

The commitment of the GISIO-SItI to contrast Healthcare-Associated Infections and the experience of prevalence studies in Sicily

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Key words: Surveillance, Intensive Care Unit, Surgical Site Infections, Prevention

Parole chiave: Sorveglianza, Unità di Terapia Intensiva, Infezioni del Sito Chirurgico, Prevenzione

Abstract

Surveillance of Healthcare-Associated Infections (HAIs) is essential to improve the quality of health services. The aim of this paper is to report the commitment of the Italian Study Group of Hospital Hygiene (GISIO) of the Italian Society of Hygiene, Preventive Medicine and Public Health (SItI) describing some experiences to contrast HAIs and antimicrobial resistance. Particularly, the commitment to contrast HAIs in intensive care with the SPIN-UTI project - Italian Nosocomial Infections Surveillance in ICUs, and in surgery with the ISCHIA project - Infections of Surgical Site in Arthroplasty Interventions - were described. Furthermore, some activities conducted in Sicily using repeated prevalence studies were reported.

The experiences reported confirmed that surveillance is essential to provide health services with information, guidance and tools to manage effectively the risk of HAI and antimicrobial resistance and to monitor the level of achievement of control programmes.

Introduction

Surveillance of Healthcare-Associated Infections (HAIs) is essential to improve the quality of health services. Surveillance is important to provide health services with information, guidance and tools to manage effectively the risk of HAI and antimicrobial resistance and to monitor the level of achievement of control programmes (1).

The aim of this paper is to report the commitment of the Italian Study Group of Hospital Hygiene (GISIO) of the Italian Society of Hygiene, Preventive Medicine and Public Health (SItI) describing some experiences to contrast HAIs and antimicrobial resistance. Furthermore, some activities conducted in Sicily on this topic were briefly reported.

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The commitment of the GISIO-SItI to contrast Healthcare-Associated Infections in intensive care

Surveillance of HAIs is an important component of health quality especially in Intensive Care Units (ICUs) where patients are at high risk of morbidity and mortality associated with HAI. ICUs are often the epicentre of emerging problems of HAI and antimicrobial resistance (AMR) in the hospital (2).

In Italy, in 2005, the GISIO-SItI established the SPIN-UTI “Sorveglianza Prospettica delle Infezioni Nosocomiali nelle Unità di Terapia Intensiva” - Italian Nosocomial Infections Surveillance in ICUs – project to build a surveillance network of Italian ICUs. The main aim is to share standardised definitions, data collection using a web-based information system, and reporting procedures for the surveillance of HAIs in ICUs. The patient-based protocol is based on the Hospital in Europe Link for Infection Control through Surveillance (HELICS)-ICU protocol (3), subsequently updated with the European Centre for Disease prevention and Control (ECDC) HAI-Net protocol (2) in order to participate in the European benchmark (4). In fact, from 2007, SPIN-UTI surveillance data have been included in the ECDC’s Annual Epidemiological Reports (5). The SPIN-UTI network has been included in the HELICS-ICU network and as a partner of the IPSE (Improving Patient Safety in Europe) project, of the BURDEN (Burden of Disease and Resistance in European Nations) project, work package 6 “Impact of AMR and appropriate antimicrobial treatment in ICU-acquired infections”, and of the IMPLEMENT (Implementing Strategic Bundles for Infection Prevention and Management) project. Furthermore, the Italian network SPIN-UTI has been acknowledged by the Italian CCM (Centro per il Controllo delle Malattie, Italian Ministry of Health) to contribute to the

development of a national database, the SITIN project (6).

The first edition of the SPIN-UTI project was implemented from October 2006 to March 2007 (4) and the sixth was concluded in June 2017. A validation study was performed, during the first edition of the project in the years 2006 and 2007, to validate infection data and to determine the sensitivity, specificity, and positive and negative predictive values of HAI data reported on patients in the ICUs participating in the SPIN-UTI network against the validated HAI data. Results highlighted a good quality of surveillance in terms of sensitivity, specificity and predictive values, thus providing evidence that the SPIN-UTI surveillance data are consistent, robust and precise enough to be used as a benchmark for inter-hospital and for European comparisons (7).

During the six editions of the project a total of 16 566 patients were enrolled for a total of 177 696 patient-days. Hospital participation was voluntary and results were handled confidentially. A total of 92 ICUs provided surveillance data. Over the 12 years of surveillance, SPIN-UTI participants have used standardized definitions and protocols thus providing national benchmark infection rates for intra- and inter-hospital comparisons. In fact, routinely collecting standardized data are used not only to track internal performance indicators but also to compare local data to national and European benchmarks. Surveillance identifies trends of indicators and provides data upon which prevention strategies can be based in order to improve patient safety (4, 8). Particularly, results of the SPIN-UTI network report that in all surveys the most frequently detected infection type was pneumonia and that the majority of pneumonia episodes were Intubator Associated Pneumonia (IAP). The implementation in clinical practice of care bundles for prevention of ventilator-associated pneumonia, as that developed by a pan-European committee (9), has been

widely encouraged in intubated ICU-patients and is associated with a reduced risk of pneumonia (10). Thus, to take into account this important issue, in the framework of the SPIN-UTI project, in order to document reported IAP prevention practices in participating ICUs and attitudes towards the implementation of a measurement system, together with compliance with IAP prevention practices, a specific survey was conducted. A large potential for improvement in clinical and non-clinical practices for the prevention of IAP was documented and a low overall compliance to all five practices of the European bundle was reported (11). Notably, a significant negative trend of IAP incidences was observed with increasing number of bundle components performed and a strong negative correlation between these two factors was shown (12).

A European study, conducted on a large database from European surveillance networks including those from the SPIN-UTI network, estimated that 52% of ventilator-associated pneumonia is preventable (13). Using an analogous approach, based on the parametric g-formula that allows for case mix adjustment, on SPIN-UTI data it has been estimated that a proportion of 44% of IAP is preventable. Furthermore, in a second analysis, considering compliance with the European bundle, a preventable proportion of 40% of IAP was shown, highlighting the important role of good clinical practices among the other factors that can be targeted by appropriate interventions of infection control (12).

In 2013, the European Commission requested ECDC to collect additional data on structure and process indicators for HAIs as well as data on mortality from HAIs, thus, the new version of the HAI-Net ICU protocol describes the methods for the surveillance of HAI and prevention indicators in ICUs (14) and the SPIN-UTI protocols of the sixth edition (2016–2017) was updated including indicators related to: hand hygiene (alcohol hand rub

consumption), ICU staffing, antimicrobial stewardship, prevention of intubation-associated pneumonia and of central line associated bloodstream infection.

Antimicrobial resistance (AMR) is a global public health threat, especially in ICU, and HAIs caused by resistant bacteria have been associated with higher mortality, a longer hospital length of stay and increased cost. Surveillance of multidrug-resistant (MDR) microorganisms is an important component of an effective strategy against this problem together with the surveillance of antibiotic consumption. One of the objective of the SPIN-UTI project was to evaluate trends and association between antibiotic consumption and resistance in the ICUs participating in the first four editions of network, during an eight-year period from 2006 to 2013 (15). Resistance rates of carbapenem-resistant *Acinetobacter baumannii*, of carbapenem-resistant *Klebsiella pneumoniae*, of third-generation cephalosporin (3GC)-resistant *K. pneumoniae* and of 3GC-resistant *Escherichia coli* showed significant increasing trends. The consumption of each antibiotic class varied with years, although not significantly. The study highlights the need for continuous comprehensive strategies targeting not only the prudent use of antibiotics, but also infection control measures to limit the epidemic spread of resistant isolates. In fact, antibiotic consumption contributes in part to the prevalence of resistant pathogens in the hospital setting together with their clonal spread that have been reported and outbreaks due to multidrug-resistant pathogens are frequently reported in ICUs participating in the SPIN-UTI network (16–18). Considering SPIN-UTI data, the impact of HAI and of AMR on mortality and length of ICU stay, focusing on multidrug-resistant (MDR) *A. baumannii* and *K. pneumoniae* HAIs, the most frequently reported microorganisms, was investigated. The study confirmed that HAIs are associated with higher mortality and a longer length of ICU-stay especially those

due to MDR microorganisms, highlighting the need for effective preventive efforts to reduce the impact of HAIs and improve the quality of care (19, 20)

The commitment of the GISIO-SItI to contrast Healthcare-Associated Infections in surgery

Surgical Site Infections (SSIs) still represent a significant burden in terms of patient morbidity and mortality and additional costs (21). Among all the HAIs they are those with the greatest economic impact (22, 23); however, a significant proportion of SSIs is preventable by effective surveillance and control programmes (21, 23).

Reporting the commitment of GISIO-SItI to contrast SSI means retracing the history of GISIO, whose origins date back to 1991, when several young experts gathered around Mario Pitzurra, Professor of Hygiene at the University of Perugia, unforgettable pioneer in the fight against HAIs, to study the problems of operating theatres, calling themselves Italian Study Group on Operating Theatres (Gruppo Italiano Studio Sale Operatorie, GISSO) (24). In the absence of specific regulations, they set out to study, with a common approach, the problems linked to the hygienic-sanitary management of operating theatres. The first publication by the Group “Multicentre study on environmental pollution in the operating theatres” reports the proposal of a study aimed to construct a picture of the situation in Italian operating theatres, identify deficiencies in design, construction and management as a knowledgeable base for implementing targeted preventive interventions (25). The study protocol included the collection of data related to the structural and plant characteristics of the operating theatre, methods of cleaning, disinfection and sterilization, hygiene of the staff and hygiene of the patients, in addition to the measurement of anaesthetic gas concentration in the air, air microbial

contamination, microclimatic parameters and noise levels.

Several aspects of the study were deepened within a project funded by the Italian Ministry of Labor and Social Security, the results of which were presented in a specific report (26).

The situation regarding the management of the HVAC (Heating Ventilation Air-Conditioning) systems was particularly worrying (27); in several operating theatres, microbial contamination values recorded at the HVAC diffusers were far higher than those recommended by British guidelines in operating theatres during surgical activity (27, 28).

The theme of the ventilation and microbial contamination of the air in the operating theatres, together with the perioperative antibiotic prophylaxis (PAP) and the surveillance of SSI represented the main areas of activity of the GISIO in the prevention of SSI (29-32) and they were the object of two projects funded by the Centro per il Controllo delle Malattie (CCM), Italian Ministry of Health, in the 2009 and 2012 programmes (33-37). The purpose of the first project “Proposal of an integrated approach for the prevention of SSI in joint prostheses: project on prospective active surveillance of infections, lines of prevention and analysis of costs and benefits”, ISCHIA I project (Infections of Surgical Site in Arthroplasty Interventions), was to evaluate the compliance with the recommendations on PAP procedures and the air microbial contamination during total hip and knee replacements, and measure the association of these two factors with the incidence of the SSIs. In particular, the project aimed at contributing to the debate on the use of unidirectional airflow system in arthroplasty operations, which started following a German study that surprisingly highlighted a significantly higher risk of acquiring a SSIs in hip arthroplasty performed in operating theatres supplied with unidirectional airflow, compared to conventional operating theatres

(38). In this study the data concerning the air microbiological contamination were not considered, assuming that the installed ventilation technique was well functioning, as it was subjected to regular checks by the health authorities. Actually, the quality of the air in the operating theatre depends not only on the correct management of the ventilation system, but also on the behaviour of the surgical team, which if not correct can inhibit the effectiveness of the ventilation system. The ISCHIA I study, in which 1285 hip and knee arthroplasty operations were monitored, showed values of bacterial air contamination higher than those recommended (39) in more than half of the unidirectional and mixed airflow operating theatres, registering up to 100 openings of doors in unidirectional airflow operating theatres, challenging the belief that unidirectional airflow system always provide acceptable airborne bacterial counts (34, 37). In operations performed in unidirectional operating theatres with air microbial contamination values as low as recommended, there was a lower incidence of SSIs than that recorded in operations carried out in conventional operating theatres, but the difference was not statistically significant (34, 37).

The debate at an international level is still open and it is hoped that a well-designed clinical trial with a large number of interventions might be conducted (23).

Within the second project funded by the Ministry of Health "*Risk analysis for the control of healthcare-associated infections in the operative units of intensive care and surgery and for the evaluation of the effectiveness of preventive strategies in clinical practice*", the evaluation of the compliance with perioperative antibiotic prophylaxis procedures and the epidemiological surveillance of the SSIs, as well as in hip and knee arthroplasty procedures (ISChIA II), were also carried out in five other surgical procedures (colon surgery, breast surgery, cholecystectomy,

caesarean section, coronary artery bypass). For the hospitals participating in both editions of the ISChIA project, a significant increase in the compliance with the guidelines on antibiotic prophylaxis was shown (36). This demonstrated the effectiveness of the training interventions implemented between the two projects, which mainly consisted of discussion of the local reports (40), the distribution of the 2013 ECDC document "*Systematic review and evidence-based guidance on perioperative antibiotic prophylaxis*" (41), the organization of a national event on the prevention of the SSI in arthroplasty operations (Convegno GISIO-SItI, Infezioni del sito chirurgico negli interventi di artroprotesi: attualità e prospettive. Rome, 2-3 February 2012), the production of a training video (42). The evidence of a significant increase of the compliance with the recommendations following training activities was a further confirmation of what emerged in a review, edited by the GISIO which shows a general low compliance with the recommendations, but also the significant improvement after training activities (43). This review updated the ECDC systematic review in which a member of the GISIO also participated as an expert (41).

The monitoring data of the ISCs of the two projects, collected by using the ECDC protocol, were included in the surveillance reports of the SSI in Italy (44) and in the ECDC reports (45, 46).

Currently the GISIO is engaged, in collaboration with the ANMDO (National Association of Hospital Medical Directors), in the "*Choosing wisely-Hospital Hygiene*" project, in surveillance and training activities to avoid inappropriate procedures which increase healthcare costs and can be harmful (47). Among the five practices identified, three are related to surgical activity, in particular the time and duration of administration of the antibiotic, and the openings of the doors in the operating theatres (48, 49). The

pilot study has already been carried out and nationwide surveys are underway (50, 51).

The experience of prevalence studies in Sicily

The surveillance of HAIs has been widely recognized as a primary step toward patient safety. Although, continuous incidence surveillance represents the gold standard for infection control, it is extremely time-consuming, very resource demanding and costly. On the contrary, prevalence surveys can be performed more rapidly on a large scale and are less expensive. Hospital-wide prevalence surveys have been acknowledged as efficient approaches to estimate and monitor the HAI burden (52). Particularly, repeated prevalence surveys have been indicated as useful for documenting trends in HAIs (53) and the effect of the implementation of multimodal infection control programmes (54).

In 2011–2012, ECDC coordinated the first European Point Prevalence Survey (PPS) of HAIs and antimicrobial use in hospitals in order to estimate the total burden of HAIs and antimicrobial use in European hospitals. Furthermore, Member States agreed that PPSs should subsequently be conducted at least once every five years (55).

Therefore, during the period September–October 2011, a PPS, in accordance with the ECDC protocol (56), was performed in a sample of Italian Hospitals including 5 Sicilian hospitals (57). In the Sicilian region the survey was repeated in 2012 and a total of 29 hospitals were included.

The introduction of the ECDC standardized protocol guarantees consistency of results and repeatability. Furthermore, results obtained at hospital level may also be used for intra-hospital comparison or benchmarking at regional, national or European level. Particularly, in Sicily, in 2011, the prevalence of HAIs was 3.2 per 100 patients and in Italy of 6.3 per 100 patients. The ECDC's 2011-12 report (55)

estimates a prevalence of patients with at least one HAI of 6.0 per 100 patients (country range 2.3%-10.8%) in European acute-care hospitals. The difference in the reported prevalence values is due in part to the different number and characteristics of the hospitals included.

As previously reported, local studies on the prevalence of HAIs can be used to tailor national or international guidelines for the prevention of infections according to local needs, and can maintain and/or increase awareness of the impact of infection on patients' outcomes (58). In order to implement a multimodal intervention aimed to prevent catheter-related bloodstream infections, in 2016, the Sicilian Region has approved the "Regional Programme for the prevention of catheter-related bloodstream infections - Targeting Zero" (D.A. N. 1004, 01/06/2016). The programme includes different components: i) surveillance of HAIs; ii) implementation of an evidence-based care bundle for the insertion, maintenance and removal of intravascular access devices (central and peripheral venous catheters); iii) monitoring of the bundle implementation, audit and feedback and continuing professional education.

Accordingly, to obtain an overview for the planning and monitoring of further infection control activities, from July to November 2016, a regional PPS of HAIs and antimicrobial use in Sicilian hospitals was conducted using the updated ECDC protocol (59). The objectives of the surveillance were, in accordance to the European protocol: i) to estimate the prevalence of HAI and antimicrobial use in acute care hospitals in the Sicilian region; ii) to describe patients, invasive procedures, infections and prescribed antimicrobials; iii) to disseminate results to those who need to know at local and regional level; iv) to identify common problems and set up priorities accordingly; v) to evaluate the

effect of strategies and guide policies for future action (through repeated PPSs); and vi) to provide a standardised tool for hospitals to identify targets for quality improvement. Furthermore, PPS also provided data on infection control structure and process indicators at the hospital level in terms of alcohol-based hand rub consumption, the percentage of single-room beds and full-time equivalents of specialised infection prevention and control staff.

Therefore, all Sicilian hospitals were invited to participate and to perform surveillance. A web-based system was designed to collect data using electronic data forms. Thus, after surveillance staff had entered surveillance data and completed online forms, each case was sent to a central web server, where it was automatically routed to the appropriate centralized database and thus became available for immediate data cleaning and data analysis. A detailed report was produced and disseminated to those who need to know at local and regional level in order to track internal performance, to identify problems and set up priorities and to compare local data to regional benchmarks.

Even if the survey needed a high workload for the infection prevention and control professionals of the participating hospitals, a large number of hospitals, 85, agreed to voluntarily participate in the regional prevalence study. Altogether 6448 patients were surveilled. The prevalence of patients with at least one HAI was of 5.1 per 100 patients (*range*: 0-28.6). The most common HAIs were respiratory tract infections followed by urinary tract infections and surgical site infections. The majority of patients included in this study were hospitalized in large hospitals. The prevalence of antimicrobial use of 50.5% higher than the prevalence found in the ECDC PPS (35.0%) (55). The most commonly isolated microorganism was *Klebsiella pneumoniae*, followed by

Acinetobacter baumannii and *Pseudomonas aeruginosa*, confirming results previously obtained in a retrospective study from Messina, Sicily (60).

In 2016, the ECDC once again advised all European countries to invite a representative sample of hospitals to participate in the European survey and thus, 4 representative Sicilian hospitals were selected and included in the national and European survey.

Participating in the prevalence survey provides hospitals with an opportunity to enhance their internal quality management with indicators and benchmark values, possibly motivating further preventive interventions. The survey was repeated in the Sicilian region at the end of 2017. The yearly repetition of the PPS will be a useful means of keeping interest alive on HAI and antimicrobial use and to highlight how changes in healthcare practices affect outcome variables to improve quality of care.

Acknowledgements

The Authors wish to thank all colleagues from the GISIO-SItI for their close co-operation during surveillance studies, and all physicians and nurses in the participating hospitals for providing surveillance data.

Riassunto

Il contributo del GISIO-SItI nella lotta alle Infezioni Correlate all'Assistenza e l'esperienza degli studi di prevalenza in Sicilia

La sorveglianza delle Infezioni Correlate all'Assistenza (ICA) è essenziale per migliorare la qualità dei servizi sanitari. L'obiettivo del presente lavoro è quello di descrivere l'impegno del Gruppo Italiano Studio Igiene Ospedaliera (GISIO) della Società Italiana di Igiene, Medicina Preventiva e Sanità Pubblica (SItI) e le diverse esperienze condotte per contrastare le ICA e la resistenza antimicrobica. In particolare, è descritto l'impegno a contrastare le ICA nelle Unità di Terapia Intensiva con il progetto SPIN-UTI - Sorveglianza Prospettica delle Infezioni Nosocomiali nelle Unità di terapia Intensiva e nei reparti chirurgici con il progetto ISCHIA - Infezioni del Sito Chirurgico in Interventi di Artroplastica.

Inoltre, sono riportate alcune attività condotte in Sicilia utilizzando studi di prevalenza ripetuti.

Le esperienze riportate confermano che la sorveglianza è essenziale per fornire ai servizi sanitari informazioni, linee guida e strumenti per gestire efficacemente il rischio di ICA e la resistenza antimicrobica e per monitorare il livello di raggiungimento degli obiettivi dei programmi di controllo.

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