

# Post-discharge surveillance methods for infection of the surgical site: integrative review

Métodos para vigilância de infecção do sítio cirúrgico pós-alta: revisão integrativa  
Métodos para control de infecciones del sitio quirúrgico posterior al alta: revisión integradora

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Surgical wound infection; Surveillance; Patient discharge; Infection control; Infection control practitioners

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Infecção da ferida cirúrgica; Vigilância; Alta do paciente; Controle de infecções; Profissionais controladores de infecções

## Descriptores

Infección de la herida quirúrgica; Vigilancia; Alta del paciente; Control de Infecciones; Profesionales para control de infecciones

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## Abstract

**Objective:** To identify post hospital discharge surveillance methods used in infection of the surgical wound.

**Methods:** Integrative review carried out in the PubMed, Cinahl, Lilacs, Embase, and Web of Science databases with studies published until July 2022, using controlled descriptors: Surgical Wound Infection, Surveillance, Patient Discharge, Infections Control, and Infection Control Practitioners. We identified 2,054 relevant records, and from that, we selected 17 studies. We used descriptive analysis and knowledge synthesis in each study.

**Results:** From the 17 selected studies, we found ten in the Pubmed database, three from Cinahl and Embase, and one from Lilacs. All of them published in English and international journals from different locations. Regarding the surveillance methods used to identify infection in the surgical wound post-hospital discharge, nine studies used telephone calls, six used medical records, four used prospective surveillance and outpatient follow-up, and others carried out a clinical evaluation, consultation of the health insurance database, virtual communication, active surveillance program, and smartphone technology. The majority (64.7%) of the selected studies used more than one surveillance method.

**Conclusion:** The main methods identified for infection surveillance of the surgical wound post-discharge were telephone calls, review of medical records, prospective surveillance, and outpatient follow-up, being the combination of methods a commonly used strategy.

## Resumo

**Objetivo:** Identificar os métodos utilizados na vigilância de infecção do sítio cirúrgico pós-alta hospitalar.

**Métodos:** Revisão integrativa, realizada nas bases de dados PubMed, Cinahl, Lilacs, Embase e Web of Science, com estudos publicados até julho de 2022, utilizando os descritores controlados: Infecção da Ferida Cirúrgica, Vigilância, Alta do Paciente, Controle de Infecções e Profissionais Controladores de Infecções. Foram identificados 2.054 títulos relevantes e destes 17 foram selecionados. Utilizou-se análise descritiva e síntese do conhecimento produzido em cada estudo.

**Resultados:** Dos 17 estudos selecionados, dez foram encontrados na base de dados Pubmed, três na Cinahl e Embase e um na Lilacs. Todos foram publicados na língua inglesa e em periódicos internacionais de localidades diversas. Quanto aos métodos de vigilância utilizados para identificar a infecção do sítio cirúrgico após a alta hospitalar nove estudos usaram chamadas telefônicas, seis utilizaram revisão de prontuários, quatro usaram vigilância prospectiva e acompanhamento ambulatorial, e, outros realizaram avaliação clínica, consulta ao banco de dados do seguro de saúde, comunicação virtual, programa de vigilância ativa e tecnologia de smartphone. A maioria (64,7%) dos estudos selecionados utilizaram mais de um método de vigilância.

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Conflicting interests: none.

**Conclusão:** Os principais métodos identificados para a vigilância da infecção do sítio cirúrgico pós-alta foram chamadas telefônicas, revisão de prontuários, vigilância prospectiva e acompanhamento ambulatorial, sendo a combinação dos métodos uma estratégia comumente utilizada.

## Resumen

**Objetivo:** Identificar los métodos utilizados en el control de infecciones del sitio quirúrgico posterior al alta hospitalaria.

**Métodos:** Revisión integradora, realizada en las bases de datos PubMed, Cinahl, Lilacs, Embase y Web of Science, con estudios publicados hasta julio de 2022, utilizando los descriptores controlados: Infección de la Herida Quirúrgica, Control, Alta del Paciente, Control de Infecciones y Profesionales Controladores de Infecciones. Se identificaron 2.054 títulos relevantes, de los cuales se seleccionaron 17. Se utilizó un análisis descriptivo y síntesis del conocimiento producido en cada estudio.

**Resultados:** De los 17 estudios seleccionados, diez fueron encontrados en la base de datos Pubmed, tres en Cinahl y Embase y uno en Lilacs. Todos fueron publicados en idioma inglés y en periódicos internacionales de distintos lugares. Con relación a los métodos de control utilizados para identificar infecciones del sitio quirúrgico después del alta hospitalaria, nueve estudios usaron llamadas telefónicas, seis utilizaron revisión de historias clínicas, cuatro usaron control prospectivo y seguimiento ambulatorio y otros realizaron evaluación clínica, consulta al banco de datos del seguro médico, comunicación virtual, programa de control activo y tecnología de smartphone. La mayoría (64,7 %) de los estudios seleccionados utilizó más de un método de control.

**Conclusión:** Los principales métodos identificados para el control de infecciones del sitio quirúrgico posterior al alta fueron llamadas telefónicas, revisión de historias clínicas, control prospectivo y seguimiento ambulatorio, y la combinación de los métodos fue una estrategia comúnmente utilizada.

## Introduction

Surgical Site Infection (SSI), considered a quality indicator of the health service, is one of the Healthcare-associated infections (HAIs) most common in the post-operative period.<sup>(1)</sup>

This type of infection undertakes about 5 to 20% of patients submitted to an anesthetic-surgical<sup>(2)</sup> procedure and presents a significant impact on morbidity, mortality, and patient safety, once that patients with SSI are twice likely to mortality and five times more likely to hospital readmission when compared to patients without SSI.<sup>(3)</sup>

The post-discharge surveillance, considered an active monitoring tool of SSI, allows the improvement of the quality of service offered, assists in the prevention of physical and emotional damage to the patient, reduces treatment costs, hospital readmission, and, consequently, SSI incidence.<sup>(4)</sup>

The methods for post-discharge surveillance vary, including the review of medical records; patients' admission and readmission registers; laboratory test results; surveillance by mail, e-mail, and telephone, among others.<sup>(4)</sup>

The SSI rate increases with the adoption of post-discharge surveillance strategies once the absence of patient follow-up after the hospital discharge generates sub-notification of the cases and, consequently, the underestimation of the real incidence, the impact, and the SSI relevance.<sup>(5)</sup>

A systematic review carried out to identify the prevalence of SSI in patients submitted to elec-

tive, clean, and contaminated surgeries in Africa, Asia, Latin America, and China identified an SSI prevalence of 6%, which increased to 15% after post-discharge surveillance.<sup>(6)</sup> In Italy, they identified 161 (1.13%) cases of SSI, 66 (41%) during hospitalization, and 95 (59%) after discharge.<sup>(7)</sup> Research carried out in Gana verified an incidence of SSI of 10%, which increased to 49% after patient discharge, showing the viability of post-discharge surveillance.<sup>(8)</sup> In Brazil, a study with patients submitted to cardiac surgeries verified that 52 (18.6%) patients were diagnosed with SSI, and from that number, 20 (38,5%) were after hospital discharge.<sup>(9)</sup>

Thus, post-discharge surveillance has become a necessary strategy considering that 12 to 84% of SSI are diagnosed after discharge<sup>(10)</sup> and that these infections are considered a public health issue of great magnitude, with alarming rates for health services. However, for its implementation, it is necessary that the perioperative team has the knowledge and apprehend safe and effective surveillance methods. Therefore, the objective of this study was to identify the methods used in the surveillance of Surgical Wound Infection post-hospital discharge.

## Methods

We carried out an integrative review of the literature in the following steps: development of the research

question; search for studies; data extraction; evaluation of included studies in the sample; analysis and synthesis of the results and presentation of the review.<sup>11)</sup> We highlight that we followed the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA).<sup>(12)</sup>

The developed research question was: what are the post hospital discharge surveillance methods used to identify Surgical Wound Infection?

We searched for primary studies in the US National Library of Medicine National Institutes of Health (PubMed), Cumulative Index to Nursing and Allied Health Literature (CINAHL), Latin American and Caribbean Health Sciences Literature (LILACS), Excerpta Medica (EMBASE), and Web of Science database. The descriptors used in the search were: Surgical Wound Infection, Surveillance, Patient Discharge, Infections Control, and Infection Control Practitioners. We combined descriptors with their synonyms using boolean operators OR and AND, amplifying then the search for the studies.

Two nurses with PhD, independently carried out the searched. Studies that would describe methods used in the post hospital discharge surveillance of Surgical Wound Infections, published until July

2022, in Portuguese, Spanish, and English were used as inclusion criteria for the primary studies in the integrative review, while the exclusion criteria were editorial, response letter, narrative/traditional literature review studies, thesis, dissertation, and review methods.

Data extraction of the included studies followed this: author, title, country, year, language, type of study, sample, and surveillance methods. We analyzed and synthesized the results descriptively.

## Results

We identified 2,054 relevant records, 1,197 from Embase, 391 from PubMed, 206 from Cinahl, 159 from Lilacs, and 98 from Web of Science. After removing duplicate titles and excluding studies that did not meet the exclusion criteria by the reading of title and abstracts, 23 articles remained, which we read the full texts, we excluded six studies after full-text reading. Finally, we selected 17 studies to compose the sample of the review (Figure 1).

From the 17 selected studies of this integrative review, we found ten (58.8%) in the Pubmed database, three (17.7%) in CINAHL and Embase,

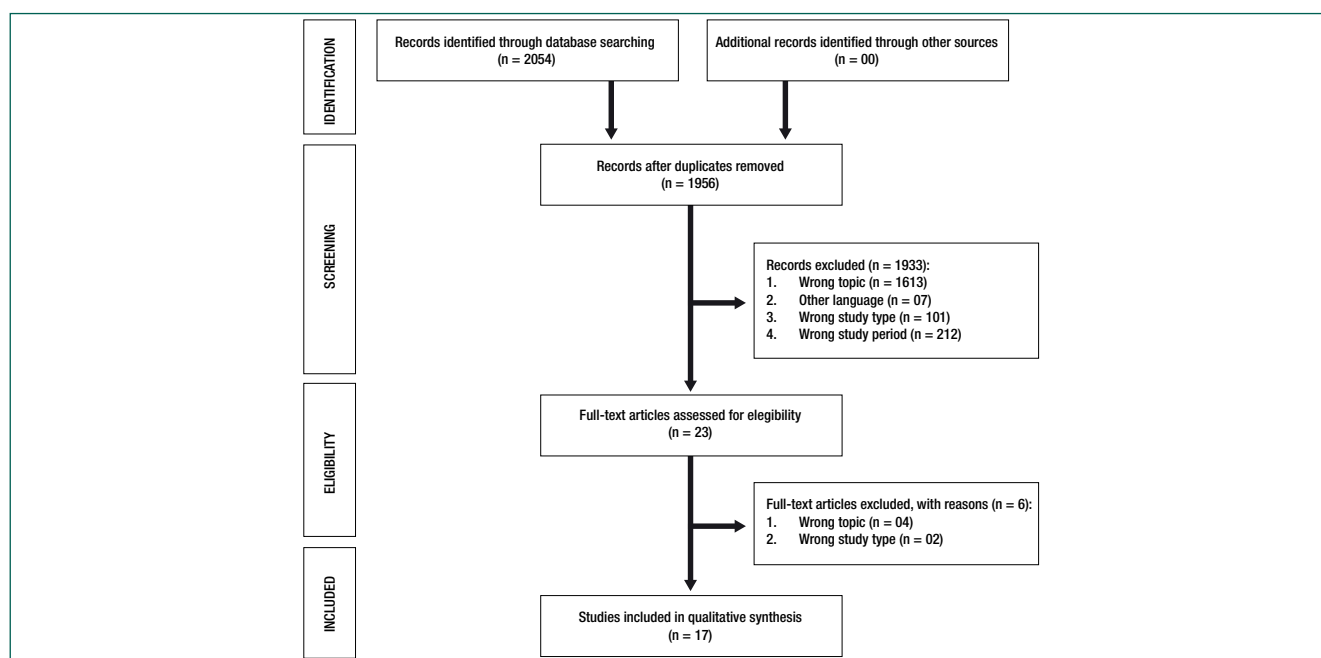


Figure 1. Flowchart of the selection process of the studies

and one (5.8%) in Lilacs. All the studies were published in English, and regarding the journals, all of them are international and from different locations. Regarding the post hospital discharge surveillance methods used to identify SSI, all studies described that the methods were efficient. Nine studies used telephone calls, six used medical records review, four studies used prospective surveillance (patient monitoring) and outpatient follow-up, one used clinical evaluation, one con-

sultation of the health insurance database, one used virtual communication with pictures of the surgical incision and/or video conference, one used an active surveillance program, and other used smartphone's technology to monitor the surgical incision through digital images. We highlight that eleven (64.7%) of the seventeen selected studies utilized more than one surveillance method. We present the characterization of the selected articles in Chart 1.

**Chart 1.** Characterization of the selected articles (authors/title, country/year/language, objective, type of study/sample, surveillance methods)

Authors/Title	Country/Year/ Language	Study design/Sample	Objective	Surveillance Methods
Pagamisse et al. <sup>(4)</sup> Post-discharge surveillance of surgical site infections in teaching hospitals in Brazil	Brazil 2020 English	Cross sectional study 193 Brazilian teaching hospitals	To understand the reality of post-discharge surveillance surgical site infections in Brazilian teaching hospitals, and to identify PDS methods used and the professionals responsible for surveying and evaluating information on PDS.	Telephone calls outpatient return
Sandy-Hodgetts et al. <sup>(13)</sup> A non-randomised pragmatic trial for the early detection and prevention of surgical wound complications using an advanced hydropolymer wound dressing and smartphone technology: the EDISON trial protocol	Australia 2022 English	Clinical trial non-randomized 200 post-surgical patients	To investigate the utility of a fully transparent dressing that may potentially ease the early identification and the prevention of a surgical wound complication after hip or knee arthroplasty.	Smartphone technology Telephone calls
Bataille et al. <sup>(14)</sup> Benefits of a 14-year surgical site infections active surveillance programme in a French teaching hospital	France 2021 English	Prospective study 181.746 surgical procedures	To describe the evolution in trends over 14 years of prospective active SSI surveillance and implementations of SSI prevention measures in a French Teaching Hospital.	Active surveillance programme
Shah et al. <sup>(15)</sup> Reducing ER Visits and Readmissions after Head and Neck Surgery Through a Phone-based Quality Improvement Program	United States of America 2021 English	Single arm trial 91 post-surgical patients	Evaluate the impact of a patient phone calls and virtual wound checks within 72 hours of discharge on reducing emergency room (ER) visits and readmissions.	Phone calls Virtual Communication
Abu-Sheasha et al. <sup>(16)</sup> Cost-effectiveness analysis of three methods of surgical-site infection surveillance: Less is more	Egypt 2020 English	Cohort study 351 surgical patients	To compare the cost-effectiveness of 3 methods of SSI surveillance: Inpatient, phone, and outpatient clinic (OPC); to ensure that the risk of SSI is independent from loss-to-follow-up in phone and OPC surveillances, and to determine the reliability of phone surveillance.	Outpatient clinic Phone calls
Manivannan et al. <sup>(17)</sup> Surveillance, auditing, and feedback can reduce surgical site infection dramatically: toward zero surgical site infection	India 2018 English	prospective cohort study 24.677 post-surgical patients	To evaluate the Surveillance of Surgical Site Infection (SSI), Auditing, and Feedback (SAF) effect on the rate of compliance with an SSI care bundle and measured its effectiveness in reducing the SSI rate.	Auditing, Feedback, Prospective surveillance
Forrester et al. <sup>(18)</sup> Development of a Surgical Infection Surveillance Program at a Tertiary Hospital in Ethiopia: Lessons Learned from Two Surveillance Strategies	Ethiopia 2018 English	Quasi-Experimental Design 86 post-surgical patients	To develop a prevention program of SSI as a strategy of peri-operative infection prevention based on the standards of the surgical safety checklist from WHO.	Long-term patient monitoring (prospective surveillance) Review of medical records
Morris et al. <sup>(19)</sup> Reduction in surgical site infections in the Southern Cross Hospitals network, 2004-2015: successful outcome of a long-term surveillance and quality improvement project	New Zealand 2018 English	Non-Experimental Design 42.792 post-surgical patients	To report on the reduction in the surgical site infection (SSI) rate in the Southern Cross Hospitals network after active surveillance and quality improvement actions.	Long-term patient monitoring (prospective surveillance)
Ashraf et al. <sup>(20)</sup> Surgical site infection surveillance following total knee arthroplasty: Tertiary care hospital experience	Holand 2018 English	Non-Experimental Design 164 post-surgical patients	To review Surgical Site Infection (SSI) rates in patients undergoing primary total knee replacement surgery.	Review of medical records Long-term patient monitoring (prospective surveillance)
Cho et al. <sup>(21)</sup> Validation of semiautomated surgical site infection surveillance using electronic screening algorithms in 38 surgery categories	United Kingdom 2018 English	Prospective cohort study 40.516 surgical procedures	To verify the validity of a semiautomated surgical site infection (SSI) surveillance system using electronic screening algorithms in 38 categories of surgery.	Review of electronic medical records
Benenson et al. <sup>(22)</sup> A practical tool for surveillance of surgical-site infections: a 5-year experience in orthopedic surgeries	United Kingdom Ingles English	Non-Experimental Design 3.378 post-surgical patients	To present a 5 year experience on SSI surveillance using semiautomatic surveillance system (direct and indirect surveillance).	Review of electronic medical records Telephone calls

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Authors/Title	Country/Year/ Language	Study design/Sample	Objective	Surveillance Methods
Guerra et al. <sup>(23)</sup> Postdischarge surveillance of surgical site infections using telephone calls and a follow-up card in a resource-limited setting	Cambodia English 2017	Non-Experimental Design 161 post-surgical patients	To evaluate post discharge surveillance in Cambodia using a follow-up card and telephone calls.	Telephone Calls Follow-up Outpatient Card
Nguhuni et al. <sup>(24)</sup> Reliability and validity of using telephone calls for post-discharge surveillance of surgical site infection following caesarean section at a tertiary hospital in Tanzania	Tanzania English 2017	Observational Cohort Study 374 women undergoing cesarean section	To examine the sensitivity and specificity of the use of telephone calls for detecting post-discharge SSI in comparison with the gold standard clinical review.	Telephone Calls Clinical evaluation
Calderwood et al. <sup>(25)</sup> Variable case detection and many unreported cases of surgical-site infection following colon surgery and abdominal hysterectomy in a statewide validation	California English 2017	Non-Experimental Design 561 patients undergoing colon surgery	To assess hospital SSI identification following colon surgery and abdominal hysterectomy via a statewide external validation.	Review of patient records
Le Meur et al. <sup>(26)</sup> Health insurance database for post-discharge surveillance of surgical site infection following arthroplasty	France 2016 English	Retrospective cohort analysis 1739 post-surgical patients	To trace hip or knee arthroplasty infection through the hospital discharge database and the National Health Insurance Cross-Schemes Information System.	Review of the Health Insurance Information System Database
Halwani et al. <sup>(27)</sup> Postdischarge surveillance for infection following caesarean section: A prospective cohort study comparing methodologies	Saudi Arabia 2015 English	Prospective cohort study 193 women undergoing cesarean section	To determine the sensibility and specificity of the current surveillance methodology to SSI post-cesarean in the Johns Hopkins Hospital, and to assess the viability of an enhanced surveillance using telephone follow-up.	Telephone Calls
Guerra et al. <sup>(28)</sup> Active prospective surveillance study with post-discharge surveillance of surgical site infections in Cambodia	Cambodia English 2015	Prospective Study 167 post-surgical patients	To estimate the SSI incidence rate in a Cambodian hospital, and to compare different modalities of SSI surveillance.	Review of Medical Charts Follow-up Card Telephone Calls

## Discussion

The findings of this study indicate that the preferential post-discharge surveillance methods for SSI were: telephone calls, review of the medical records, prospective surveillance, and outpatient follow-up.

In some analyzed studies,<sup>(4,13,15-18,20,22-24,28)</sup> we evidence that the methods for surveillance of SSI were combined among each other we highlight that this combination is acceptable, however, the diagnostic criteria from the Centers for Disease Control and Prevention (CDC) for the definition of SSI must be adopted.<sup>(29)</sup>

We recommend that the surveillance of SSI be carried out retrospectively or prospectively by the Hospital Infection Control Service (SCIH); in the patient's medical record or based on laboratory results or in clues contained in the antimicrobial prescription; however, the surveillance method adopted must be according to the institutional reality, once that it may present limitations and impact the interpretation of the rate and indicators, care quality and costs increase.<sup>(29,30)</sup>

In Brazilian teaching hospitals, surveillance by telephone is the main method used, being the nurses as the main professionals involved with the surveillance actions of SSIs.<sup>(4)</sup> A study that evaluated

the relation cost-benefit of three distinct methods of surveillance of SSI evidenced that surveillance by telephone is an economic, efficient, and reliable method with high sensitivity and specificity for SSI detection post-discharge.<sup>(16)</sup>

Telephone calls are positive strategies in patient follow-up, immediate post-operative, in the significant decrease of visits of the first-aid post, and better patient satisfaction, which contributes to decreasing the pressure on the health system and improving the care quality to the patient.<sup>(15)</sup>

One of the selected studies of this review evidenced that the review of medical records to identify SSI during the hospitalization was not efficient, however, the use of a follow-up card with calls to the surveillance post-discharge was effective, reaching a general contact rate of 87%.<sup>(23)</sup>

A comparison involving the use of two surveillance methods of SSI - direct monitoring of the hospitalized patient and review of medical records post-discharge - demonstrated that the review of medical records in an isolated way does not reflect precision postoperative complications due to inconsistency of registration.<sup>(18)</sup>

Although limitations attributed to surveillance through medical records, other authors observed that the impact of surveillance by the review of the

medical records represented an increase of more than 38.4% of SSI in cardiac surgeries, compared to those carried out by clues laboratory test results, positive cultures, antimicrobials prescription or direct contact with professionals).<sup>(9)</sup>

An active surveillance program, based on patient data of the surgical procedure and data from the microbiology laboratory with continuous monitoring by infection control professionals associated with the implementation of measures for the prevention of SSI was efficient to decrease the SSI rates throughout fourteen years of surveillance, demonstrating that the surveillance of SSI is fundamental to assess the impact of the implementation of preventive measures in health institutions.<sup>(14)</sup>

The patient follow-up in the postoperative period through the outpatient return has been demonstrated to be an efficient strategy, with a good return index because a health professional carried out the evaluation of the surgical site, and the data collected are more consistent.<sup>(31,32)</sup> However, outpatient follow-up tends to be a costlier method for health services.<sup>(16)</sup>

SSI rates may vary from 1% to 5% in the following month of surgery, thus, we recommend that post-discharge surveillance be carried out until 90 days, depending on the surgical procedure, through contact with the patient by a phone call or outpatient follow-up, aiming to early identify the SSI.<sup>(29,30,33)</sup> A study in six Iranian hospitals evidenced that 76.24% of SSIs occurred after discharge, among which 45.54% within 31 days after the orthopedic surgical procedure, and 17.82% of SSIs were detected within 90 days to a year after the surgery.<sup>(34)</sup> Another study evidenced that all the cases of SSI were diagnosed in the post-discharge surveillance, mainly in the outpatient return, within the 8<sup>o</sup> and 11<sup>o</sup> postoperative days.<sup>(35)</sup>

Considering the fragility of conventional methods for infection surveillance, emerge the use of telehealth, defined as “the use of telecommunications and information technology to provide access to the assessment of health, diagnosis, intervention, consultation, supervision, and information from a distance.”<sup>(36)</sup> It consists of an im-

portant element of health systems to extend the outreach or impact of infection control professionals, and yet is a resource capable of increasing patient accessibility through health professionals' virtual visitations. In this scenario, we highlight the virtual prevention and control of infections, which, although incipient, is becoming viable and applicable in configurations with limited resources strategy because it allows fast communication and is geographically remote, besides it can be integrated into telehealth.<sup>(37)</sup>

The accessibility and simplicity of using a smartphone demonstrate its utility associated with patient care in postoperative and its potential to decrease hospital readmissions, especially those infections that may be managed in the environment of home care.<sup>(13,15)</sup>

In this scenario, another method that demonstrates promising results for infection surveillance in comparison with the conventional methods is the utilization of semi-automated methods, which gives high-quality results, providing increased reliability, efficiency, and standardization of surveillance practices, besides decreasing the workload associated with infection control professionals.<sup>(14,18,21)</sup>

The SSI epidemiological surveillance contributes to the opportune detection of infection, it helps the prevention of lost causes, and underestimation of records, besides being an important measure for the prevention of infections.<sup>(34,38)</sup>

Finally, we add that an efficient surveillance program for SSI is associated with a significant decrease in SSI incidence.<sup>(14)</sup>

As a limitation, we evidenced during the search in the database a high quantity of articles, however, with divergent themes regarding the research study question. That might be related to the inexistence of the controlled descriptor “surveillance method” and to the increasing number of publications relating to the infection of COVID-19 that significantly increased the number of publications in the database.

It is important to highlight that none of the investigations of the sample of the present study evaluated the surveillance in the outpatient return in an isolated way, considered by some authors as an efficient method.

## Conclusion

The preferential methods for post-discharge surveillance for SSIs identified in this integrative review comprehend telephone calls, review of medical records, prospective surveillance, and outpatient follow-up, being the combination of methods a commonly used strategy. The findings of this study allow the gathering of scientific evidence to guide hospital infection control service teams regarding the methods used for post-discharge surveillance aligned to the institutional reality. Therefore, health institutions must apprehend safe and secure surveillance methods to monitor infection rates, assist in the early detection of SSIs, and, consequently, prevent the occurrence of SSIs.

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