

SUPPLEMENTAL DIGITAL CONTENT

Methods

Organization of the Spanish National Health Care System

The Spanish National Health System is a public system that provides full free health care services to all citizens living in Spain. The organization depends on the Ministry of Health, Social Policy and Equality, although competences of the system are transferred to the 17 Health Regions (one for each Autonomous Community) to which the country is divided. The central government administration and the Health Regions work in coordination to cover all health care duties and benefits for which public authorities are legally responsible. The Central Government is involved in health basic principles and general coordination, foreign health affairs and international relations and agreements and legislation on pharmaceutical products.

The Quality Agency of the Ministry of Health, Social Policy and Equality proposes to a national level. One of these proposals was the project for the prevention of catheter-related bloodstream infections (CRBSI), the so-called Bacteremia Zero project. This project was supported by the Quality Agency of the Ministry of Health, Social Policy and Equality and accepted by all health councils of the Health Regions, which made diffusion of the project to the different hospitals with intensive care unit (ICU) available in the area. In each Autonomous Community project managers were appointed who were responsible to contact the leaders of each participating ICU. Managers at each hospital signed a compromise for active participation through which they agreed to facilitate the implementation of measures proposed in the project.

Organizational Structure of Intensive Care Medicine

In relation to organizational structure of critical care medicine, Intensive Care Medicine has been officially recognized as a basic specialty since 1981. The Spanish Society of Intensive and Critical Care Medicine and Coronary Units (SEMICYUC) is the scientific society that agglutinates Intensive Care Medicine specialists. One of the working groups of SEMICYUC is the Infectious Diseases Working Group, which promotes training activities, epidemiologic studies, or registry of infections related to invasive devices (ENVIN-HELICS). This group has established a national network of intensivists with special interest in the field of infectious diseases in the critically ill patient, who cooperate continuously in the different projects developed by the Infectious Diseases Working Group.

Description of the ENVIN-HELICS Registry

The ENVIN-HELICS registry was developed in 1994 with the aim of recording infections related to invasive devices developed during the patient's stay in the ICU. To this purpose a database was designed which has been adapted to the European surveillance normative (HELICS-ECDC). Currently, data are collected using the ENVIN-HELICS software application located in a web-based server available through Internet (<http://hws.vhebron.net/envin-helics>). The database (in SQL Server) runs on the same server. Access is free previous registration of responsible physicians at each ICU. The program is supplemented by safety systems that force to enter data of variables defined as basic and prevent to enter illogical values, as well as by self-analyses systems, which allow obtaining real-time information for each ICU in particular and for national data set. Participation in the ENVIN-HELICS registry is voluntary and the data collection is longitudinal and prospective. Since its implementation, the inclusion of

UCIs has been increasing, with a total of 174 ICUs in 2010 (53% of all Spanish ICUs). Information provided by the registry is as follows: a) administrative data including patient characteristics, occupancy rate, severity level, mean length of stay, mortality rate; b) rates of infections that are controlled in the registry (e.g. ventilator-associated pneumonia, catheter-related infection, etc.) in relation to patients admitted to the ICU, the days of ICU stay, and days in which the risk factor associated with each infection was present; c) etiology of each controlled infections; d) markers of multiresistance of the most frequent pathogens; and e) consumption of antimicrobials. Annual national reports are available at the webs of the ENVIN-HELICS registry and the SEMICYUC. The first database audit was performed in 2009 (currently in the publication process).

Adherence to the Intervention

A registry of adherence to six measures of the intervention was established (chlorhexidine skin antisepsis, check-list for catheter insertion, central-line cart, daily goals, learning from errors, and safety rounds) through a web site available at <http://hws.vhebron.net/bacteriemia-zero/>. Adherence to safety indicators were registered by 90% of the participating ICUs. The percentage of ICUs that had registered these measures at least on one occasion is shown in Figure 1-e. Use of chlorhexidine, check-list, and central-line cart were the measures with the highest adherence. The overall adherence rate during the study period was higher than 50%.

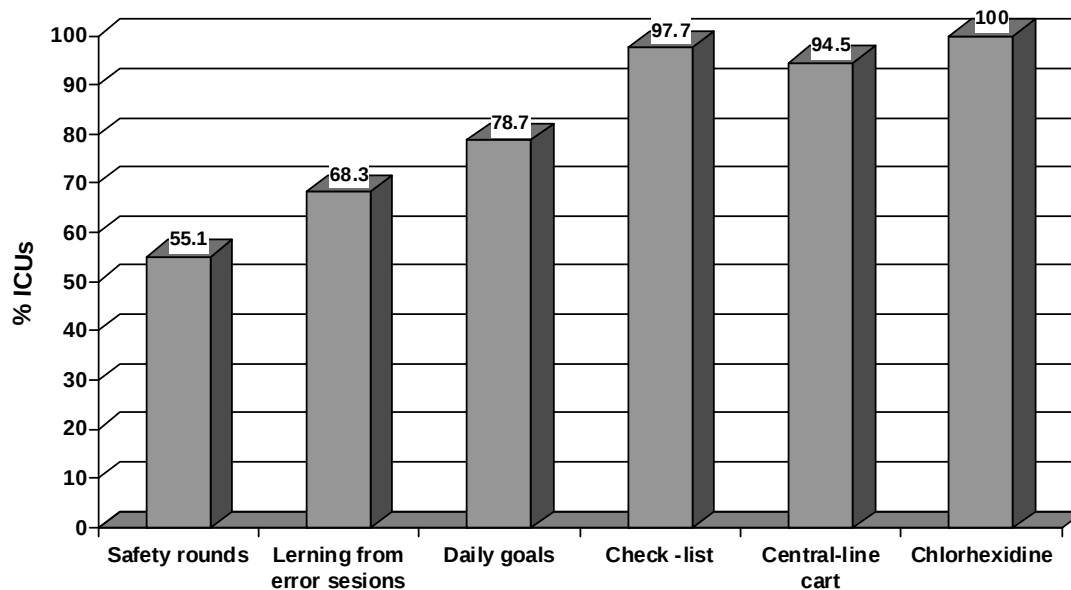


Figure 1-e. Adherence to six safety indicators of the Bacteremia Zero project.

Etiologies of CRBSI

In the 1399 cases of CRBSI identified in the post-implementation phase, 1753 microorganisms were isolated. As shown in Table 1-e, there was a predominance of Gram-positive pathogens (60.5%) especially *Staphylococcus epidermidis* (26.1%). In the group of Gram-negative pathogens (28.1%), *Pseudomonas aeruginosa* was the most frequent pathogen (6%). A total of 185 cases of fungemia were diagnosed, with *Candida albicans* as the most frequent species (4.4%).

Table 1-e. Etiologies of CRBSI during the 18-month period after implementation of measures of the Bacteremia Zero project

	CRBSI
Total microorganisms	1753
Gram-positive cocci	1061 (60.52)

<i>Staphylococcus epidermidis</i>	458 (26.13)
Coagulase-negative <i>Staphylococcus</i>	263 (15.0)
<i>Enterococcus faecalis</i>	112 (6.39)
Other <i>Staphylococcus</i> spp.	77 (4.39)
<i>Methicillin-susceptible Staphylococcus aureus</i>	47 (2.68)
<i>Enterococcus faecium</i>	43 (2.45)
<i>Methicillin-resistant Staphylococcus aureus</i>	34 (1.94)
Other <i>Streptococcus</i> spp.	17 (0.97)
Other Gram-positive pathogens	10 (0.57)
Gram-negative bacilli	493 (28.12)
<i>Pseudomonas aeruginosa</i>	106 (6.05)
<i>Klebsiella pneumoniae</i>	81 (4.62)
<i>Acinetobacter baumannii</i>	69 (3.94)
<i>Enterobacter cloacae</i>	51 (2.91)
<i>Escherichia coli</i>	44 (2.51)
<i>Serratia marcescens</i>	30 (1.71)
<i>Proteus mirabilis</i>	21 (1.20)
<i>Enterobacter aerogenes</i>	18 (1.03)
<i>Stenotrophomonas maltophilia</i>	14 (0.80)
<i>Klebsiella oxytoca</i>	13 (0.74)
Other Gram-negative bacilli	46 (2.62)
Fungi	185 (10.55)
<i>Candida albicans</i>	77 (4.39)
<i>Candida parapsilosis</i>	62 (3.54)
<i>Candida glabrata</i>	23 (1.31)
<i>Candida tropicalis</i>	9 (0.51)
Other <i>Candida</i> spp.	12 (0.69)
Other fungi	2 (0.11)
Other microorganisms	14 (0.80)

Percentages in parenthesis.