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Laboratory-based surveillance of hospital-acquired catheter-related bloodstream infections in Catalonia. Results of the VINCat Program (2007-2010)

Benito Almirante[a,*], Enric Limón[b], Núria Freixas[c] and F. Gudiol[d], on behalf of VINCat Program[☆]

[a]*Infectious Diseases Department, Hospital Universitari Vall d'Hebron, Barcelona, Spain*
[b]*VINCat Coordinating Center, Barcelona, Spain*
[c]*Hospital Universitari Mutua de Terrassa, Terrassa, Barcelona, Spain*
[d]*Infectious Diseases Service, Hospital Universitari de Bellvitge, Barcelona, Spain*

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A B S T R A C T

The VINCat Program is an institutional surveillance program for hospital-acquired infections developed in the healthcare institutions of Catalonia, Spain. The program includes the monitoring of various components of hospital-acquired infection, among which is catheter-related bloodstream infection (CRBSI). The aim of this study was to describe the frequency of CRBSI in hospitals participating in the VINCat Program over a period of 4 years (2007-2010).

The monitoring of the CRBSI component is carried out continuously in all inpatient units by performing a daily assessment of all blood culture results issued by the Microbiology Laboratories. Precise definitions are used for CRBSI, and adjusted rates are expressed per 1,000 days of hospitalization, hospital size and type of catheter. The rates of CRBSI in catheters used for parenteral nutrition are adjusted and expressed per 1,000 days of device use. The aggregate data of the total period are shown in percentiles (10%, 25%, 50% or median, 75%, and 90%).

From 2007 to 2010, a total of 2977 episodes of CRBSI were reported in 40 hospitals participating in the VINCat Program. The cumulative incidence of CRBSI has been 0.26 episodes per 1,000 days of hospitalization (CI95% 0.2 to 0.3). The overall incidence varied depending on hospital size: 0.36‰ for hospitals in Group I (>500 beds), 0.17‰ for Group II (200-500 beds), and 0.09‰ for Group III (<200 beds). 76% of the episodes were associated with central venous catheters (CVC), 19% of the episodes with peripheral venous catheters (PVC), and the remaining 5% with peripherally inserted CVCs (PICC). The most common organisms causing CRBSI were staphylococci, the group *Klebsiella*, *Serratia* and *Enterobacter*, *Candida* spp., and *Pseudomonas aeruginosa*. There are important differences in the etiology of CRBSI in relation to these variables. During the reporting period, a significant reduction (38.1%, CI95%, 29.0-46.0%) of CRBSI rates have been observed in Group I hospitals.

CRBSI surveillance is an important element of the VINCat Program, offering to us the possibility of establishing standard values for this component and implementing intervention strategies for its reduction.

Palabras clave:
Bacteriemia relacionada con los catéteres vasculares
Vigilancia
Programa VINCat

Vigilancia de bacteriemias relacionadas con el uso de catéteres venosos en los hospitales de Cataluña. Resultados del Programa VINCat (2007-2010)

R E S U M E N

El Programa VINCat es un programa institucional de vigilancia de las infecciones nosocomiales desarrollado en el ámbito de las instituciones sanitarias de Cataluña, España. En el programa se incluye la vigilancia de diferentes componentes, entre los que se encuentran las bacteriemias relacionadas con el uso de catéteres venosos (BRCV). El objetivo de este estudio ha sido aportar las frecuencias de este componente en los hospitales participantes del Programa VINCat durante un período de 4 años (2007-2010).

La vigilancia de este componente se realiza de manera continuada en todas las unidades de hospitalización, mediante la evaluación diaria de todos los resultados de los hemocultivos emitidos por los laboratorios de

*Corresponding author.
E-mail: balmiran@vhebron.net (B. Almirante).

☆A detailed list of the members is available at additional data of the electronic version of the supplement.

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microbiología. Se utilizan unas definiciones precisas de bacteriemia relacionada con el uso de los catéteres vasculares y se expresan las tasas ajustadas por 1.000 días de hospitalización, por tamaño de hospital y por tipo de catéter. En los catéteres utilizados para la nutrición parenteral las tasas se ajustan por 1.000 días de uso del dispositivo para esta indicación terapéutica. Los datos agregados del período total se desglosan en interquartiles (10, 25, 50% o mediana, 75 y 90%).
Desde 2007 hasta 2010 se ha detectado un total de 2.977 episodios de BRCV en los 40 hospitales participantes en el Programa VINCat. La incidencia acumulada de la BRCV ha sido de 0,26 episodios por 1.000 días de hospitalización (IC del 95%, 0,2-0,3). La incidencia global fue diferente en función del tamaño del hospital: 0,36‰ para hospitales del grupo I (> 500 camas), 0,17‰ para los del grupo II (200-500 camas) y 0,09‰ para los del grupo III (< 200 camas). El 76% de los episodios se asoció a los catéteres venosos centrales (CVC), el 19% a los catéteres venosos periféricos y el 5% restante a los CVC de inserción periférica. Los microorganismos más frecuentes causantes de BRCV fueron los estafilococos, el grupo *Klebsiella*, *Serratia* y *Enterobacter*, *Candida* spp. y *Pseudomonas aeruginosa*. Existen importantes diferencias en la etiología de la BRCV en relación con las diferentes variables analizadas. Durante el período analizado se ha observado una disminución importante (38,1%; IC del 95%, 29-46) de las tasas de BRCV en los hospitales del grupo I.
La vigilancia de las BRCV es un elemento relevante en el Programa VINCat por la posibilidad de establecer los valores estándar de este componente y para poder implementar estrategias de intervención para su reducción.

Introduction

Catheter-related bloodstream Infections (CRBSI) are among the most frequently found hospital-acquired infections.[1,2] In specific settings of the hospital, such as intensive care units (ICUs), this type of infection has been related with substantial morbidity, attributable mortality, and relevant added healthcare costs.[3,4]

Although the true incidence of CRBSI is not well known, it is estimated that in the U.S. during the year 2002 a total of 250,000 episodes may have occurred, with an attributable mortality ranging between 12% and 25% (over 30,000 deaths), and an added cost estimated to range from 3,000 US$ to 56,167 US$ per episode.[5] Most of these incidences of CRBSI are associated with the presence of a central venous catheter (CVC) and the stay of patients in ICUs[6], although in recent years the importance of the problem has also been reported in inpatient conventional units[7-9] and with other types of catheters, such as peripheral venous catheters (PVC) or central venous peripherally-inserted CVCs (PICC), which have significant use outside the ICUs.[10,11]

Surveillance programs for the prevention of CRBSI —principally aimed at the implementation of a bundle of easy-to-apply preventive measures, in conjunction with educational campaigns for staff— have had a significant impact in reducing CRBSI in the ICUs.[12,13] Strict adherence to the recommendations made has facilitated a 70% reduction in the frequency of episodes of CRBSI in U.S. ICUs. In 2009, the estimated number of CRBSI episodes was 18,000, a reduction of 58% compared with the data from 2001.[14]

In Spain, since 1994 there has been a specific program of surveillance of device-associated infections acquired during stays in ICUs (named ENVIN·UCI), with more than 100 hospitals participating in the surveillance program.[15] However, to date no information has been available about the frequency of CRBSI in conventional hospital wards. In 2006, the VINCat Program of surveillance of nosocomial infections was begun, with the main objective of reducing the frequency of these infections through continuous active monitoring. A key objective of the VINCat Program is continuous monitoring of CRBSI in the entire hospital and in all types of venous catheters (with the exception of permanent CVC, Port-a-Cath® type devices), utilizing a system based on reports of positive blood cultures from the Microbiology Lab of each participating institution.[16]

This article reports the primary results from this indicator, as collected by hospitals participating in the VINCat Program, and as analyzed in the Coordinator Center during its first 4-year period (2007-2010).

Patients and Methods

Setting

Data for this study were reported to the VINCat Program between January 2007 and December 2010. The component blood stream related with the use of venous catheters is monitored at all participating hospitals using a continuous monitoring system that is integrated into the VINCat Program, and is based on daily reports from the Microbiology Lab of positive blood cultures of hospitalized patients older than 18 years. Participation in this indicator is voluntary, but since 2007 the VINCat Program has provided data from approximately 40 hospitals each year, 35 of them continuously, dating from the beginning of the surveillance period.

Hospitals participating in the VINCat Program are classified into three categories with regard to the number of beds available for hospitalization: more than 500 beds (Group I), between 200 and 500 beds (Group II), and fewer than 200 beds (Group III). There are two single-specialty hospitals included in the program.

Methodology and procedures

In the VINCat Program, the surveillance of bloodstream infections associated with the use of venous catheters is carried out continuously throughout the year and prospectively in all the wards, including those attending critically ill patients. Because of the difficulty of diagnosing catheter-related bloodstream infection, the nosocomial infection surveillance team must have experience with monitoring this condition. This team is responsible both for the prospective detection of cases and for the collection of data.

The results and the comparisons are presented at general clinical sessions in the hospitals, and specifically in the wards with the highest rates of infection. The annual incidence rates are compared with the hospitals' records from previous years, and with the aggregate data compiled in the VINCat Program. The detection of cases is based on the daily evaluation of all patients with positive blood cultures. This information is provided to the surveillance team by the Microbiology Laboratory at each hospital. The application of precise definitions allows the identification of bloodstream infections associated with the use of venous catheters. The incidence rates of bloodstream infection are adjusted to the number of overall hospital stays and to the stays in the ward in which each case is detected.

Basic indicators and calculation of the rates

The basic indicator of the surveillance of bloodstream infection is the incidence of venous catheter-related bloodstream infection (VC-BSI), including and grouping together those related to CVC, PICC and PVC catheters. This indicator should be evaluated at all the participating hospitals. In hospitals that use parenteral nutrition (PN), a second basic indicator is calculated for the rate of bloodstream infection associated with the venous catheter used for parenteral nutrition (PN-BSI).

The annual incidence of BSI is calculated using the following formula:

VC-BSI = Total no. of bloodstream infections detected in 1 year x 1,000 / Hospital stays

The annual incidence of PN-BSI will be calculated using the following formula:

PN-BSI = No. of episodes of PN-BSI x 1,000 / Total days of use of the catheter for PN

Venous catheter-related bloodstream infection: data compilation

a) Population under surveillance

The population under surveillance comprises all patients aged 18 or over who are hospitalized for longer than 48 hours. The following are not included in the study:

• Outpatients with CVCs (used for hemodialysis, home PN, or chemotherapy), with a hospital stay of less than 48 hours at the time of detection of BSI-CVC.
• Patients in whom BSI-CVC is detected in outpatient care (especially those who receive home PN, treatment with hemodialysis or therapy with cytostatics or immunosuppressive agents).

b) Study period

The follow-up period each year will be from 1 January to 31 December. This means that the data for each full year should be available during the first trimester of the following year. This is an indicator of continued surveillance throughout the year.

c) Definitions

c.1) Type of catheter

Central venous catheter: a catheter inserted in a subclavian, jugular or femoral vein, percutaneously (with or without tunneling), for the administration of fluids, medication, PN or renal clearance therapies. Fully implanted catheters (type Port-a-Cath®) are not included in the surveillance program.

Peripherally inserted central venous catheter: a catheter inserted percutaneously through a vein in the forearm (usually a basilica vein). Its distal end reaches the right heart cavities. These catheters are generally used in the same way as conventional CVCs.

Catheter for PN: any CVC or PICC used for the administration of PN during the week prior to the detection of the bloodstream infection. If one of the lumens of a multiple-lumen catheter is used for PN, the bloodstream infection will always be considered as related to this use.

Peripheral venous catheter: short or medium-length catheter inserted percutaneously in a peripheral location (normally arm or forearm).

c.2) Venous catheter-related bloodstream infection

This type of infection is defined as the detection of the growth of bacteria, yeasts or fungi in a patient utilizing a venous catheter, with at least one set of blood cultures performed with blood obtained from a peripheral vein (in the case of habitual skin-colonizing microorganisms, such as coagulase-negative *Staphylococci* species, at least two sets of positive blood cultures are required). These cultures must be associated with clinical manifestations of infection (fever, chills and/or hypotension) and the absence of an apparent source of the bloodstream infection other than the catheter.

These conditions must be accompanied by one or more of the following: *a)* semi-quantitative culture (>15 colony forming units [CFU] per catheter segment) or quantitative culture (>10^3 CFU per catheter segment), with detection of the same microorganism as in the blood cultures obtained from the peripheral blood (at least identical species and, if possible, with a similar susceptibility pattern); *b)* quantitative blood cultures with detection of the same microorganism, with a difference of 5:1 or greater between the blood obtained from any of the lumens of a venous catheter and that obtained from a peripheral vein by puncture; *c)* difference in time to positivity of the blood cultures of above two hours between the cultures obtained from a peripheral vein and that obtained from the lumen of a venous catheter; *d)* presence of signs of inflammation or purulent secretions in the insertion point or in the subcutaneous tunnel of a venous catheter. A culture of the secretion showing growth of the microorganism detected in the blood cultures is also useful; and, *e)* resolution of clinical signs and symptoms after the withdrawal of a CVC or a PICC with or without appropriate antibiotic treatment (this will be accepted as a condition if it was not possible to perform the above conditions). For the clinical diagnosis of peripheral venous catheter-related bloodstream infection, the presence of signs of phlebitis is required (induration, pain or signs of inflammation at the insertion point or in the trajectory of the catheter).

Results

Of the 39 participating hospitals, 6 belonged to Group I (15.4%), 15 to Group II (38.5%), 16 to Group III (41%) and 2 were single-specialty centers (5.1%). During the whole period of surveillance a total of 2,977 episodes of CRBSI were reported, over a period of 11,671,959 patient-days (overall rate of episodes/1,000 patient-days 0.26, 95%CI 0.2 to 0.3). Table 1 summarizes the distribution of pooled means and the key percentiles of CRBSI rates, adjusted by 1,000 patient-days and by hospital type. The median rates were 0.36 episodes in Group I hospitals, 0.17 episodes in Group II hospitals, 0.09 episodes in Group III hospitals, and 0.12 episodes in single-specialty hospitals.

A total of 740 episodes (25%) of CRBSI were associated with catheters used for the administration of PN (at least one of the catheter lumens). The median rate of CRBSI in this type of catheter was 1.57 episodes/1,000 catheter-days (percentile 25^{th}-75^{th} 0-3.7).

A total of 2,276 episodes (76.5% of the total cohort) of CRBSI were reported as associated with a CVC, 142 episodes (4.7%) associated with a PICC, and 559 episodes (18.8%) associated with a PVC. In Tables 2, 3, and 4 the distribution of pooled means and key percentile rates of CRBSI related to each type of catheter are detailed, adjusted by 1,000 patient-days and hospital size. The median rate for central venous CRBSI were 0.29 episodes/1,000 patient-days in Group I hospitals, 0.12 episodes in Group II hospitals, 0.04 episodes in Group III hospitals, and 0.06 episodes in single-specialty hospitals (Table 2). The median rate for peripherally inserted central CRBSI were 0.003 episodes/1,000 patient-days in Group I hospitals, and 0 episodes in the rest of institutions (Table 3). The median rate for peripheral venous CRBSI were 0.05 episodes/1,000 patient-days in Group I hospitals, 0.03 episodes in Group II hospitals, 0 episodes in Group III hospitals, and 0.06 episodes in single-specialty hospitals.

Table 1
Pooled means and key percentiles of the distribution of catheter-related bloodstream infections (CRBSI) rates, adjusted by 1,000 patient-days (VINCat Program 2007-2010)

						Percentile				
	No. of hospitals*	No. of CRBSI	Patient-days	Pooled means CRBSI rate (±SD)	Range	10th	25th	50th, Median	75th	90th
Hospital size										
>500 beds	21	1,757	4,513,798	0.38 ± 0.18	0.10-0.67	0.17	0.2	0.36	0.48	0.66
200-500 beds	57	933	4,898,561	0.18 ± 0.10	0.03-0.48	0.06	0.1	0.17	0.24	0.32
<200 beds	60	192	2,071,929	0.10 ± 0.07	0.02-0.31	0.03	0.05	0.09	0.16	0.18
Single-specialty	7	95	187,711	0.50 ± 0.56	0.03-1.25	0.03	0.05	0.12	0.98	1.21

*Cummulative numbers of participating hospitals through the entire surveillance period

Table 2
Pooled means and key percentiles of the distribution of central venous catheter-related bloodstream infections (CRBSI) rates, adjusted by 1,000 patient-days (VINCat Program 2007-2010)

					Percentile				
	No. of CRBSI	Patient-days	Pooled means CRBSI rate (±SD)	Range	10th	25th	50th, Median	75th	90th
Hospital size									
>500 beds	1,362	4,513,797	0.29 ± 0.15	0.08-0.62	0.1	0.17	0.29	0.36	0.49
200-500 beds	731	4,898,561	0.14 ± 0.08	0.01-0.41	0.04	0.07	0.12	0.18	0.26
<200 beds	115	2,071,929	0.05 ± 0.05	0-0.19	0	0.03	0.04	0.07	0.12
Single-specialty	68	187,711	0.32 ± 0.37	0-0.79	0.02	0.03	0.06	0.67	0.76

Table 3
Pooled means and key percentiles of the distribution of peripheral inserted central venous catheter-related bloodstream infections (CRBSI) rates, adjusted by 1,000 patient-days (VINCat Program 2007-2010)

					Percentile				
	No. of CRBSI	Patient-days	Pooled means CRBSI rate (±SD)	Range	10th	25th	50th, Median	75th	90th
Hospital size									
>500 beds	110	2,418,474	0.04 ± 0.03	0-0.08	0.01	0.01	0.03	0.06	0.07
200-500 beds	21	2,590,196	0.01 ± 0.01	0-0.07	0	0	0	0.01	0.03
<200 beds	8	1,036,906	0.01 ± 0.03	0-0.16	0	0	0	0.02	0.03
Single-specialty	3	123,228	0.03 ± 0.04	0-0.10	0	0	0	0.05	0.08

Table 4
Pooled means and key percentiles of the distribution of peripheral venous catheter-related bloodstream infections (CRBSI) rates, adjusted by 1,000 patient-days (VINCat Program 2007-2010)

					Percentile				
	No. of CRBSI	Patient-days	Pooled means CRBSI rate (±SD)	Range	10th	25th	50th, Median	75th	90th
Hospital size									
>500 beds	275	4,380,266	0.05 ± 0.04	0-0.12	0.01	0.02	0.05	0.09	0.10
200-500 beds	182	4,515,215	0.04 ± 0.04	0-0.17	0	0.01	0.03	0.06	0.08
<200 beds	72	2,071,929	0.04 ± 0.05	0-0.18	0	0	0	0.07	0.12
Single-specialty	30	187,711	0.15 ± 0.17	0-0.45	0	0.03	0.06	0.23	0.35

Overall, 34% of the episodes of CRBSI were reported as affecting patients admitted to ICUs, 36% to patients admitted to medical wards, and the remaining 30% to patients admitted to surgical wards. The median rates of CRBSI were 1.83 episodes/1,000 patient-days in ICU patients, 0.22 episodes in patients admitted to medical wards, and 0.18 in patients admitted to surgical wards.

The most frequent microorganisms causing CRBSI are shown in Figure 1. Overall, CNS, *Staphylococcus aureus*, *Klebsiella*, *Enterobacter* and *Serratia* group (KSE group), *Candida* spp., and *Pseudomonas aeruginosa* were the etiological agents of CRBSI in 93% of the episodes. In Table 5 the etiological distribution of CRBSI with regard to the hospital size, the type of catheter, the vein localization of the catheter, and hospital ward are detailed. The frequencies of CRBSI caused by gram-negative rods (GNR) were higher in venous catheters inserted in the femoral veins, and in patients admitted to critical care units. The frequencies of CRBSI caused by gram-positive cocci (GPC) were higher in PVC, and in patients admitted to medical or surgical wards. No relevant differences were observed with regard to the frequencies of CRBSI caused by yeasts (Table 5).

The trends in CRBSI aggregated rates adjusted by hospital size are depicted in Figure 2. In Group I hospitals, the median aggregated rate of CRBSI decreased from 0.54 episodes/1,000 patient-days in 2007 to 0.33 episodes/1,000 patient-days; this signifies a 38.1% (CI95% 29.0-46.0%) rate reduction. The trend of the median rates for the entire period was statistically significant (P<.00001 by the Mantel-Haenszel test for temporal tendencies). No relevant differences were detected in the trend of median rates in Group II and Group III hospitals.

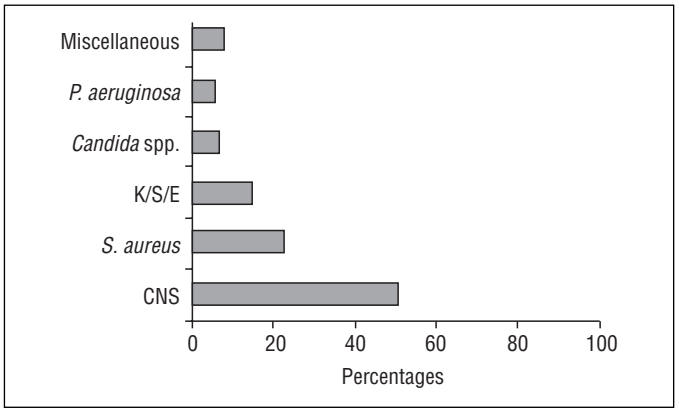

Figure 1. Etiological agents of 2860 episodes of catheter-related bloodstream infection (VINCat Program 2007-2010). K/S/E: *Klebsiella* spp., *Serratia* spp., and *Enterobacter* spp. Group; CNS: coagulase-negative staphylococci.

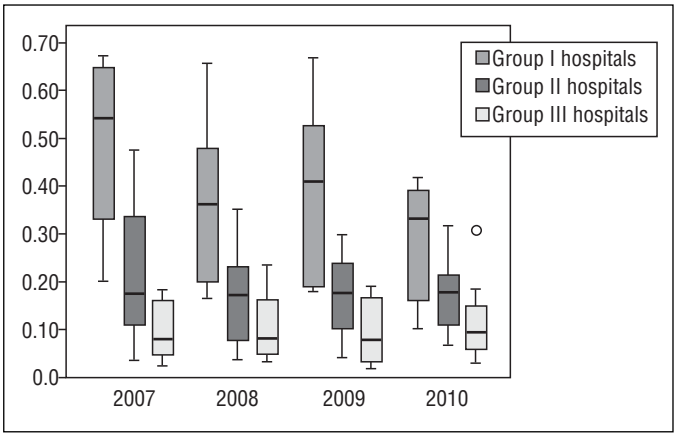

Figure 2. Trends in catheter-related blood stream infection aggregated rates adjusted by hospital size (VINCat Program 2007-2010).

Table 5
Etiological distribution of CRBSI in relation to hospital size, type of catheter, vein localization of catheter, and hospital ward (VINCat Program 2007-2010)

	GNR No. (%)	GPC No. (%)	Yeasts No. (%)
Hospital size			
>500 beds	439 (26)	1163 (68)	105 (6)
200–500 beds	198 (23)	614 (70) 66 (7)	66 (7)
<200 beds	48 (29)	108 (65) 10 (6)	10 (6)
Single-specialty	5 (5)	90 (93)	2 (2)
Type of catheter			
CVC	546 (25)	1471 (68)	145 (7)
PICC	59 (26)	146 (62)	28 (12)
PVC	85 (19)	358 (79)	10 (2)
Vein localization of catheter			
Subclavian vein	228 (20)	823 (73)	73 (7)
Jugular vein	133 (23)	393 (70)	38 (7)
Femoral vein	172 (38)	242 (54)	34 (8)
Antecubital vein	145 (22)	470 (72)	35 (6)
Other	10 (18)	43 (77)	3 (5)
Hospital ward			
Medical wards	175 (17)	804 (78)	47 (5)
Surgical wards	169 (20)	613 (71)	75 (9)
Critical care units	346 (36)	558 (56)	61 (6)

CVC: central venous catheter; CRBSI: catheter-related bloodstream infection; GNR: gram-negative rods; GPC: gram-positive cocci; PICC: peripherally-inserted central venous catheter; PVC: peripheral venous catheter.

Discussion

This article presents the results of the VINCat Program, which is based on continuous monitoring of bacteremia associated with vascular catheters in all patients admitted to health institutions in Catalonia between 2007 and 2011. In most institutional surveillance programs, the CRBSI component is limited to areas of critical care patients; rarely have experiences been published regarding the incidence of CRBSI in patients hospitalized in other hospital areas. Where they have been published, these experiences address only the monitoring of CVC-related bacteremia.[7,8,17] In our program, 68% of the episodes were detected in patients hospitalized outside of the critical care area, and 24% of the total was associated with the use of PVC or PICC.

This surveillance program is unique because of the rigorous methodology used for the detection of cases and the continuous monitoring system, which is based on daily assessment by qualified personnel of all patients with reports of positive blood cultures issued by the Microbiology Laboratory. These circumstances do not allow easy comparisons with other surveillance programs regarding the frequency of bacteremia acquired from catheters. Most programs are based on regular evaluation of the frequency of bacteremia associated with CVC, adjusted for days of use of these devices.[7,17] Monitoring throughout the hospital, including all venous catheters with risk, does not allow the use of a methodology based on monitoring of patients with these devices, so as a result the frequency adjustment has been set depending on the stays in the hospital, similar to the previously published British experience.[2]

In a recent study, a community hospital in our country reported that the surveillance carried out in a standardized manner on patients with CVC offered a frequency of bacteremia-related episodes slightly higher than that observed when surveillance was based on monitoring of patients with positive blood cultures.[18] However, in most health institutions, continued monitoring of all patients with venous catheters would require the use of a great deal of resources and would thus need to demonstrate cost-effectiveness for its implementation.

Several studies have evaluated the rates of BSI among inpatients with CVCs.[7,19,20] In a prospective cohort study of one American teaching hospital, the CRBSI rates were similar between ICU medical wards and medical wards (5.7 episodes/1,000 catheter-days versus 5.2 episodes/1,000 catheter-days). However, the device-utilization ratio was considerably lower than those of medical ICUs.[19] Another study from the German Nosocomial Infection Surveillance Study (the DEVICE-KISS module) reported that the CRBSI rate in a non-ICU setting (4.3 episodes/1,000 catheter-days) was clearly higher than the rate detected in the surveillance system from ICUs (1.8 episodes/1,000 catheter-days)[7]. In the 2010 National Healthcare Safety Network (NHSN) report, there are several differences in the central line BSI rates between wards and ICUs depending on the types of units and the teaching status of the facility. However, the pooled mean of the central line BSI rates for medical-surgical wards was slightly lower than the rate reported for medical-surgical ICUs.[17] In the VINCat Program, the overall CRBSI rate was 0.26 episodes/1,000 patient-days, and no comparison is possible with other surveillance programs.

The characteristics and size of the hospitals are very important in the frequency of CRBSI, as has been reported in various studies.[2,17] The larger university hospitals have a markedly higher frequency than those observed in smaller hospitals or in facilities without teaching

activities. In the VINCat Program we can clearly see these frequency differences, depending on the size of the hospital. The frequency of CRBSI related to CVCs and the PICCs are higher in Group I hospitals (university-affiliated facilities with over 500 beds), in relation to smaller hospitals. However, the frequencies of CRBSI associated with the PVCs are similar in all facilities. In British hospitals, the frequency of CRBSI is more than doubled in teaching hospitals compared with nonteaching hospitals[2]. This may determine the adoption of various preventive strategies based on the size of the health institutions and the type of device that would be targeted to them.

Gram-positive bacteria are the most common etiologic agents of CRBSI, producing about two-thirds of the episodes.[5] The importance of other microorganisms has been highlighted recently in one paper, which reported that up to 25% of the episodes may be caused by various species of GNR, often with multiple resistance to antibiotics, and more than 5% are caused by yeast.[21] In our study, we can analyze the frequency of various etiological agents of CRBSI in our environment and establish some risk factors. Patients with CVCs inserted into the femoral veins and those admitted to critical care areas have higher frequencies of CRBSI caused by GNR. Knowledge of the risk factors for CRBSI caused by species other than the GPC may contribute to the selection of appropriate empirical therapies in patients with clinical suspicion of this infection.

Surveillance programs of hospital-acquired infections allow us to know in detail the frequencies of the most common infections, and to implement strategies targeted at preventing them. Recently, it has been published that as many as 65%-70% of the cases of CRBSI may be preventable with current evidence-based strategies.[22] In the United States it is estimated that between 2001 and 2009 the number of CRBSI episodes in ICU patients declined from 43,000 episodes to 18,000 episodes (a 58% reduction), representing (in 2009) up to 6,000 lives and US$ 414 million in potential excess healthcare costs saved[14]. Preventive strategies, applied systematically[23,24] through an intervention program based on training, education, surveillance, and implementation of a selective group of evidence-based preventive measures, have demonstrated the preventability of these infections in ICUs.[12,13]

The effectiveness of the implementation of these intervention programs outside of the ICU patients has not been validated to date. In a selected group of hospitals participating in the VINCat Program, the impact of a multimodal intervention program for reducing CRBSI in conventional hospital wards has been assessed. The overall mean CRBSI incidence decreased from 0.30 episodes/1,000 patient-days in 2009 to 0.25 episodes/1,000 patient-days in 2010 (P = .04), and the mean incidence of CRBSI associated with CVC decreased from 1.77 episodes/1,000 patient-days to 1.24 episodes/1,000 patient-days (P= .003). The mean incidence in PVC remained unchanged.[25] A similar experience of reductions in central-line-associated BSI in two community hospitals has recently been published.[26]

In Group I hospitals of the VINCat Program, throughout the entire surveillance period, a significant reduction of 38.1% in the aggregated median rates of CRBSI has been detected. The systematic application of specific intervention programs in the ICUs of these hospitals (named the Bacteremia Zero Program)[27] and the diffusion of the comparative results of the monitoring of this indicator to professionals involved in the care of vascular catheters, associated with educational programs specific to each institution, may have contributed significantly to reducing the frequency of these infections. We need to generalize these preventive strategies to all hospitals of the VINCat Program to try to obtain this reduction in all health institutions in Catalonia.

In summary, the implementation of a surveillance program of CRBSI in hospitals in Catalonia, using a standardized methodology, has provided data on the frequency of this infection and the dissemination of the methodology to professionals involved in the use of catheters. The results have allowed the application of preventive measures aimed at the reduction and eventual eradication of CRBSI in certain areas of the hospital, or in some institutions.

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Conflicts of Interest

All authors declare that they have no conflicts of interest in this article.

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