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Prevalence of nosocomial infections in acute care hospitals in Catalonia (VINCat Program)

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ABSTRACT

The first objective of the Catalonian Nosocomial Infection Surveillance Program (VINCat) is to monitor the prevalence (%) of patients with nosocomial infections (NI), patients undergoing urinary catheterization with closed circuit drainage (%) and patients undergoing antibiotic treatment (%). We present the results for the period 2008-2010.

Comprehensive and point annual prevalence surveys were conducted that included conventionally hospitalized patients in acute care hospitals belonging to the VINCat Program. The number of participating hospitals was 46 (2008), 48 (2009) and 61 (2010), most belonging to the Network of Public Use Hospitals of Servei Català de la Salut. The results are presented globally and by hospital size (<200 beds, 200-500 beds, >500 beds).

The prevalence of patients with active NI acquired during the current or the previous hospitalization (global NI/P%) was 7.6 (2008), 6.2 (2009) and 6.3 (2010). The prevalence of patients with active NI acquired during the current (actual NI/P%) was 6.2 (2008), 4.7 (2009) and 4.6 (2010).The results by hospital size shows that the variation occurred mainly in <200 beds hospitals. The proportion of closed circuit urinary catheterization use was 90.2%. The use of antibiotics varied between 34.6% and 37.6%, with no differences due to hospital size.

The global prevalence of NI provides information on the burden of NI at the institutional and regional level. Between 17.3% and 26.9% of patients with NI at the time of the study had acquired it in a previous hospitalization at the same institution.

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Prevalencia de infección nosocomial en los hospitales de agudos de Cataluña (Programa VINCat)

Palabras clave:
Prevalencia
Infección nosocomial
Cateterismo urinario con sistema de drenaje cerrado
Uso de antibióticos

RESUMEN

El primer objetivo del Programa de Vigilancia de la Infección Nosocomial en Cataluña (VINCat) es monitorizar la prevalencia (%) de pacientes con infección nosocomial (IN) activa, pacientes sometidos a cateterismo urinario con sistema de drenaje cerrado (%) y pacientes que reciben tratamiento antibiótico (%). Presentamos los resultados del período 2008-2010.

Estudio de prevalencia puntual anual. Se han incluido todos los pacientes ingresados en el momento del estudio en los hospitales de agudos que participan en el Programa VINCat. El número de hospitales incluidos ha sido 46 (2008), 48 (2009) y 61 (2010), la mayoría de la Red de Hospitales de Utilización Pública (XHUP) del Servei Català de la Salut. Se presentan resultados globales y por tamaño de centro (< 200, 200-500 y > 500 camas).

La prevalencia de pacientes con IN activa adquirida en ingreso actual o previo (global NI/P%) ha sido de 7,6 (2008), 6,2 (2009) y 6,3 (2010). La prevalencia de pacientes con IN activa adquirida en ingreso actual (actual

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NI/P%) ha sido de 6,2 (2008), 4,7 (2009) y 4,6 (2010). La variación se ha producido preferentemente en hospitales < 200 camas. La proporción de cateterismo urinario de circuito cerrado ha sido del 90,2%. El uso de antibióticos ha variado del 34,6 al 37,6%, sin diferencias por tamaño de hospital.
La global NI/P% informa de la carga de infección nosocomial, tanto en el centro como regionalmente. Entre el 17,3 y el 26,9% de los pacientes con IN la han adquirido en hospitalización previa en la misma institución.

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Introduction

Prevention and control of nosocomial infection (NI) is one of the key objectives of clinical quality and safety programs in acute hospital care. The objective should be approached using risk management methodology and the epidemiological surveillance of NI is an essential aspect for the implementation and assessment of prevention and control activities.[1] Prevalence surveys have been one of the most widely used epidemiological methods, at the institutional level and at the various regional levels.[2] These studies have provided information on the frequency of NI and the most frequent locations, helped identify susceptible patients and determined risk areas in hospitals.

In recent decades, there has been significant development in surveillance directed at instrumentation and procedure risks, based on incidence studies that calculate risk-adjusted rates, allowing efforts to be focused on preventable cases of NI.[3] However, this type of approach does not provide an overview of the magnitude of the problem; some cases of NI and hospital areas remain without surveillance, and require greater availability of resources. Therefore, prevalence studies are still considered a quick, relatively inexpensive and useful instrument for assessing the total burden of NI as well as the frequency of use of instruments of risk and antibiotics. Their periodic repetition helps to monitor the evolution over time of the prevalence of NI and to evaluate the impact of the implemented programs of prevention and control.[4] Limitations of these studies include: the information about NI is punctual, the tendency to overestimate the frequency of NI, the over-representation of long-stay patients and low incidence phenomena that are difficult to assess.

The use of prevalence surveys in large countries or geographical areas, with a common study protocol and a comprehensive study sample (or one representative at the institutional level), provides information on the overall situation and differences between institutions.[2] In Europe, numerous prevalence studies have been performed at the regional level.[5-16] The European CDC is implementing a common prevalence protocol for European Union countries.[17]

Since 1990, Spain has been performing EPINE, the annual point prevalence study promoted by the Spanish Society of Preventive Medicine, Public Health and Hygiene.[9] This is a comprehensive survey in which both public and private acute care hospitals from all over the region may participate voluntarily. It gathers information on NI, community infection, intrinsic and extrinsic risk factors and the use of antibiotics. Currently, 25 quality-related indicators are calculated.[18]

In Catalonia, the first prevalence studies were published in the 1980s.[19-23] It is a methodology that many hospitals have incorporated as part of their routine surveillance of NI. Since 1990, some of these hospitals have systematically participated in the EPINE study.

The VINCat Program was launched in 2006.[24] It is a Servei Català de la Salut de Catalunya program that establishes a minimum and unified system of NI surveillance for acute care hospitals in the Network of Public Use Hospitals (NPUH). Private hospitals may voluntarily participate. VINCat incorporates six objectives, the first of which is global surveillance of NI using a prevalence survey with the minimum information necessary to assess the total burden of NI in institutions and at the regional level, as well as its evolution over time. In addition, two indicators of the process are collected: the use of closed drainage urinary catheterization and the use of antibiotics.

The aim of this study is to present the results of the prevalence surveys performed between 2008 and 2010, showing the overall results and the results by hospital size.

Methods

This is an annual point prevalence survey. Period: 2008-2010. Participating centers: acute care hospitals belonging to the VINCat Program. The number of participating hospitals included in the study was 46 (2008), 48 (2009) and 61 (2010), most belonging to the NPUH of Servei Català de la Salut. Currently, there are 69 acute care hospitals in the NPUH (basic general, reference and high technology hospitals) distributed throughout the region.

The participating institutions were classified according to size: >500 beds (group I), 200-500 beds (group II) and <200 beds (group III), as was done with the other VINCat objectives.

A comprehensive survey was performed in each participating center, which included all patients hospitalized at the time of the study, except for those patients admitted for diagnostic and therapeutic purposes who were admitted and discharged the same day as the study (short-stay beds). When presenting the results, we did not consider institutions that had included less than 20 patients (2, 2 and 4, respectively).

The study methodology is similar to that of studies and is described in the VINCat Program manual.[25] The prevalence survey was performed simultaneously in all participating institutions during the second and third week of May, coinciding with the dates of the EPINE study, to facilitate participation in the latter study by the hospitals if they so desired.

The protocol recommended that data collection be performed by personnel trained in detecting nosocomial infections. The completed questionnaires were to be reviewed by a member of the institution's infection control team, who was responsible for the information contained in the questionnaires and acted as coordinator. It was further recommended that the coordinator validate between 5% and 10% of the questionnaires, repeating the data collection process to determine the quality of the task performed.

The questionnaire contained the minimum data that the participating institutions were required to fill out. Each institution could expand the collection with other variables, if they wished. The variables included: demographic data, whether the patient had a urinary catheter (open o closed drainage system type) or vascular catheter (peripheral, central or peripherally inserted central) at the time of study, and whether the patient had been subjected to surgery during the current hospitalization. Information was collected on active NI at the time of the study: whether they were related to the current hospitalization or to a previous one at the institution, the location (urinary, pneumonia, surgical wound infection, bacteremia related to vascular catheter and other locations) and causal microorganisms. Lastly, in terms of antibiotic treatment, the type of antibiotic and indication (empiric, targeted or prophylaxis) was recorded.

A urinary drainage system is considered closed when it has one-way-valve to prevent the reflux of urine and a tap at the bottom of the collecting container which permit to empty them.

Active NI is defined as the infection that the patient has on the day of the survey or as the infection for which the patient is undergoing antibiotic treatment on the day of survey.

The definitions of NI used were those of the SENIC project;[26] however, asymptomatic bacteriuria was not considered as NI.

Training and support was provided by the VINCat Coordination Center for professionals who collected the data.

Despite the fact that the majority of acute care hospitals in Catalonia have experience in this type of methodology, the VINCat Coordination Center conducted workshops where there was extensive involvement from infection control nursing staff.

The VINCat manual is updated annually and includes warnings and notes on how to avoid common mistakes.

Lastly, the members of the Coordination Center were available to answer questions from participants.

Definitions of indicators

1. Prevalence of nosocomial infection. We calculated two types of measures related to the prevalence of nosocomial infection:

– Prevalence of patients with global nosocomial infection (gNI/P%): This refers to all patients with active NI detected during the prevalence study. This includes all patients who acquired NI at the institution, either during the current or the previous hospitalization.

gNI/P% = Number of patients with NI acquired during the current or the previous hospitalization x 100 / Number of patients studied

– Prevalence of patients with active nosocomial infection acquired during the current hospitalization (acNI/P%): This includes patients with active NI acquired during the current hospitalization.

acNI/P% = No. patients with NI acquired during the current hospitalization x 100 / Number of patients studied

2. Process indicators

– Patients with closed urinary drainage system

No. Patients with closed urinary drainage system x 100 / No. patients with urinary catheterization

– Use of antibiotics

P/UATB = Number of patients in antibiotic treatment x 100 / Number of patients studied

Table 1
Global prevalence of patients with NI (gNI/P%) during the 3 years of the study

	VINCat 2008	VINCat 2009	VINCat 2010
Hospitals included in analysis	46	48	61
Number of patients surveyed	9,578	10,241	10,542
gNI/P%	7.6	6.2	6.3
95% CI	6.9-8.0	5.7-6.7	5.8-6.7
Percentile gNI/P% (by hospitals)			
10th	3.1	2.0	1.0
25th	5.5	3.7	3.3
50th, median	6.9	6.0	6.0
75th	10.5	8.8	8.9
90th	12.9	12.0	11.2

gNI/P%: prevalence of patients with NI acquired during the current or previous hospitalization; 95% CI: 95% confidence interval.

Statistical analysis

We present the overall results using the prevalence (%) and its 95% confidence interval (95% CI), as well as the percentile distribution by hospitals. The results by hospital size are presented as mean prevalence (%) and range. In this case, single-purpose hospitals were excluded from the analysis (3 institutions in each survey).

Data analysis was performed using the SPSS 11 program.

Results

The number of patients included was 9578 (2008), 10241 (2009) and 10542 (2010). The global prevalence of patients with NI (gNI/P%) was 7.6% (2008), 6.2% (2009) and 6.3% in 2010 (Table 1). The gNI/P% range among hospitals was between 0% and 16.4%. The results by hospital size (Table 2) shows that the variation between of the 2008 survey and the following surveys occurred mainly in group III hospitals.

The acNI/P% varied from 6.2% to 4.6% (Table 3). The prevalence range among hospitals was between 0% and 14.8%. As with the gNI/P%, the variation occurred mainly in group III hospitals (Table 4).

In terms of location of NI, the distribution is similar throughout the period. Among the infections related to the study period (acNI), 29.8% were urinary tract infections, 30.3% were surgical wound infections, 16.5% were pneumonia, 5.6% were vascular catheter-related bacteremia and 17.8% were infections in other locations. In contrast, infections related to previous hospitalization at the same institution were mainly surgical wound infections (65%).

Table 2
Mean global prevalence (rank) by hospital size

	VINCat 2008*		VINCat 2009*		VINCat 2010*	
Hospital size groups	gNI/P% (rank)	No. hospitals	gNI/P% (rank)	No. hospitals	gNI/P% (rank)	No. hospitals
Group I >500 beds	11.0 (7.1-15.1)	7	11.6 (9.2-13.9)	4	10.9 (6.9-16.4)	7
Group II 200-500 beds	7.2 (2.0-12.8)	13	6.7 (2.8-12.1)	13	6.9 (1.0-13.1)	16
Group III <200 beds	6.9 (1.0-14.0)	23	5.5 (0.0 -12.1)	28	5.0 (0.0-12.0)	35

*3 single-purpose hospitals were excluded from the analysis.
gNI/P%: prevalence of patients with NI acquired during current or previous hospitalization.

Table 3
Prevalence of patients with NI acquired during the current hospitalization (acNI/P %) in the 3 years of the study

	VINCat 2008	VINCat 2009	VINCat 2010
Hospitals included in analysis	46	48	61
Number of patients surveyed	9578	10241	10542
acNI/P%	6.2	4.7	4.6
95% CI	5.7-6.7	4.3 -5.1	4.2-5.0
Percentile acNI/P% (by hospitals)			
10th	1.0	1.1	1.0
25th	5.5	2.7	2.4
50th, median	5.7	4.8	4.1
75th	8.5	6.9	6.9
90th	11.4	8.7	8.6

acNI/P%: prevalence of patients with NI acquired during the current hospitalization; 95% CI: 95% confidence interval.

Table 5
Prevalence of antibiotic use

	VINCat 2008	VINCat 2009	VINCat 2010
Hospitals included in analysis	46	48	61
Number of patients surveyed	9578	10241	10542
Antibiotic use %	34.6	35.9	37.6
95% CI	33.6-35.6	35.0-36.8	36.7-38.5
Percentile antibiotic use % (by hospitals)			
10th	10.0	13.6	20.8
25th	30.0	33.1	33.2
50th, median	36.1	38.4	38.7
75th	42.8	42.8	44.4
90th	53.6	54.7	52.0

95% CI: 95% confidence interval.

Process indicators

Use of urinary catheterization with closed circuit drainage

During the study period, 4173 (13.7%) patients carried urinary catheters. The prevalence of the use of closed circuit drainage for the period was 90.2% (95% CI: 89.3-91.1), with no differences over the 3 years. There were no differences according to hospital size.

Use of antibiotics

The prevalence of antibiotic use varied between 34.6% and 37.6% for the period (Table 5). There were no differences according to hospital size (Table 6).

Discussion

There was remarkably extensive participation of institutions during this initial period, which reached 83% of the NPUH hospitals in 2010.

The results show that the prevalence of NI, both overall and current, has varied between the 2008 survey and the following surveys. When stratifying by hospital size, we observe that group III hospitals had a reduction of 20,3% for gNI/P% and 43.5% for acNI/P%. Group I and II hospitals show no such trend. In our view, there are several possible reasons for this. First, the VINCat program began in 2007. While the majority of group I and II hospitals had already implemented an Infection Control Team and NI surveillance program, some group III hospitals had to launch the team and program, which required an effort on the part of the institutions to designate medical and nursing staff who could commit time to this task. Therefore, data for 2008 would reflect the baseline situation and subsequent data could have been the result of the impact of these actions. This impact is not seen in groups I and II, which already had consolidated programs and whose prevalence remained stable. Second, the greater number of participating small hospitals in 2009 and 2010, with lower prevalence of NI, may influence the decrease in the combined prevalence. However, the analysis of institutions that have participated for the 3 years shows the same trend. Third, we cannot rule out the learning effect that may have taken place between the

Table 4
Mean prevalence of patients with NI acquired during the current hospitalization (acNI/P%) by hospital size

	VINCat 2008*		VINCat 2009*		VINCat 2010*	
Hospital size groups	acNI/P% (rank)	No. hospitals	acNI/P% (rank)	No. hospitals	acNI/P% (rank)	No. hospitals
Group I >500 beds	7.4 (0-12.3)	7	9.1 (7.8-11.7)	4	8.8 (5.1-13.0)	7
Group II 200-500 beds	5.5 (1.5-11.3)	13	5.1 (2.0-9.2)	13	5.9 (0.7-9.4)	16
Group III <200 beds	6.2 (0.0-14.8)	23	2.7 (0.0-6.1)	28	2.9 (0.0-8.6)	35

*3 single-purpose hospitals were excluded from the analysis.
acNI/P%: prevalence of patients with NI acquired during the current hospitalization.

Table 6
Use of antibiotics according to hospital size

	VINCat 2008*		VINCat 2009*		VINCat 2010*	
Hospital size groups	Antibiotic use % (rank)	No. hospitals	Antibiotic use % (rank)	No. hospitals	Antibiotic use % (rank)	No. hospitals
Group I >500 beds	39.0 (27.0-47.4)	7	40.0 (34.0-43.0)	4	37.1 (24.1-43.4)	7
Group II 200-500 beds	39.9 (30.6-60.9)	13	37.8 (27.0-56.7)	13	38.2 (24.2-56.4)	16
Group III <200 beds	35.7 (0.0-56.3)	23	33.8 (0.0-57.0)	28	34.6 (0.0-68.1)	35

*3 single-purpose hospitals were excluded from the analysis.

2008 survey and the following surveys in group III hospitals, which had less experience in collecting data on NI.

The differences between gNI/P% and acNI/P% show that between 17.3% and 26.9% of patients with NI at the time of the study had acquired it in a previous hospitalization at the same institution. Regarding the two measures of NI prevalence, we believe that the global prevalence gNI/P% is a better approximation of the total burden of NI in the institution because it measures the proportion of patients treated for this problem at the time of the study. Other authors have used different indicators. For example, the French national prevalence survey[27] defines NI as all infections associated with health care, acquired in the study institution or at some other institution. The EPINE study recorded information on NI acquired during another hospitalization or other institutions,[28] although its proportion is presented separately. VINCat, with the option of providing information by institution, decided to include those associated with hospitalization in the same institution. It is likely that in order to have a regional perspective of the total burden, we must also include a section for NI acquired in another healthcare institution.

A comparison of the results with data from other European studies is difficult, given the differences in measures, definitions, methodology and type of population included. Still, the results are within the range obtained in recent studies.[13-16,27,29] If we compare these results to those of the EPINE study, which has a similar methodology, at the Spanish state level[29] for the period 2008-2010, the prevalence of patients with NI acquired during the current hospitalization varies between 6.7% and 7%, which is above the acNI/P% of the VINCat Program. It is likely that this is related to the differences among the study population, which had a greater representation of larger and medium hospitals due to the inclusion criteria. If we compare data by hospital size, the differences between both studies are found in group III, with very similar prevalence rates in groups I and II.

The proportion of patients who underwent urinary catheterization was slightly lower than that obtained in other studies in which the prevalence was between 18%-20%.[13-16,27,29] The use of closed circuit drainage was high, above 90% on average, and did not vary during the study period. These results show that the NPUH institutions mostly used the closed drainage system, although it should be noted that in our study we only evaluated the type of system used, not its maintenance.

In terms of antibiotics, the proportions varied between 34.6% in 2008 and 37.6% in 2010, with an increasing trend. Regarding hospital size, group I and II institutions behaved similarly and those of group III had a lower proportion. The results are similar to those of other recent studies[13-16,27,29] in which the use of antimicrobials varied between 24% and 43%. The EPINE 2010 study reported that the use of antibiotics was 42.3%, with no differences due to hospital size, which was higher than our results. As with the on NI prevalence, the differences may be due to the sample included.

Regarding the validity of the data and given that its collection was performed by hospital personnel, there may be differences between institutions. Although the manual recommends that the institution coordinator validate 5%-10% of the surveys, this validation has not been monitored. However, there are points in favor of the validity of the data given that, as indicated earlier, many NPUH hospitals had incorporated the prevalence surveys as part of the routine surveillance of NI, and thus the personnel responsible for surveillance was already familiar with the methodology and definitions. Moreover, ongoing technical training and support performed by the coordination center has undoubtedly helped the appropriate collection of data. As has been reported in the literature, the training of personnel who perform the data collection is a key aspect in reducing variability.[2] Still, studies that have incorporated some method of validation show variable results, and therefore it is recommended that a formal validation and/or confirmation of correlation between surveyors be included to increase confidence in the interpretation of the data.

Prevalence studies are useful because they give an overview of the burden of NI and the frequency of use of instruments of risk and antibiotics. The periodic repetition of these studies helps monitor the evolution of these phenomena.[4] As noted by some authors,[31] however, the comparison of raw prevalence data between institutions and over time may be distorted by differences in the *case mix*. Therefore, the inclusion of comorbidity indices may be useful for performing these comparisons by adjusting for risk, which is an issue that must be addressed in the future.

This study presents the results of NI prevalence in acute care hospitals of Catalonia (VINCat Program) for the period 2008-2010. There was extensive involvement by institutions, with an implementation of a common protocol with minimum information, which probably contributed to this involvement. The two prevalence indicators of patients with NI (gNI/P% and acNI/P%) provided information on the total burden of NI at the institutional and regional level. Moreover, the process indicators (the percentage frequency of the use of closed circuit urinary catheterization and the percentage use of antibiotics) measure two aspects related to the quality of healthcare. In those institutions that did not have a surveillance program and NI control, the prevalence study has allowed the institution to come into contact with the problem and, based on the results, establish areas of improvement. In those institutions with surveillance system objectives, the implementation of a prevalence survey provides an overview and detects potential risk areas that lie outside the specific objectives.

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Conflicts of Interest

The authors declare that they have no conflicts of interest.

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