, respectively. Rates increased 5 and 4 times, respectively.	Both groups had a high prevalence of superficial SSI during and after hospital-ization. Hospital A had a higher SSI rate after discharge surveillance as patient follow-up was done by phone. Phone contact follow-up and SSI surveillance during hospital stay and after discharge are critical to ensuring consistent SSI rates.

REFERENCES

1. The Centers for Disease Control and Prevent (CDC). (2022). Surgical Site Infection Event (SSI). National Healthcare Safety Network. https://www.cdc.gov/nhsn/pdfs/pscmanual/9pscssicurrent.pdf.
2. Ashraf, I., Mohib, Y., Hasan, O., et al. (2018). Surgical site infection surveillance following total knee arthroplasty: Tertiary care hospital experience. Annals of Medicine and Surgery, 31(14-16). DOI: 10.1016/j.amsu.2018.04.006.
3. Guerra, J., Guichon, C., Isnard, M., et al. (2015). Active prospective surveillance study with post-discharge surveillance of surgical site infections in Cambodia. Journal of Infection and Public Health. 8(3):P298-301. DOI: 10.1016/j.jiph.2014.09.007.
4. De Oliveira A. and Carvalho D. (2007). Evaluation of underreported surgical site infection evidenced by post-discharge surveillance. Rev Lat Am Enfermagem. 15(5):992-7. doi: 10.1590/s0104-11692007000500017.
5. Noy, D. and Creedy D. (2002). Postdischarge surveillance of surgical site infections: a multi-method approach to data collection. Am J Infect Control, 30(7):417-24. doi: 10.1067/mic.2002.123393. PMID: 12410219.
6. Nguhuni, B., De Nardo, P., Gentilotti, E. et al. (2017). Reliability and validity of using telephone calls for post-discharge surveillance of surgical site infection following caesarean section at a tertiary hospital in Tanzania. Antimicrob Resist Infect Control 6, Article 43 . DOI: 10.1186/s13756-017-0205-0.
7. Cardoso Del Monte, M. and Neto A. (2010). Postdischarge surveillance following cesarean section: The incidence of surgical site infection and associated factors. American Journal of Infection Control. 38(6) P467-472. DOI: https://doi.org/10.1016/j.ajic.2009.10.008.
8. Halwani, M., Turnbull A, Harris M. (2015). Postdischarge surveillance for infection following cesarean section: A prospective cohort study comparing methodologies. American Journal of Infection Control. 44(4): P455-457. DOI: https://doi.org/10.1016/j.ajic.2015.10.023.
9. Elbur, A., MA, Y., ElSayed, A., et al. (2013). Post-discharge surveillance of wound infections by telephone calls method in a Sudanese Teaching Hospital. Journal of Infection and Public Health. 6(5):P339-346. DOI: 10.1016/j.jiph.2013.04.005.
10. Taylor, E., Duffy, K., Lee, K., et al. (2003). Telephone call contact for post-discharge surveillance of surgical site infections. A pilot, methodological study. The Journal of Hospital Infection. 55(1): P8-13. DOI: https://doi.org/10.1016/S0195-6701(03)00217-2.
11. Whitby, M., McLaws, M., Collopy, B., et al. (2002). Post-discharge surveillance: can patients reliably diagnose surgical wound infections? The Journal of Hospital Infection. 52(3): P155-160. DOI: https://doi.org/10.1053/jhin.2002.1275.
12. Mannien, J., Wille, J., Snoeren, M., et al. (2006). Impact of Postdischarge Surveillance on Surgical Site Infection Rates for Several Surgical Procedures: Results From the Nosocomial Surveillance Network in The Netherlands. Infect Control Hosp Epidemiol. 27:P809-816. https://rivm.openrepository.com/bitstream/handle/10029/6764/mannien.pdf;jsessionid=F5DF983DED693DB35DBA07939BA9576A?sequence=1.
13. Aiken, A., Wanyoro, A. Mwangi, J., et al. (2013). Evaluation of surveillance for surgical site infections in Thika Hospital, Kenya. Journal of Hospital Infection. 83(2):P140-145. DOI: 10.1016/j.jhin.2012.11.003.
14. Reilly, J., Allardice, G., Bruce, J., et al. (2006). Procedure-Specific Surgical Site Infection Rates and Postdischarge Surveillance in Scotland. Infection Control & Hospital Epidemiology, 27(12), 1318-1323. DOI:10.1086/509839.
15. Løwer, HL, Dale, H, Eriksen, H., et al. (2015). Surgical site infections after hip arthroplasty in Norway, 2005-2011: influence of duration and intensity of postdischarge surveillance. Am J Infect Control. (4):323-8. DOI: 10.1016/j.ajic.2014.12.013.
16. Friedman, C., Sturm, L., Chemoweth, C. (2001). Electronic chart review as an aid to postdischarge surgical site surveillance: Increased case finding. American Journal of Infection Control. 29(5) P329-332. DOI: https://doi.org/10.1067/mic.2001.114401.
17. Bluebelle Study Group. (2019). Validation of the Bluebelle Wound Healing Questionnaire for assessment of surgical-site infection in closed primary wounds after hospital discharge. Br J Surg. 106(3):226-235. DOI: 10.1002/bjs.11008.
18. Alfouzan, W., Al Fadhli, M., Abdo, et al. (2019). Surgical site infection following cesarean section in a general hospital in Kuwait: Trends and risk factors. Epidemiology and Infection, 147, E287. DOI: 10.1017/S0950268819001675.
19. Prospero, E., Cavicchi, A., Bacelli, S., et al. (2006). Surveillance for Surgical Site Infection After Hospital Discharge: A Surgical Procedure–Specific Perspective. Infection Control & Hospital Epidemiology, 27(12), 1313-1317. DOI:10.1086/509838.
20. Avato, J., and Lai, K. (2002). Impact of Postdischarge Surveillance on Surgical-Site Infection Rates for Coronary Artery Bypass Procedures. Infection Control & Hospital Epidemiology, 23(7), 364-367. DOI:10.1086/502076.
21. Ward, V., Charlotte, A., Fagan, J., et al. (2010). Enhanced surgical site infection surveillance following caesarean section: experience of a multicentre collaborative post-discharge system. The Journal of Hospital Infection. 70(2): P166-173. DOI:https://doi.org/10.1016/j.jhin.2008.06.002.
22. Gil, P., Esteban, E., Legido, P., et al. (2005). Tasa de infección en cirugía limpia: seguimiento hasta 30 días tras la intervención. Cirugía Española. 77(4) P226-229. DOI: https://doi.org/10.1016/s0009-739x(05)70842-3.
23. Creedy, D. and Noy, D. (2001). Postdischarge Surveillance After Caesarean Section. Wiley Online Library. DOI: 10.1046/j.1523-536x.2001.00264.x.
24. Raouf, M., Ghazal, T., Kassem, M., et al. (2020) Surveillance of surgical-site infections and antimicrobial resistance

patterns in a tertiary hospital in Alexandria, Egypt. J Infect Dev Ctries 14:277-283. DOI: 10.3855/jidc.12124.
25. Alnajjar, M. and Alashker, D. (2020). Surgical site infections following caesarean sections at Emirati teaching hospital: Incidence and implicated factors. Sci Rep 10, 18702. DOI: 10.1038/s41598-020-75582-9.
26. Stockley, J., Allen R., Thomlinson D., et al. (2001). A district general hospital's method of post-operative infection surveillance including post-discharge follow-up, developed over a five-year period. The Journal of Hospital Infection. 49(1) P48-54. DOI:https://doi.org/10.1053/jhin.2001.1029.
27. Tanner, J., Khan, D., Aplin, C., et al. (2009). Post-discharge surveillance to identify colorectal surgical site infection rates and related costs. The Journal of Hospital Infection. 72(3): P243-250. DOI: 10.1016/j.jhin.2009.03.021.
28. Ng W., Brown A., Alexander D., et al. (2015) A multifaceted prevention program to reduce infection after caesarean section: Interventions assessed using an intensive postdischarge surveillance system. American Journal of Infection Control, 43(8): P805-809. DOI:https://doi.org/10.1016/j.ajic.2015.04.001.
29. Whitby, M., McLaws, M., Doidge, S., et al. (2007). Post-discharge surgical site surveillance: does patient education improve reliability of diagnosis? The Journal of Hospital Infection. 66(3): P237-242. DOI: 10.1016/j.jhin.2007.04.014.
30. Vilas-Boas, V., Mingotte, P., Pedreira de Freitas, P. (2015). Post-discharge surveillance by telephone: validation and application of an instrument for video-assisted surgeries. Brazilian Journal of Nursing. 68(5): 617-622. DOI: http://dx.doi.org/10.1590/0034-7167.2015680519i.
31. Pagamisse, A., Tanner J., Poveda, V. (2020). Post-discharge surveillance of surgical site infections in teaching hospitals in Brazil. Rev Esc Enferm USP. 54:e03542. DOI: 10.1590/s1980-220x2018038203542.
32. Balaban, R., Weissman J., Samuel P., et al. (2008). Redefining and redesigning hospital discharge to enhance patient care: a randomized controlled study. J Gen Intern Med. 23(8):P1228-33. DOI: 10.1007/s11606-008-0618-9.
33. Crocker, J., Crocker, JT., Greenwald, J. (2012). Telephone Follow-up as a Primary Care Intervention for Postdischarge Outcomes Improvement: A Systematic Review. The American Journal of Medicine. 125(9):P915-921. DOI: 10.1016/j.amjmed.2012.01.035.
34. Becker, C., Zumbrunn S., Beck K., et al. (2021) Interventions to Improve communication at Hospital Discharge and Rates of Readmission: A Systematic Review and Meta-analysis. JAMA. 2;4(8):e2119346. DOI: 10.1001/jamanetworkopen.2021.19346.
35. Sanger, P., Hartzler, A., Han, S., et al. (2014). Patient Perspectives on Post-Discharge Surgical Site Infections: Towards a Patient-Centered Mobile Health Solution. Plos One. DOI: 10.1371/journal.pone.0114016.
36. Srun, S., Sinath, Y., Seng, AT., et al. (2013) Surveillance of post-caesaren surgical site infections in a hospital with limited resources, Cambodia. J Infect Dev Ctries 7:579-585. DOI: 10.3855/jidc.2981.