



OUTCOME AND PROCESS SURVEILLANCE WORLDWIDE. INTERNATIONAL NOSOCOMIAL INFECTION CONTROL CONSORTIUM (INICC)

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INTRODUCTION

Dr. Victor D. Rosenthal, MD, CIC, MSc, founder and director of INICC, received his training in Infection Control and Hospital Epidemiology at APIC, SHEA, JCAHO, and Wisconsin University. He initiated a system to collect data in 1998 from three hospitals in Buenos Aires where active prospective surveillance in intensive care units (ICU) and in surgical settings was performed.

The original data forms were adapted from the Center for Disease Control and Prevention's (CDC) National Nosocomial Infection Surveillance system (NNIS). However these forms did not allow detection of risk factors, mortality, and extended length of stay or cost. Therefore, a new form was developed to record data from control patients as well as cases with HAI. The new forms include name, medical record, age, gender, underlying diseases, and severity of illness score at time of entrance to the ICU. Data on temperature, blood pressure, use of invasive devices, cultures taken, presence of clinical pneumonia, antibiotic use, and characteristics of any infection is collected both for cases and controls daily. This allows analysis of cases and controls in a prospective cohort nested studies.

These studies showed that the principal modifiable risk factors associated with HAI were invasive devices.¹⁻¹¹ The only modifiable risk factor found to prevent mortality was the reduction of HAI.^{4-6, 8, 11} Surveillance lead to an understanding of several aspects of causality related to HAIs and, as a result, allowed more effective and targeted interventions. Process surveillance and performance feedback on hand hygiene compliance, vascular catheter care, Foley catheter care, mechanical ventilator care, and surgical site care were implemented. Data showed a significant and timely sustained reduction in HAI rates, associated mortality, extra length of stay, extra cost, and antibiotic consumption.

INTERNATIONAL STUDIES

By 2001, following a series of talks at national meetings in different countries, Dr Rosenthal started receiving requests for advice on conducting this type of surveillance from several countries in Latin America, Asia, Europe, and Africa and this stimulated development of a global international strategy. This project was named the International Nosocomial Infection Control Consortium (INICC), and its aims are as follows:

- 1- Surveillance in ICUs of any type.
- 2- Participants must have an infection control nurse, and a microbiology laboratory.
- 3- A protocol is sent to each hospital that wishes to participate.
- 4- The recipient agrees to participate by reviewing the protocol with the research committee (if any), signing a commitment sheet, and sending it to the INICC central office in Buenos Aires.
- 5- As soon as the signed commitment is received, the central office sends forms and a manual.



- 6- The central office is open from Monday to Friday 12 hours daily to answer questions by email, fax, or phone related to the methodology, completing the forms, and general infection control guidelines. A mobile phone number is available for advice 24 hours a day, 7 days a week.
- 7- Participating hospitals send completed forms to the central office monthly.
- 8- Every month the data entry team in Buenos Aires uploads the data to software developed by Dr. Rosenthal.
- 9- Validation of forms' is performed by matching daily antibiotic use, presence of fever, blood pressure reduction, cultures taken, and culture results with the HAI diagnosis. The central office detects under-diagnosis or over-diagnosis of HAI. A random sample of forms is validate monthly.
- 10- Every month the central office sends each hospital a report detailing those patients suspected of having an HAI diagnosis. The participant hospital validates the suspicion by reviewing each case.
- 11- An outcome and process rate report is prepared using PowerPoint charts and tables. It is sent to each participant hospital monthly.
- 12- The monthly report includes the following surveillance data: HAI per 1000 bed days, percentage of HAI, bloodstream infections (BSI) per 1000 CVC days, urinary tract infections (UTI) per 1000 Foley days, ventilator-associated pneumonia (VAP) per 1000 ventilator days, microbiological profile by type of infection, bacterial resistance by type of bacteria, type of bacteria per 1000 bed days, extra length of stay by HAI type, and extra mortality by HAI type.
- 13- The monthly report includes the following process surveillance data: hand hygiene compliance stratified by healthcare worker (HCW), work shift, and gender; vascular catheter care compliance, detailing five different aspects of care; and Foley catheter and mechanical ventilator care compliance.
- 14- The outcome and process surveillance charts are posted on the wall of the ICUs as performance feedback information. This has proven to be useful in improving infection control guidelines compliance and subsequently reducing HAI rates.
- 15- The infection control guidelines designed to reduce HAI rates and consequences are the local approved national guidelines (after Dr. Rosenthal checks their accuracy); or International Federation of Infection Control (IFIC), World Health Organization, Pan American Health Organization, or CDC's Healthcare Infection Control Practices Advisory Committee's guidelines, if applicable.
- 16- This process is a multiple approach strategy combining the following interventions:
 - a. Outcome surveillance.
 - b. Process surveillance.
 - c. Performance feedback.
 - d. Targeted interventions guided by risk factor analysis.
 - e. Cost effective interventions guided by cost analysis.
 - f. Tutorial for surveillance.
 - g. Training in infection control guidelines application.
 - h. Secretarial and administrative support in entering data and developing charts.
 - i. Scientific data analysis and data interpretation to guide actions.
 - j. Sharing data at scientific meetings and in peer review journals, allowing other hospitals worldwide with similar conditions to learn about new approaches to fight against HAI.



Findings of an International Infection Control Consortium (INICC) surveillance study from 2002 through 2005 in 57 ICUs in Argentina, Brazil, Colombia, Peru, Philippines, Mexico, Turkey, India and Morocco.

22,069 patients in study ICUs, for an aggregate of 144,188 days, acquired 3,207 device-associated HAIs, i.e. 14.5% or 22.2 infections per 1,000 ICU-days. Although device utilization in the developing countries' ICUs was remarkably similar to that reported from U.S. ICUs in the CDC's National Nosocomial Infection Study (NNIS) network, rates of device-associated HAI were markedly higher in the ICUs of the INICC hospitals (See Table 1).

Table 1. Device-Associated HAI

	Pooled rate of CVC-associated BSI	VAP	CAUTI	References
Consortium medical-surgical ICUs	12.4 per 1000 central line-days	23.9 per 1000 ventilator-days	8.6 per 1000 catheter-days	¹²
NNIS comparable U.S. ICUs	3.1 - 3.4 per 1000 central line-days	4.6 - 5.1 per 1000 ventilator-days	3.1 - 3.3 per 1000 catheter-days	¹³

VAP = Ventilator-acquired pneumonia

CAUTI = catheter-associated urinary tract infection

Most strikingly, the frequencies of resistance of *Staphylococcus aureus* isolates to methicillin—MRSA (81.6% vs. 48.1%), Enterobacteriaceae to ceftriaxone (50.0% vs 17.8%) and *Pseudomonas aeruginosa* to fluoroquinolones (58.3% vs. 29.1%) were also far higher among the consortium ICUs than in the NNIS survey.. The crude unadjusted mortality of device-related infections ranged from 37.7% (CAUTI) to 43.4% (VAP). Length of stay (LOS) of patients without HAI was 4.9 days; LOS of patients with CVC-BSI was 14.1 days (RR, 2.89; 95% CI, 2.83-2.96; P, 0.0000), representing 9.2 extra days; LOS of patients with VAP was 14.1 days (RR, 2.89; 95% CI, 2.83-2.95; P, 0.0000), representing 9.2 extra days; and LOS of patients with CA-UTI was 13.2 days (RR, 2.70 ; 95% CI, 2.62-2.77; P, 0.0000), representing 8.3 extra days.

INICC

Today in 2005, the INICC includes around 50 hospitals from 30 cities from 11 countries (Argentina, Brazil, Colombia, Croatia, Egypt, India, Mexico, Morocco, Peru, Philippines, and Turkey) on four continents (America, Africa, Asia, and Europe).

There have been more than 170 peer review manuscripts published at peer review journals and scientific abstracts presented at international meetings describing the methodology and successful results of the INICC Project. The data in Table II come from various countries, and have either been presented elsewhere, and will be presented at future meetings including the IFIC meeting in Cape Town and Pan American Infection Control Meeting in Brazil.

INICC is growing quickly and several hospitals in developing countries, or under-resourced hospitals, are requesting interventions to improve the infection control process; to identify modifiable risk factors; and to perform cost effective interventions. All these strategies have a main goal of reducing morbidity and mortality attributable to HAI.

IFIC Collaboration

The INICC project is consistent with IFIC's mission, i.e., "...minimize the risk of infection within the healthcare setting world-wide through development of a network of infection control organizations for communication, consensus building, education and sharing expertise". In addition, IFIC occupies a global platform that is independent of any single country or continent. While the consortium has been exceedingly successful to date, expansion of the INICC surveillance model has the potential of optimizing prevention of HAIs worldwide. Through a new partnership with IFIC, INICC representatives envision a consortium that: i) is scientifically validated, ii) embraces open communication to share information and findings, and iii) improves safety and quality of care in facilities that are located in under-resourced countries.

**Table 2. Outcomes of INICC surveillance**

Country	Study Type	ICU	Reduction	RR	CI (95%)	p-value	Ref
Argentina							
	Overall D-A I	A	41%; 47.55 to 27.9 / 1000 bed-days	0.59	0.46 - 0.74	<0.0001	⁵
	IVD-BSI	A	75%; 45.94 to 11.1 / 1000 catheter days	0.25	0.17 - 0.36	<0.001	¹⁴
	IVD-BSI	A	64%; 6.52 to 2.36 / 1000 catheter days	0.36	0.14 - 0.94	0.02	¹⁵
	VAP	A	31%; 51.28 to 35.5 / 1000 ventilator days	0.69	0.49 - 0.98	<0.003	¹⁶
	CA-UTI	A	42%; 21.3 to 12.39 / 1000 catheter days	0.58	0.39 - 0.86	0.006	¹⁷
BRAZIL							
	IVD-BSI	A	50%; 14 to 7.1 / 1000 CVC days	0.5	0.32 - 0.8	0.0029	¹⁸
	IVD-BSI	A	54%; 7.1 to 3.2 / 1000 CVC days	0.46	0.23 - 0.91	0.02	¹⁹
COLOMBIA							
	IVD-BSI	N	89%; 54.8 to 6 / 1000 CVC days	0.11	0.01 - 0.98	0.0163	²⁰
INDIA							
	Overall D-AI	A	99.3%; 3.89 to 0.29 / 1000 bed-days	0.07	0.02 - 0.34	0.000	²¹
	Overall D-AI	A	62%; 18.09 to 6.89 / 1000 bed-days	0.38	0.19 - 0.78	0.006	²²
	Mortality	A	78%; 1.9 to 0.4 / 1000 bed-days	0.22	0.06 - 0.74	0.0071	²³
	IVD-BSI	A	54%; 22.6 to 10.3 / 1000 bed-days	0.46	0.21 - 0.98	0.03	²²
	VAP	A	50.6%; 29.1 to 14.4 / 1000 ventilator days	0.49	0.26 - 0.93	0.0246	²³
	CA-UTI	A	88.8%; 4.5 to 0.5 / 1000 catheter days	0.11	0.01 - 0.86	0.0104	²³
MEXICO							
	Overall D-AI	N	62% ; 12.96% to 4.95%	0.38	0.15 - 0.99	0.0393	²⁴
	Mortality	A	78%; 48.5% to 32.8%	0.68	0.50 - 0.81	0.01	⁴
	Mortality	A	33%; 27% to 16.6%	0.67	0.52 - 0.87	0.002	²⁵
	IVD-BSI	A	58%; 46.3 to 19.5 / 1000 CVC days	0.42	0.27 - 0.66	0.0001	⁴
	IVD-BSI	A	82%; 16.97 to 3.0 / 1000 CVC days	0.18	0.10 - 0.32	0.000	²⁵
	IVD-BSI	N	75%; 40.7 to 10.3 / 1000 CVC days	0.25	0.08 - 0.84	0.0152	²⁴
TURKEY							
	Overall D-AI	A	39%; 30 to 18.3 / 1000 bed-days	0.61	0.38 - 0.98	0.0380	²⁶
	IVD-BSI	A	82%; 10 to 1.8 / 1000 CVC days	0.18	0.05 - 0.6	0.0016	²⁷

ICU: A=adult; N = neonatal. D-AI = Device-associated infection. VAP = Ventilator associated pneumonia. CA-UTI = catheter-associated urinary tract infection. IVD- BSI= Intravenous device associated Blood stream infection. CVC = central venous catheter

INICC has recently joined with IFIC and now we are working together to fight against HAI. With this renewed strength and energy every hospital of every country is welcome to join the Joint INICC-IFIC program.

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We have a "Country Coordinator" per country; who has been recruiting several new hospitals, training them, supporting the logistic of sending the filled forms from the country level to the head quarters; in this role we would like to thank very much for all the hard work, responsibility, responsiveness, and commitment made especially by our country coordinators Hakan Leblebicioglu from Ondokuz Mayıs University Medical School, Samsun, Turkey and Carlos Alvarez Moreno from Hospital Universitario San Ignacio, Universidad Pontificia Javeriana, Bogota, Colombia.

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