

# **Surveillance of nosocomial infections**

## **My experience from the last 10 years**

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**Hanover Medical School, Germany**

# Situation in Germany 1993

A lot of infection control people wanted to start with surveillance, but

- no agreement about the definitions for NI (too difficult?)
- no agreement about surveillance methods
  - active or passive surveillance?
  - hospital wide or concentration on patients at risk?
  - number of risk factors to record
  - methods for standardization and stratification
- no structures to establish a national database

# German national prevalence survey NIDEP 1 (1994)

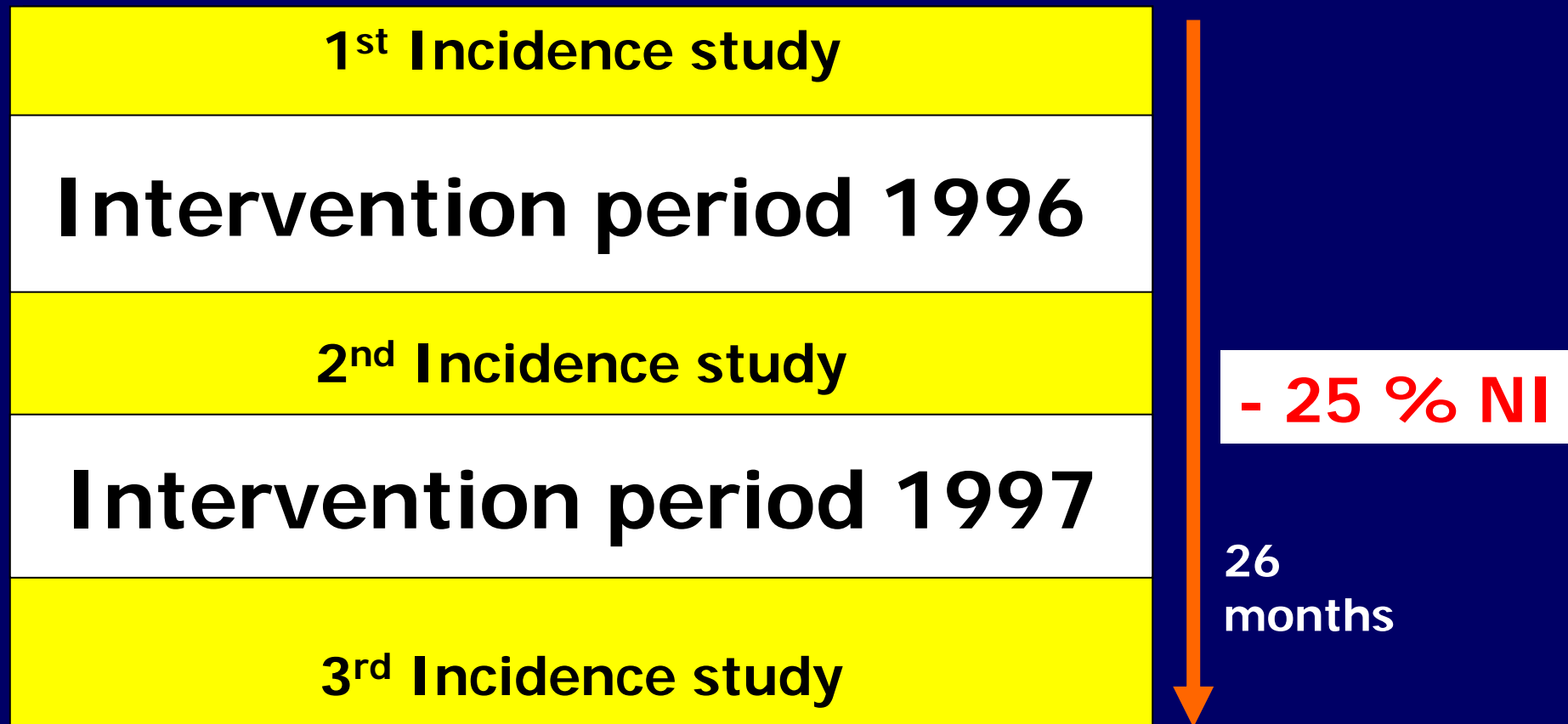
- National point-prevalence survey of nosocomial infections in 72 random selected acute care hospitals (14,966 patients)
- Overall prevalence of nosocomial infections  
**3.5 %**

Gastmeier P, Kampf G, Wischnewski N, Hauer T, Schulgen G,  
Schumacher M, Daschner F, Rüdén H.  
J.Hosp Infect 1998; 38: 37-49

## NIDEP 1 conclusions

- CDC definitions are useful, but it is necessary to train people diagnosing NI according to CDC criteria
- It is not useful to perform surveillance in all hospital departments, it makes sense to concentrate on high risk areas and high risk infections

# **NIDEP 2 (1996-98):** **Quality management project in 8 hospitals**

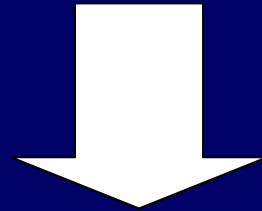


Gastmeier P et al. ICHE 202; 23:91-97

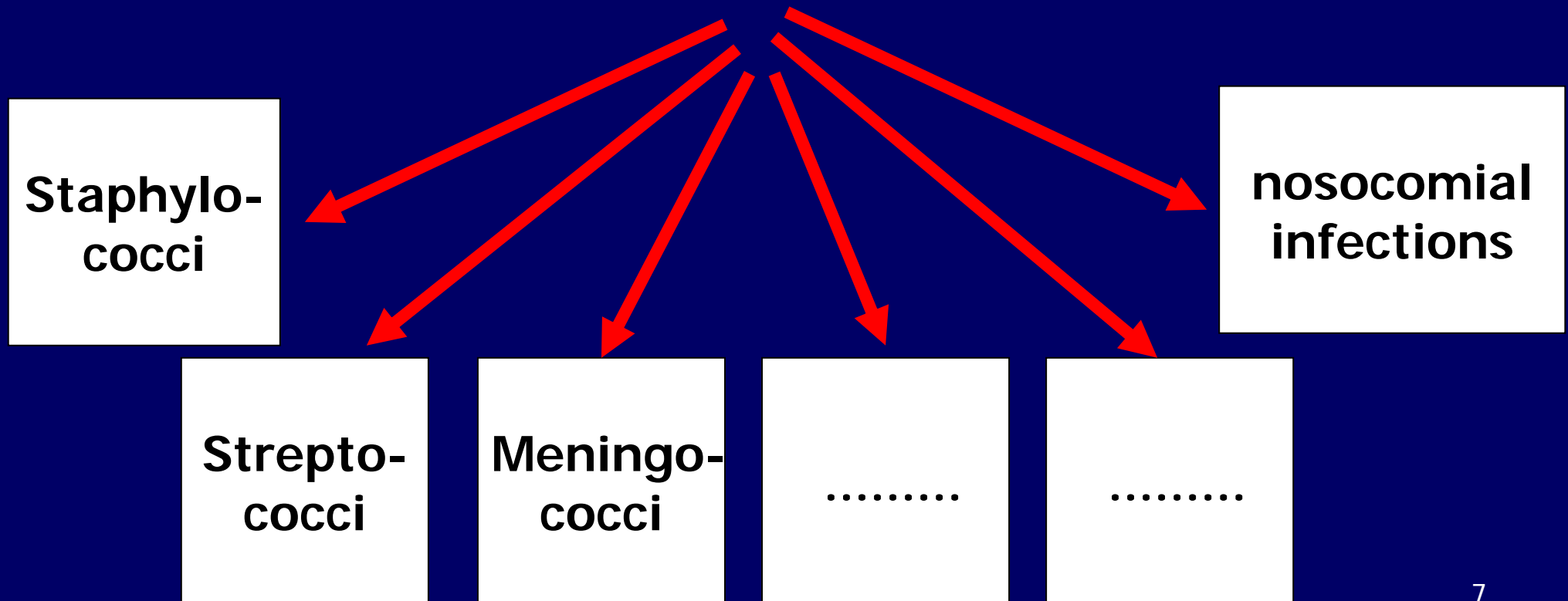
## NIDEP 2 conclusions

- It is possible to decrease nosocomial infection rates significantly by introducing surveillance and using surveillance data in quality circles to improve infection control measures

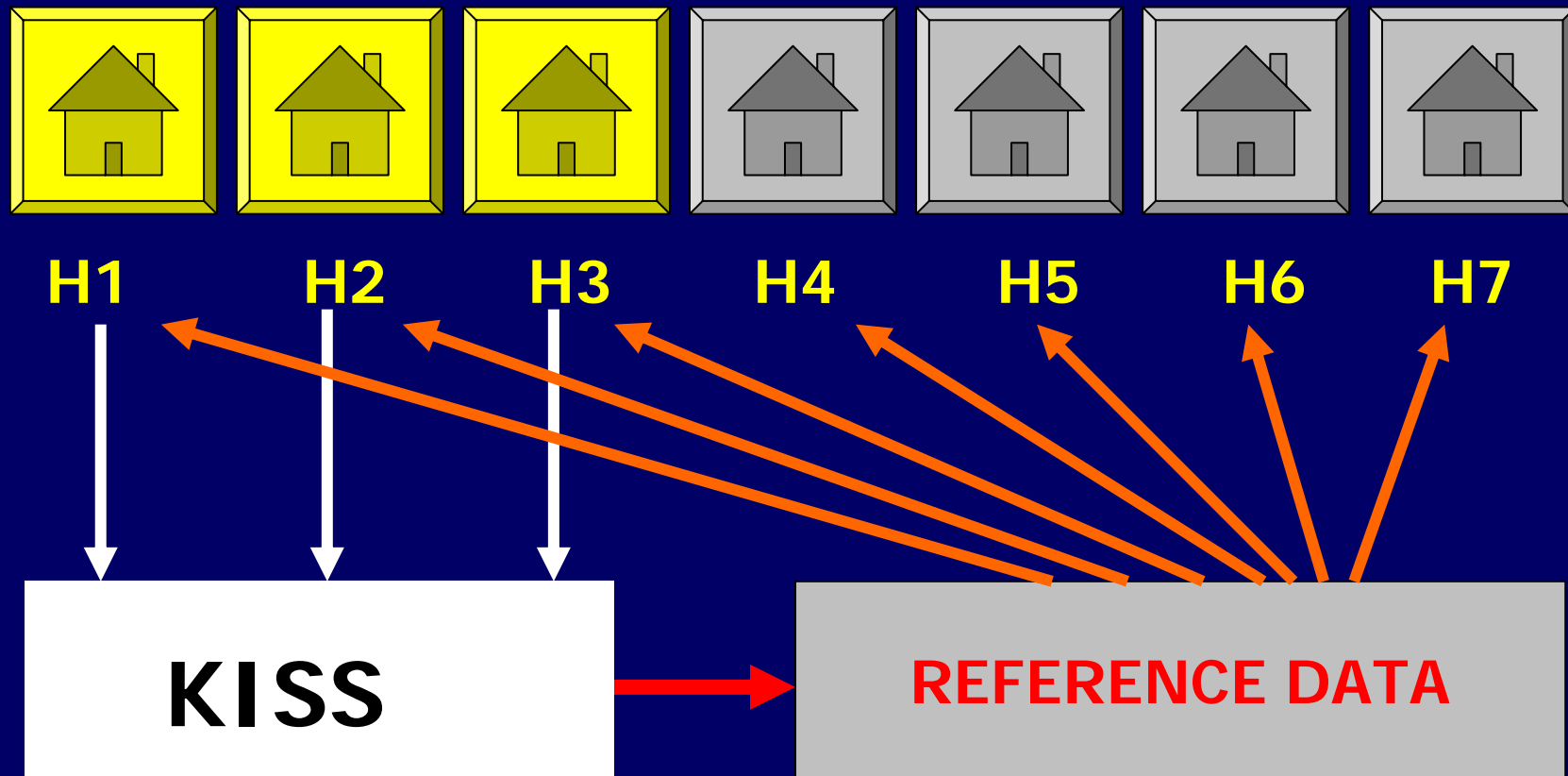
# 1996: Robert Koch-Institute



## Network of National Reference Centres

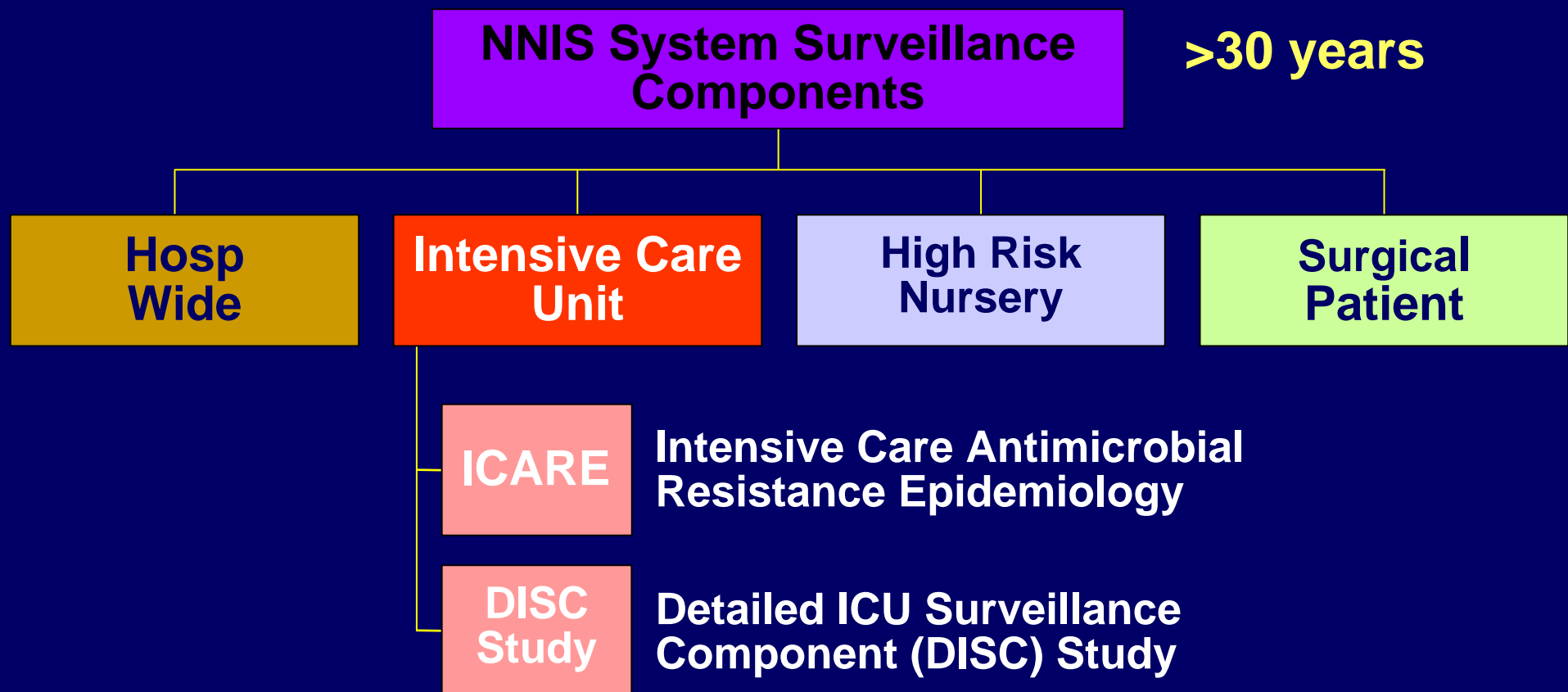


# Reference data for nosocomial infections Krankenhaus-Infektions-Surveillance System (KISS)



1. Steps of the development of the surveillance system
2. Workload for surveillance
3. Reduction of infection rates

# National Nosocomial Infections Surveillance (NNIS) System



# KISS components 2004

ICU KISS	OP KISS	NEO KISS	ONKO KISS	DEVICE KISS	AMBU KISS
For ICUs	For operated patients	For neonatal ICU patients	For BMPSCT patients	For Non-ICU patients	For out-patient surgery
289 ICUs	285 departments	39 NICUS	17 centres	95 units	105 centres

# Uniform definitions

- Translation of CDC definitions
- Training of diagnosing according to CDC definitions  
(atwo day introductory course is mandatory)

# Appropriate methods for the various patient groups

- Considering the most important risk factors
- Considering cost effectiveness

# ICU-KISS

# Method (ICU-KISS)

Concentration on:

Ventilator associated pneumonia

CVC associated Bloodstream infections

Urinary catheter associated urinary tract infections

# Method (ICU-KISS)

## Standardisation:

$$\text{VAP rate} = \frac{\text{Pneumonias in ventilated patients}}{\text{ventilator days}}$$

## Stratification:

separate data for different types of ICUs

# STANDARDIZATION: VAP pneumonia rates

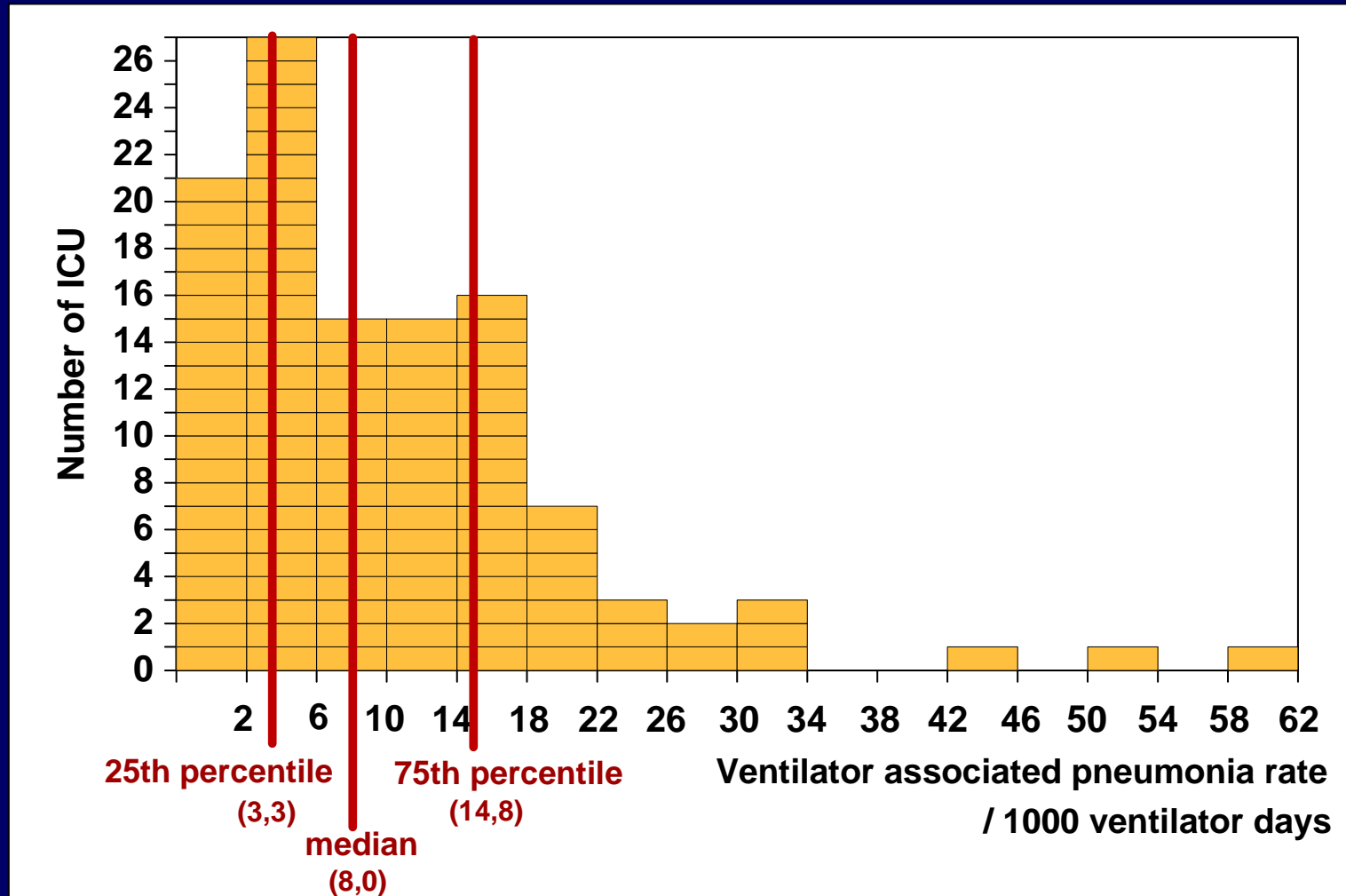
	Days on ventilation	Mean	Median	75th percentile
All ICUs (n=289)	989,259	8.5	7.0	11.8

**KISS 6/2003**

# STRATIFICATION: VAP pneumonia rates

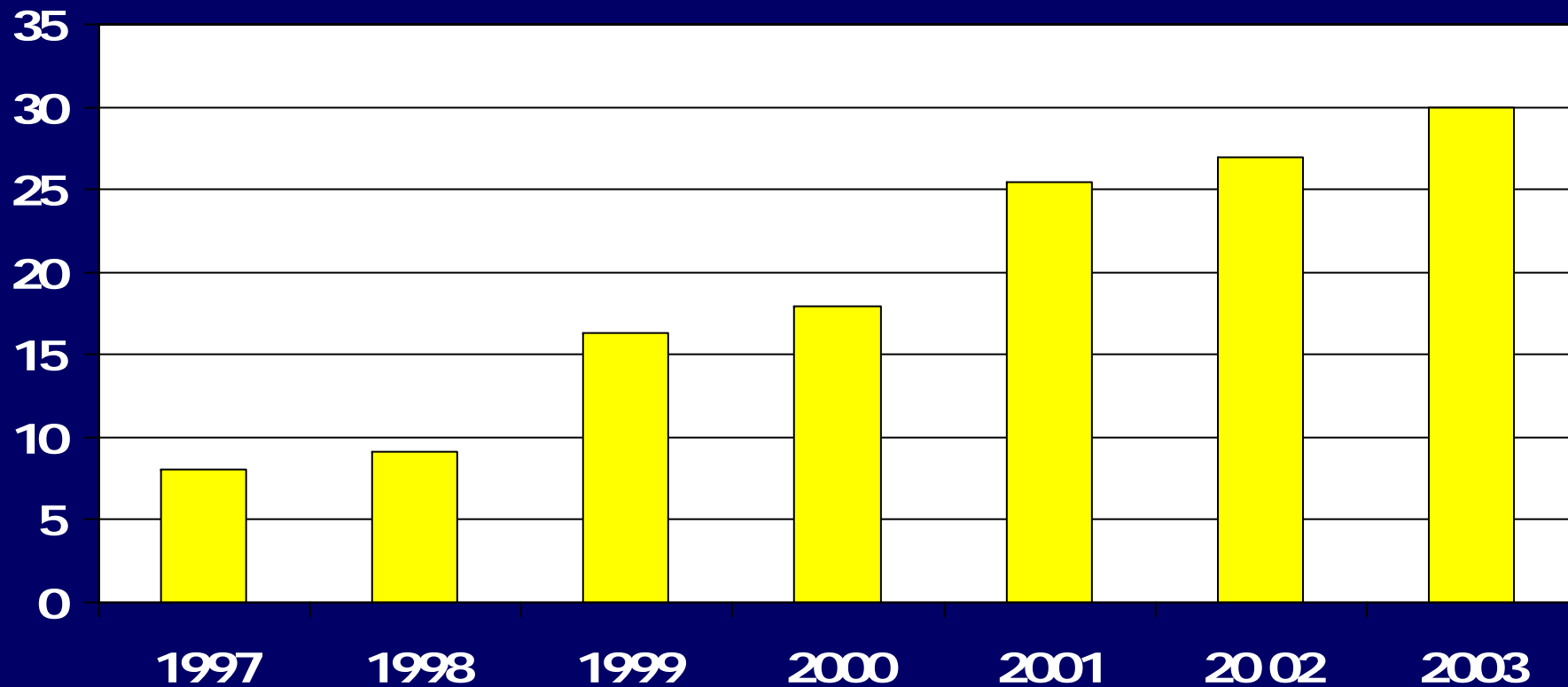
	Days on ventilation	Mean	Median	75th percentile
Medical ICUs (n=59)	156,427	7.5	6.0	9.4
Surgical ICUs (n=73)	279,237	10.2	8.2	13.1
Neurosurgical ICUs (n=10)	46,119	10.7	9.1	12.9

# DISTRIBUTION of VAP rate



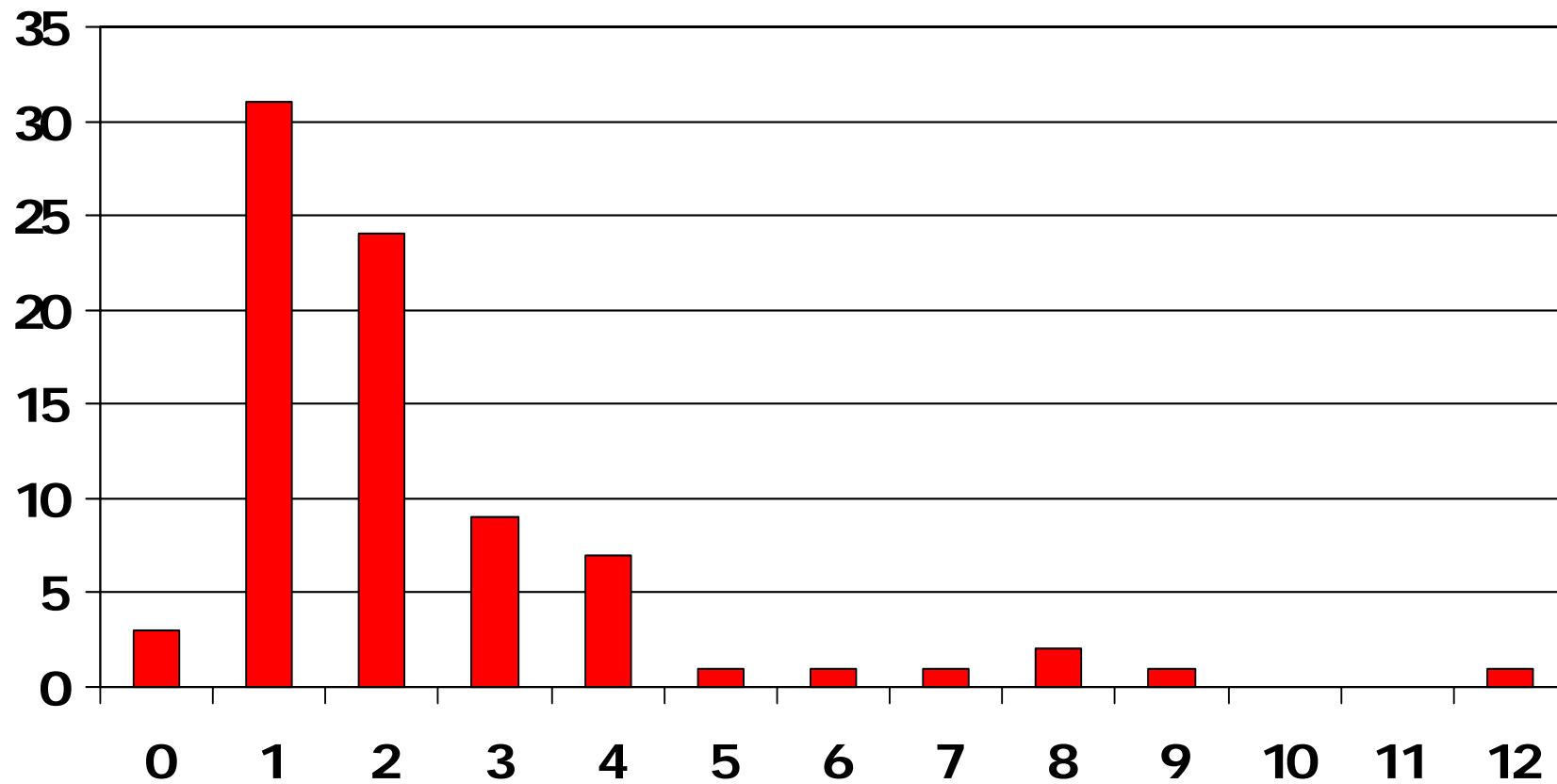
# Development of nosocomial MRSA-infections in KISS ICUs

MRSA/S.aureus (%)



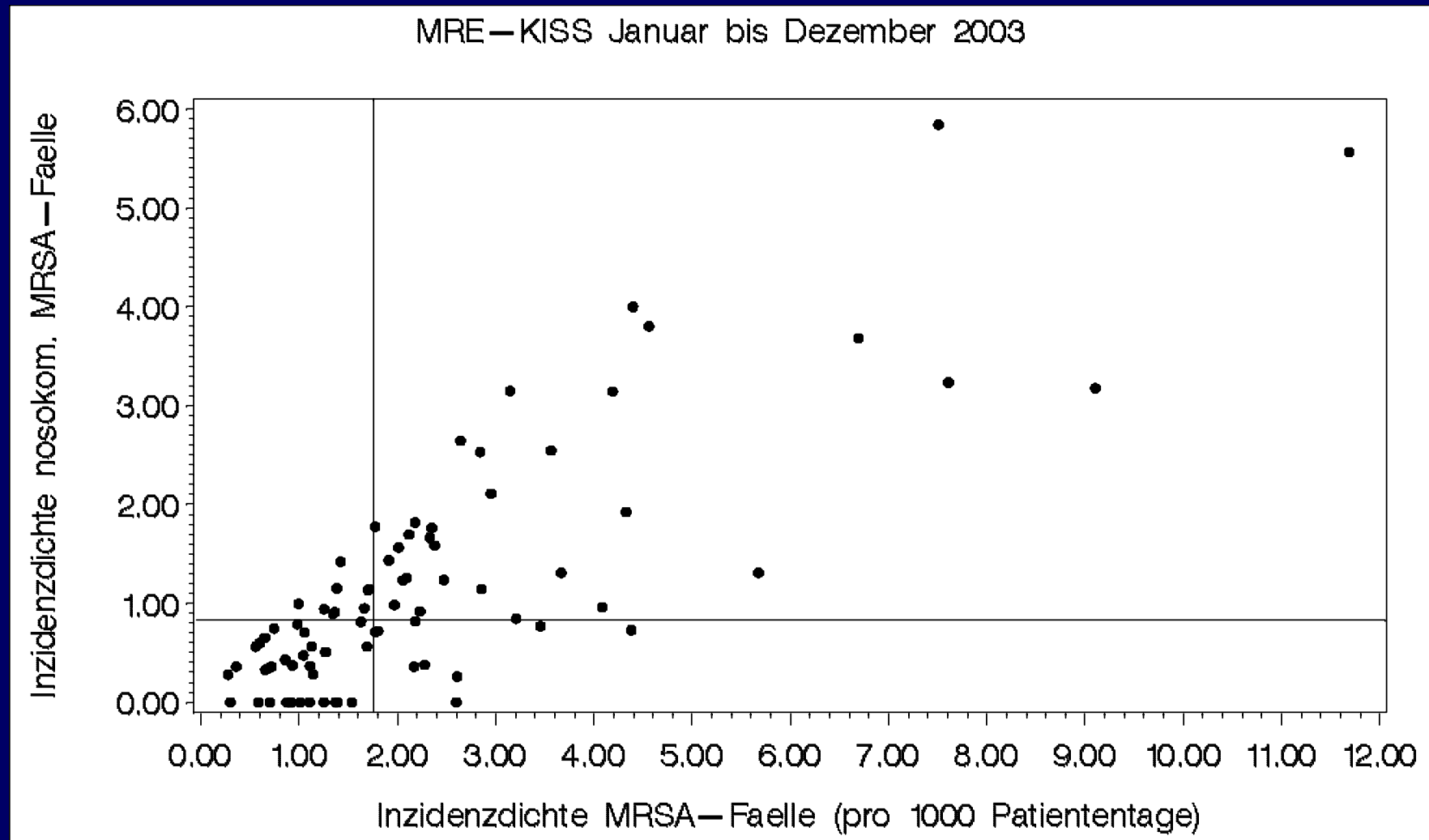
# Distribution of MRSA incidence density in KISS ICUs

Number of ICUs



MRSA/  
1000  
patient  
days

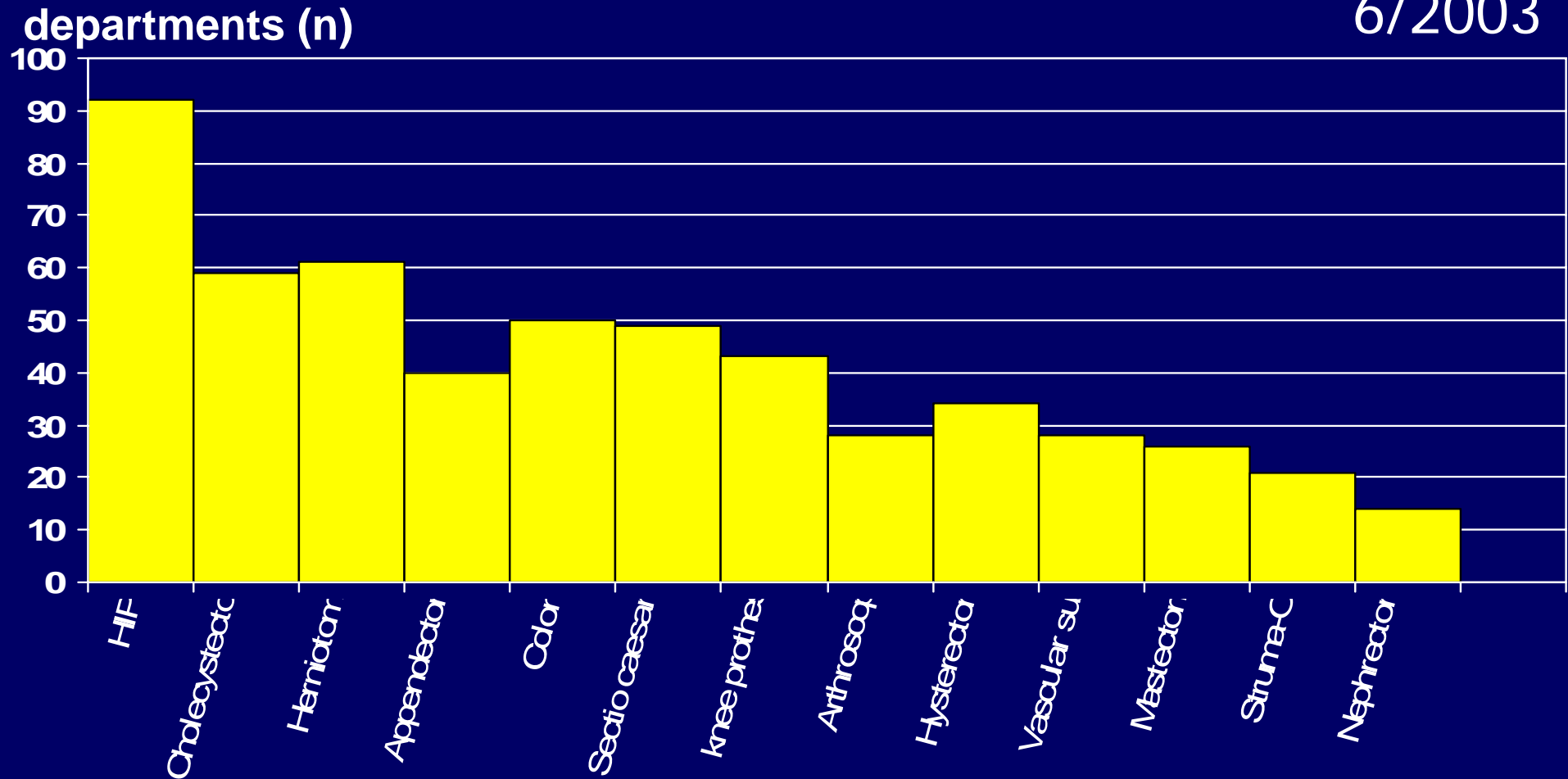
# Correlation between MRSA incidence density and nosocomial MRSA cases in KISS ICUs



# OP-KISS

# Departments per indictaor operation

6/2003



# Method (OP-KISS)

## Stratification:

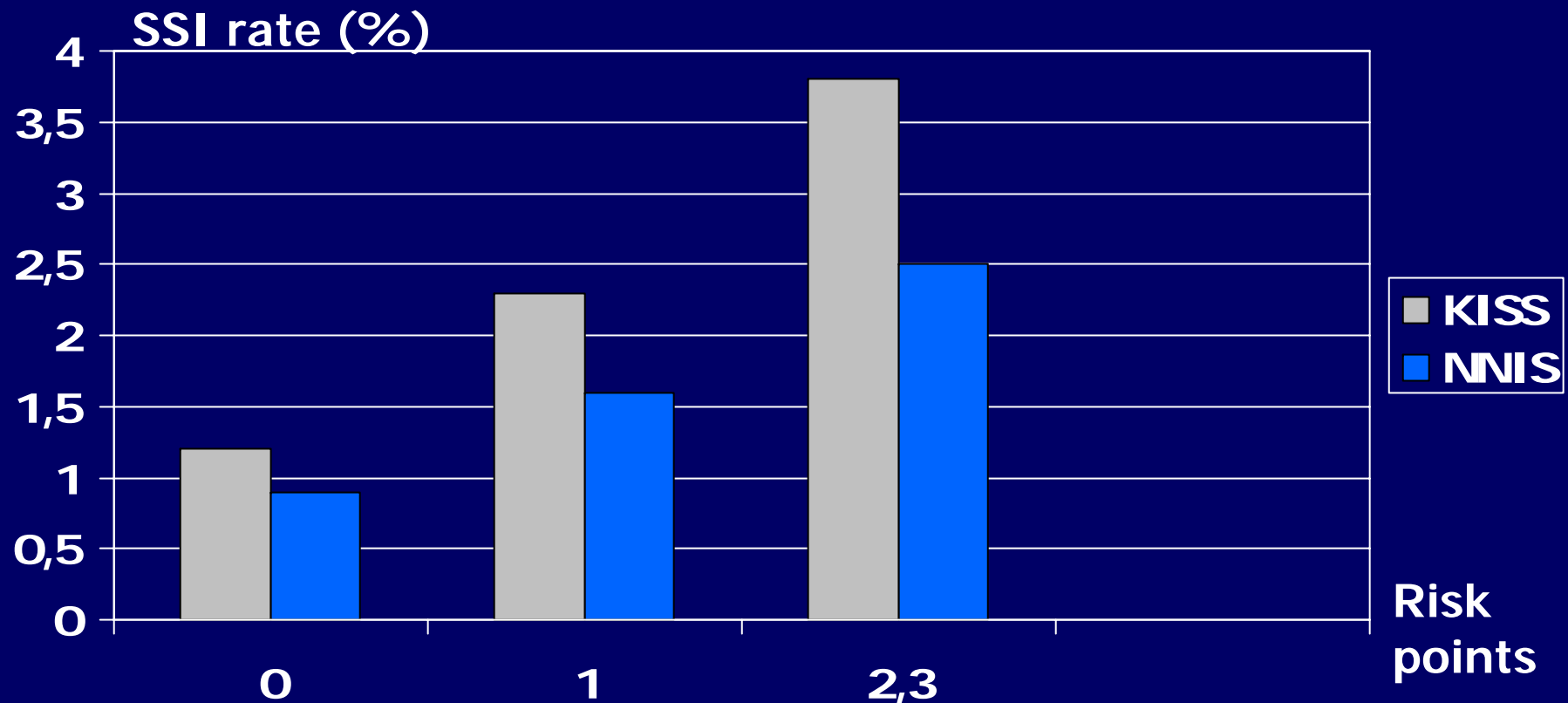
separate data according to the number of risk points

(Risk points for wound class, ASA score, duration of surgery)

Standardisation: calculation of SIR for each department

$$\text{SIR} = \frac{\text{observed SSI}}{\text{expected SSI}}$$

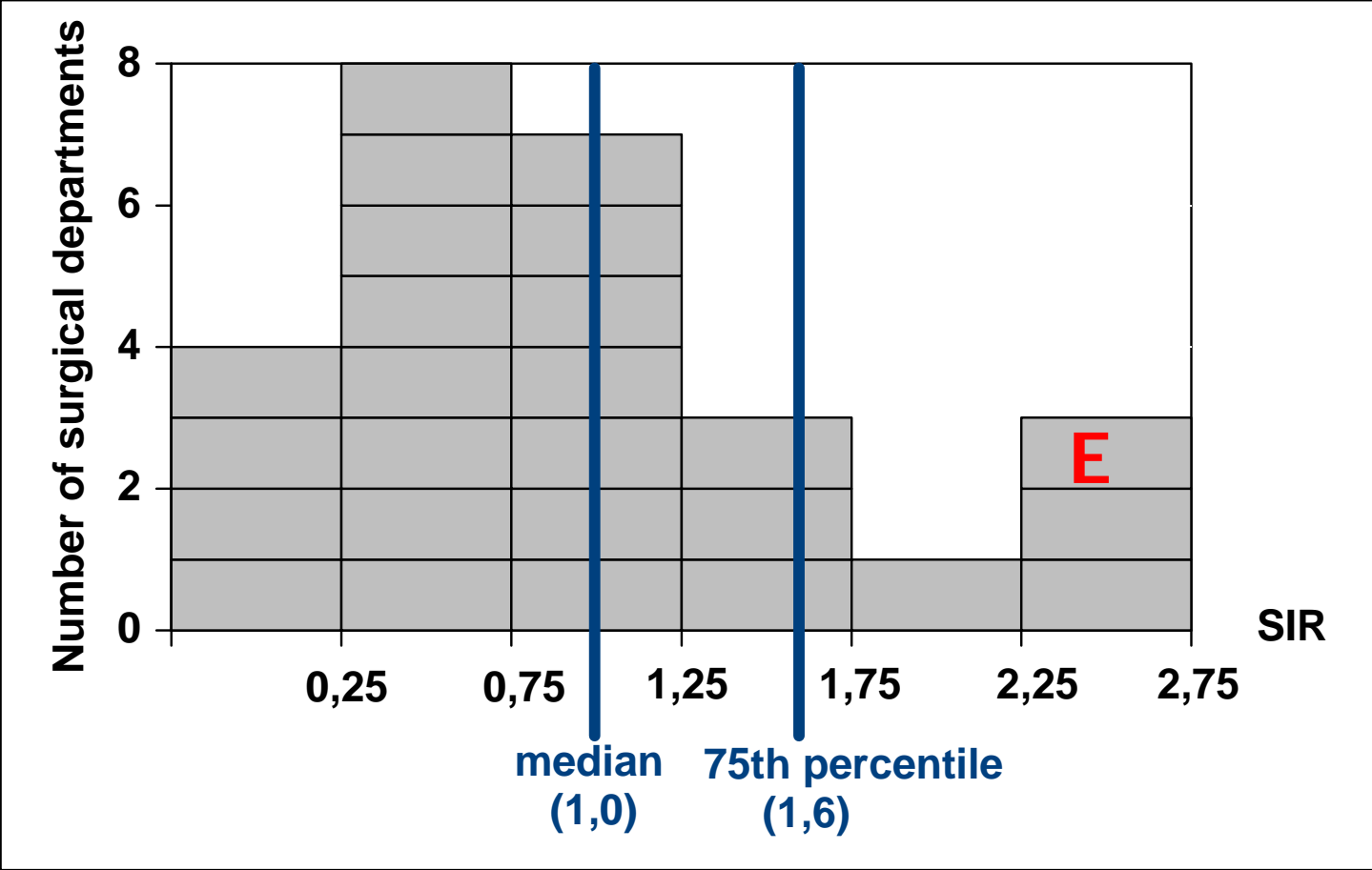
# STRATIFICATION: Hip prosthesis



NNIS: 112,025 operations (12/2002), 153 hospitals

KISS: 47,347 Operations ( 6/2003), 92 hospitals

# STANDARDISATION: Colon surgery (2,851 operations)



KISS June 1999

**NEO-KISS**

# Method (NEO-KISS)

for neonates with < 1500g birth weight

- Modified NNIS method and modified definitions
- Concentration on:
  - Ventilator associated pneumonia
  - CVC associated Bloodstream infections
  - NEC
- Stratification according to birth weight categories
- 12/2002: 33 departments with

< 500 g:	61 Newborns
500-999 g:	1 318 Newborns
1000-1500 g:	1 978 Newborns

**ONKO-KISS**

# Method (ONKO-KISS) for patients with bone marrow and stem cell transplantation

- newly developed
- concentration on blood stream infections and pneumonia
- Standardization according to neutropenia days
- 6/2003: 17 centers with  
929 patients with allogeneic transplantation  
547 patients with autolog transplantation
- mean observation period: 15 days

# German Protection Infection Act 2001

## § 23

It requires the ongoing surveillance of nosocomial infections in at least one hospital department with a high risk of these infections, such as intensive care units or surgical departments.

In addition, it also requires the surveillance of surgical site infections in surgical outpatient settings.

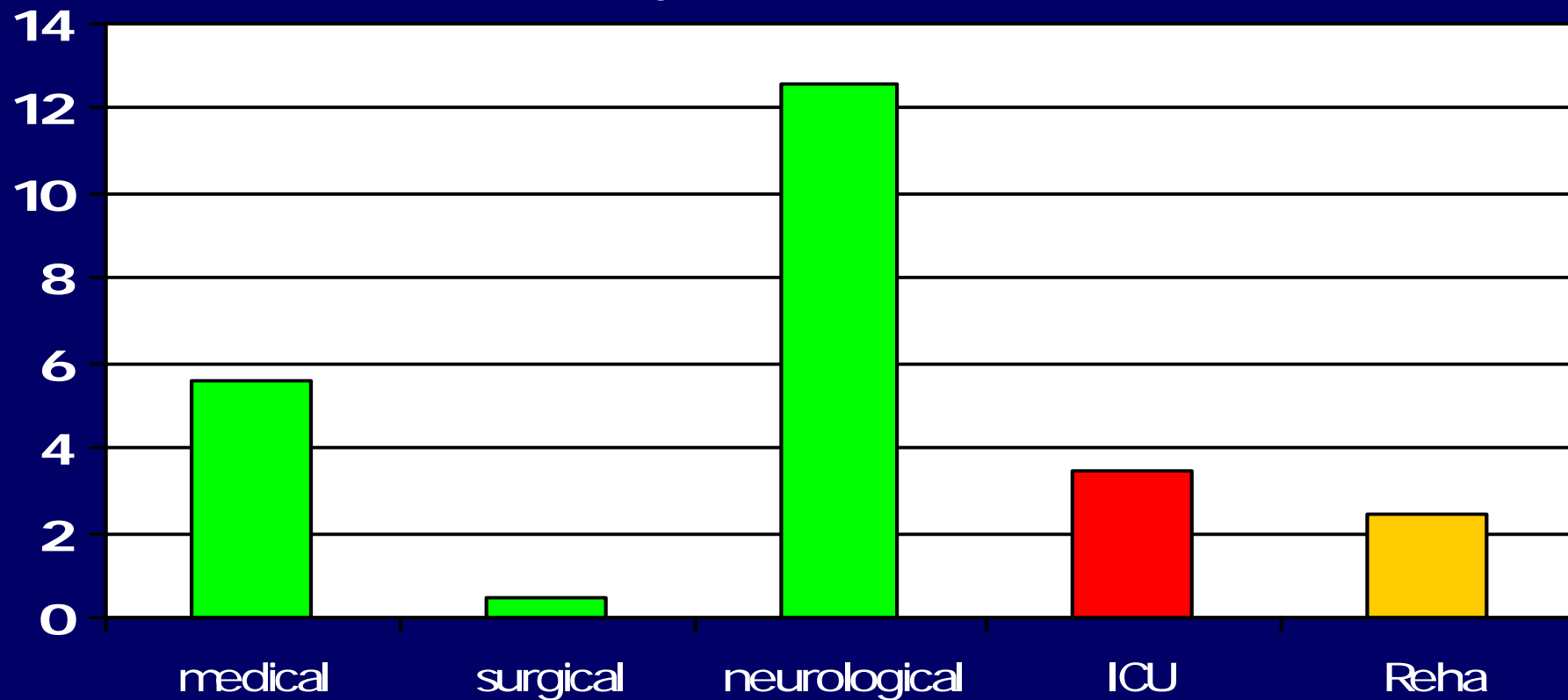
# DEVICE-KISS

## Method (DEVICE-KISS) for patients with devices in non-ICUs

- use of the method for ICUs (device associated NI)
- concentration on  
CVC associated BSI and  
urinary catheter associated urinary tract infections
- 6/2003: Data from 63 wards

# Data from 63 device-KISS wards urinary catheter associated UTI 6/2003

CAUTI/1000 UC days



# AMBU-KISS

## Method (AMBU-KISS) for SSI in outpatient settings

Calculation of crude SSI rates:

$$= \frac{\text{number of SSI for a given indicator operation}}{\text{number of operations of this type}} \times 100$$

# Comparison with hospital data

## KISS data for hospitals

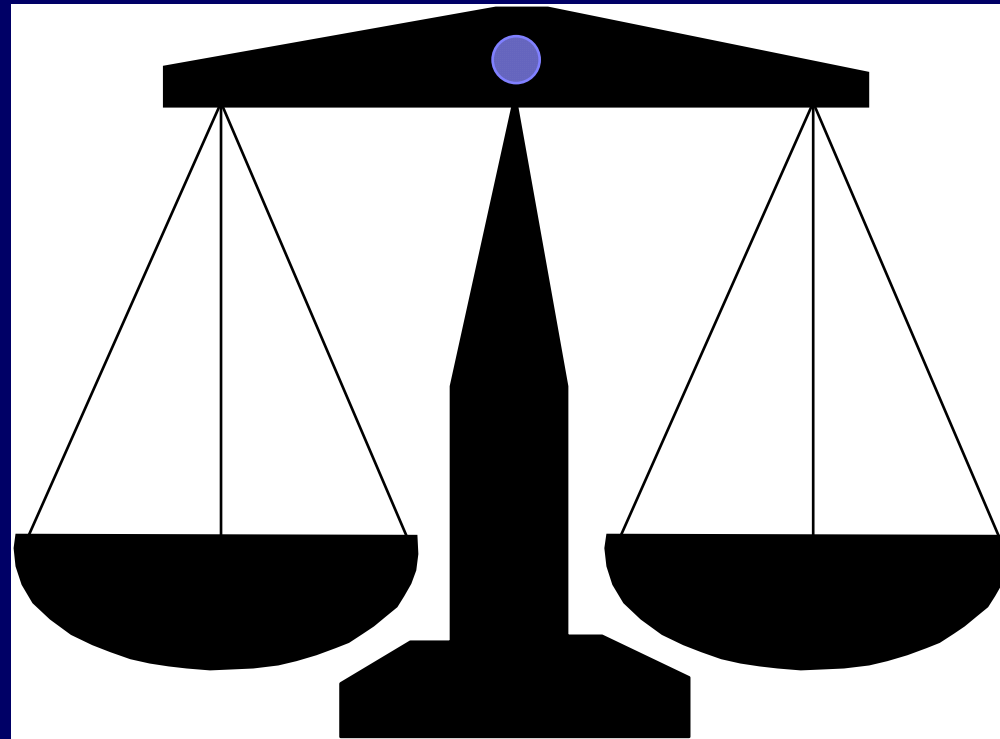
## KISS data for outpatient settings

	OPs	SSI rate (%)	SSI rate (%) NNIS index 0	OPs	SSI rate (%)
Hernia repair	29 121	1,36	0,78	3 094	0,65
Varicosis OP	3 878	0,80	0,64	5 020	0,38
Arthroscopic knee procedures	23 163	0,20	0,11	7 931	0,09

- 1. Steps of the development of the surveillance system**
- 2. Workload for surveillance**
- 3. Reduction of infection rates**

# Cost effectiveness of surveillance

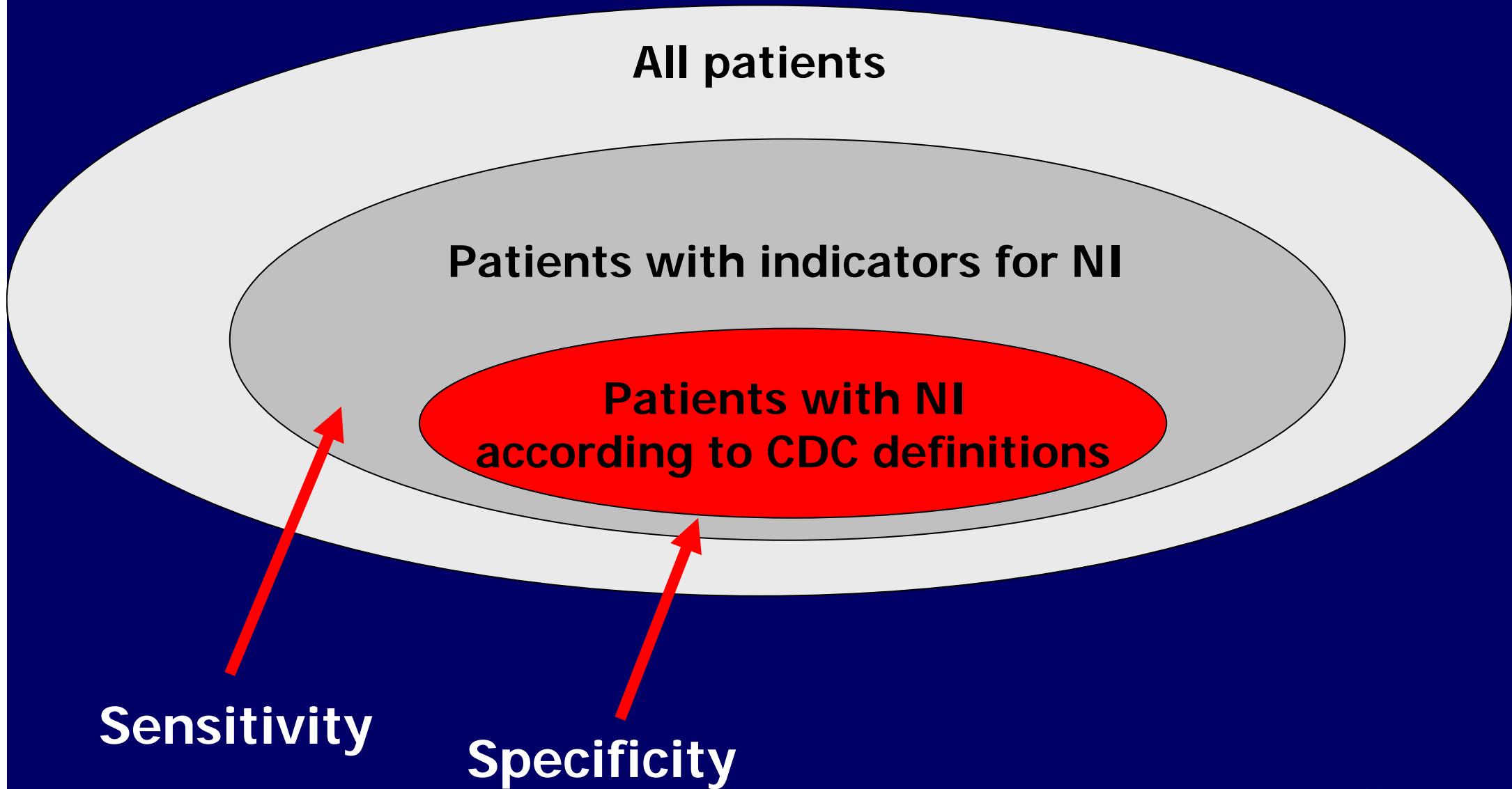
Reduction  
of  
infection  
rates



Expenses for  
surveillance

- Numerator  
data
- Denominator  
data

# Process of identifying nosocomial infections



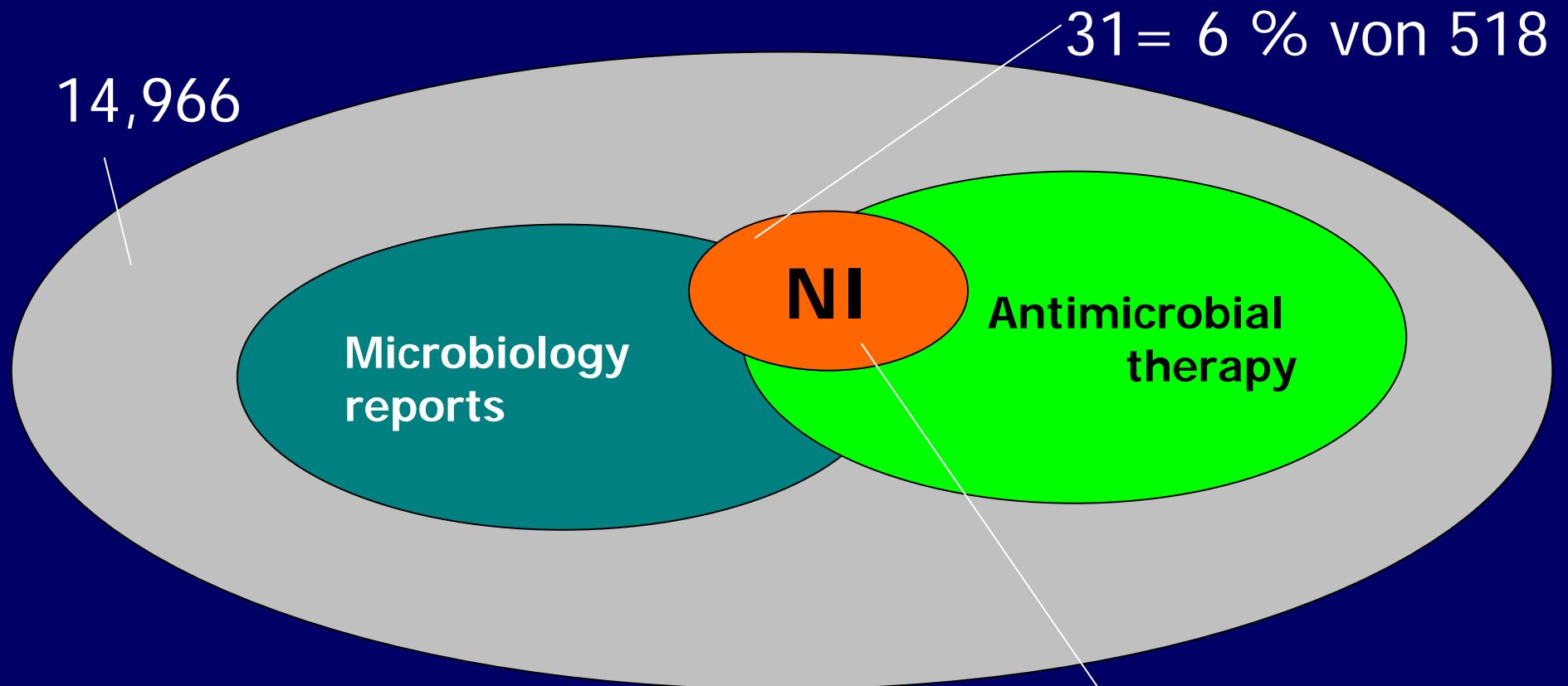
# Methods for identification of cases

## Sensitivity of indicators

Method	Sensitivity (%)	h per week per 100 beds
Laboratory based telefon call	36	1.2
Laboratory based ward visit	51	3.1
Ward rounds	62	3.5
Temperature based chart review	41	3.6
Temperature +treatment based chart review	65	6.5
Laboratory based ward rounds	76	6.4

# Methods for identification of cases

## Sensitivity of indicators

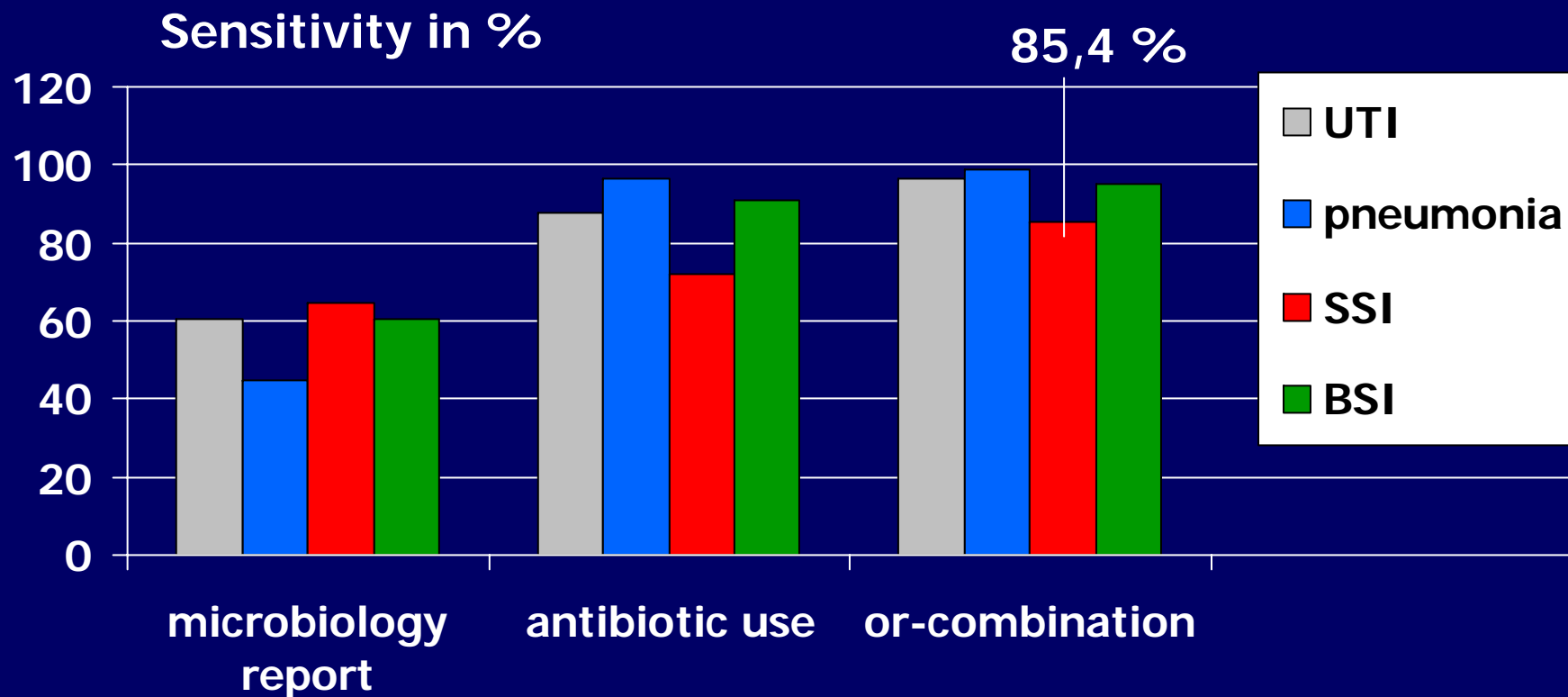


Gastmeier et al. ICHE 1999; 20:124-127

518 (3.5 %)

# Methods for identification of cases

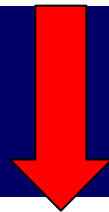
## Sensitivity of indicators



Gastmeier et al. ICHE 1999; 20:124-127

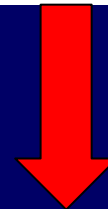
# Two strategies

To be present on the wards for several hours a week to gather information



Combination of surveillance and infection control activities

To use hospital databases as much as possible to acquire necessary information



Extra stimulation of infection control activities

# Active surveillance is preferred

- In most hospitals infection control nurses are responsible for surveillance (about 70%)
- They get support from link nurses in many hospitals.
- In the remaining hospitals the doctors of the ward are doing surveillance.

# Time required for surveillance: questionnaire in KISS hospitals 2002

## ICU-KISS

**Median:  
2 h/week**

4-28 ICU beds,  
On average 10

## OP-KISS

**Median:  
2 h/week**

1-12 indikator  
operations

# Reporting and Using Surveillance Information

*“Surveillance without action should be abandoned.”*



Present surveillance information in a manner to stimulate ideas for process improvement.

Perform follow-up surveillance to monitor for improvement following changes (“close the loop”).

# ICU-KISS: Validation study 2001/02

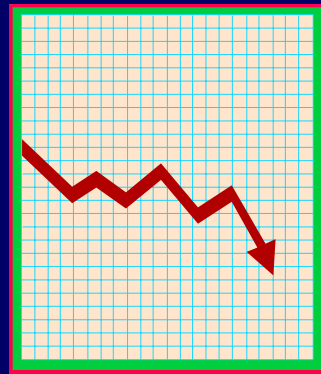
Retrospective study in 20 randomly selected ICUs  
A total of 1,481 cases  
(286 NI cases, 1,195 Non-NI cases)

Positive predictive value 83 %;  
Negative predictive value 98 %

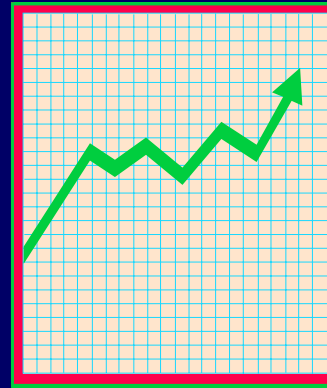
Median specificity 99,6 %  
Median sensitivity 79 %

# Reporting and Using Surveillance Information

Facility A



Facility B



***Use extreme caution when surveillance information is used for external comparisons!***

# Who gets surveillance information?

**CONFIDENCE is the most important principle!**

The unit/department itself should decide who gets this information inside and outside the hospital

- 1. Steps of the development of the surveillance system**
- 2. Workload for surveillance**
- 3. Reduction of infection rates**

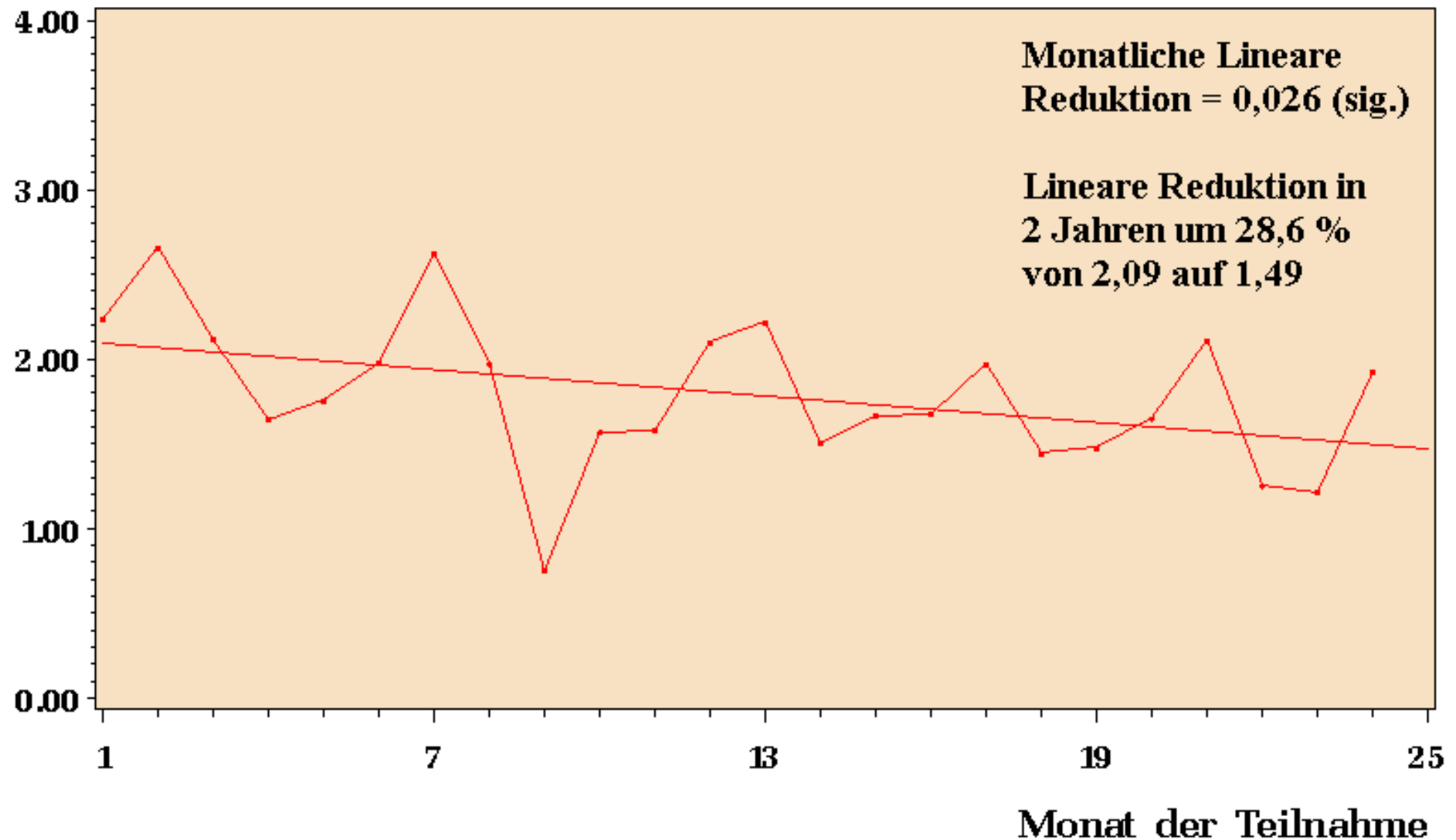
# Reduction of CVC associated BSI rate in KISS ICUs

Data from 84 ICUs participating for at least 2 years, only the data from the first 24 months of participation were considered.

Zuschneid et al. *ICHE* 2002; 24: 501-05

# ZVK – assoziierte Sepsisrate

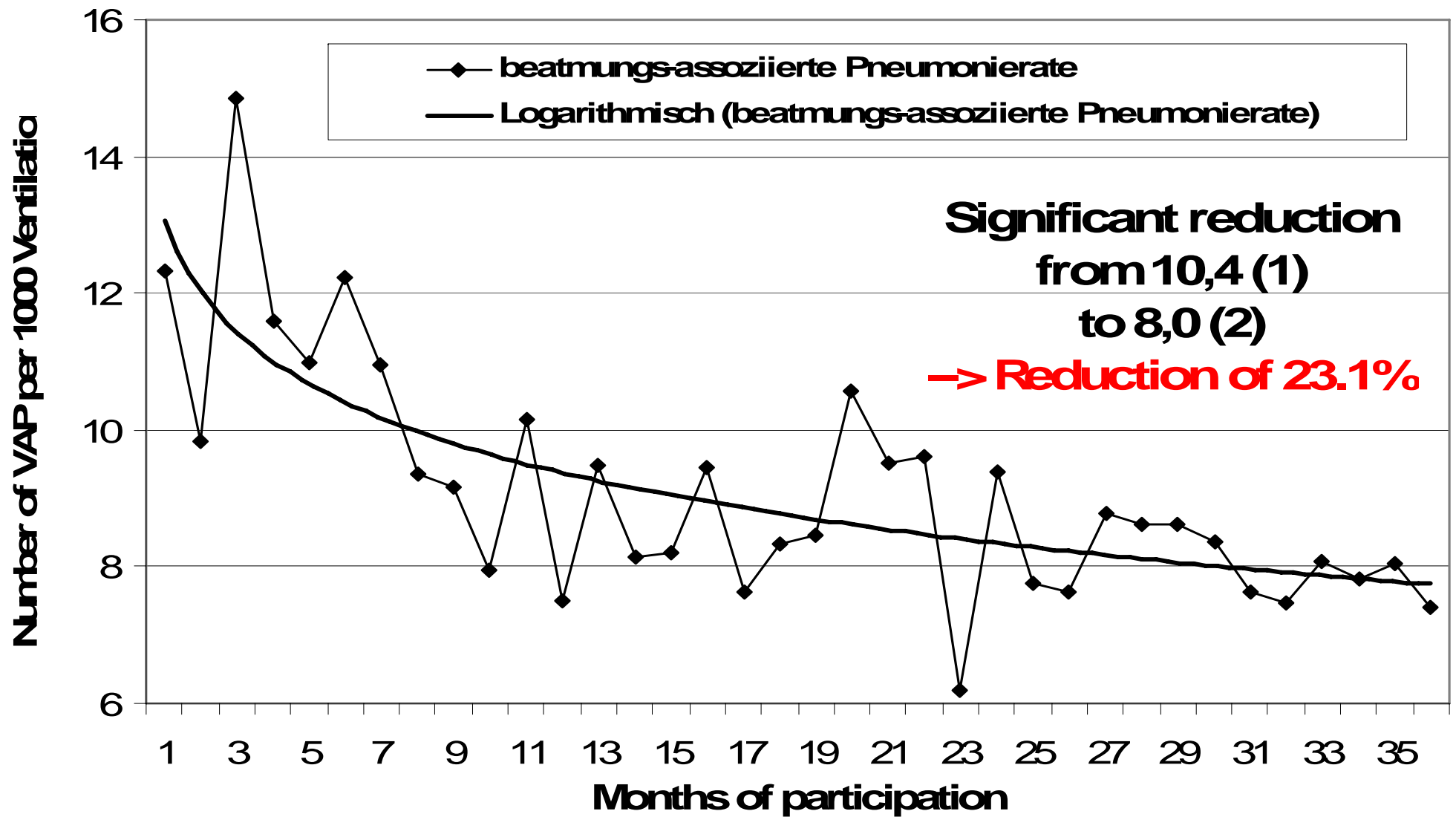
Anzahl ZVK – assoz. Sepsen  
pro 1000 ZVK – Tage



KISS – Daten 01/97 – 06/01, 84 Stationen mit mind. 24 Monate Teilnahme

# Reduction of ventilator associated pneumonia rates in KISS ICUs

Data from 71 ICUs participating for at least 3 years since 1999, only the first 3 years were considered.



# Reduction of surgical site infection rates in KISS

Inclusion criteria:

- Indicator operations with  $> 15$  departments participating and with  $\geq 30$  procedures of this type and  $\geq 3$  years participation

Calculation of SSI rates per year of participation

Stratification of departments according to the basic SSI rate (1st year)

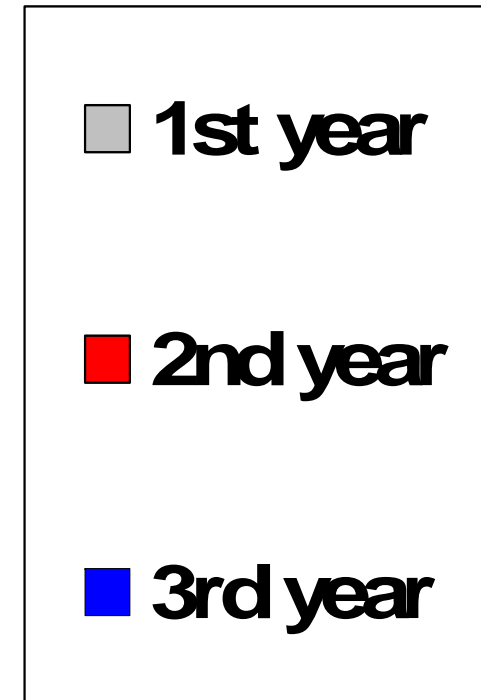
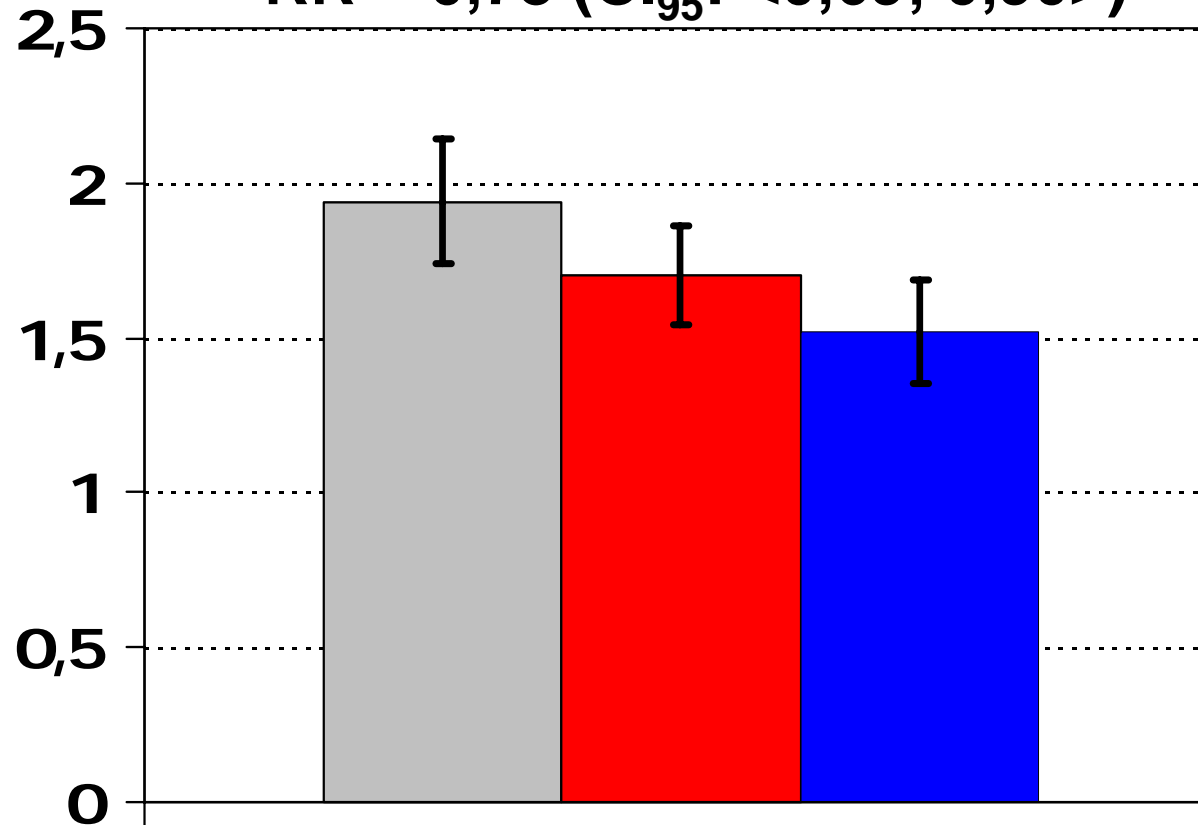
## Data used for this analysis

Type of procedure	departments	operations
CHOLECYSTECTOMY	25	14,500
COLON OPERATION	37	4,924
HERNIA REPAIR	25	12,092
HIP PROTHESIS	37	23,953
KNEE PROTHESIS	17	7,842
SECTIO CAESAREA	16	11,750
<b>total</b>	<b>79</b>	<b>75,061</b>

# SSI rates

SSI (%)

RR = 0,78 (CI<sub>95</sub>: <0,69; 0,90>)



**pooled**

(n = 75.061 OP from 79 departments)

- 1. Steps of the development of the surveillance system**
- 2. Workload for surveillance**
- 3. Reduction of infection rates**



# Nationales Referenzzentrum für Surveillance von nosokomialen Infektionen

- NRZ
- SURVEILLANCE
- SUPPORT
- DOWNLOAD
- LINKS
- KONTAKT

- AKTUELL
- VORSTELLUNG
- AUFGABE
- PUBLIKATIONEN
- STELLENANGEBOTE

## Aufgaben des NRZ

Das NRZ für Surveillance von nosokomialen Infektionen bietet seinen Partnern, behandelnden Ärzten, medizinischen Einrichtungen, Laboratorien und Gesundheitsbehörden folgende Leistungen an:

### 1. Ausbau und Optimierung und Pflege der Referenzdatenbank für nosokomiale Infektionen (Krankenhaus-Infektions-Surveillance-System - KISS)

- Modul OP-KISS (für Operationen)
- Modul ITS-KISS (Intensivstationen)
- Modul NE-KISS (für neurologisch ITS)
- Modul ONKO-KISS (für Patienten mit Blutstammzelltransplantation)

### 2. Aufbau einer Referenzdatenbank für nosokomiale Infektionen (Krankenhaus-Infektions-Surveillance-System - KISS)



Institut für Hygiene und Umweltmedizin - FU Berlin

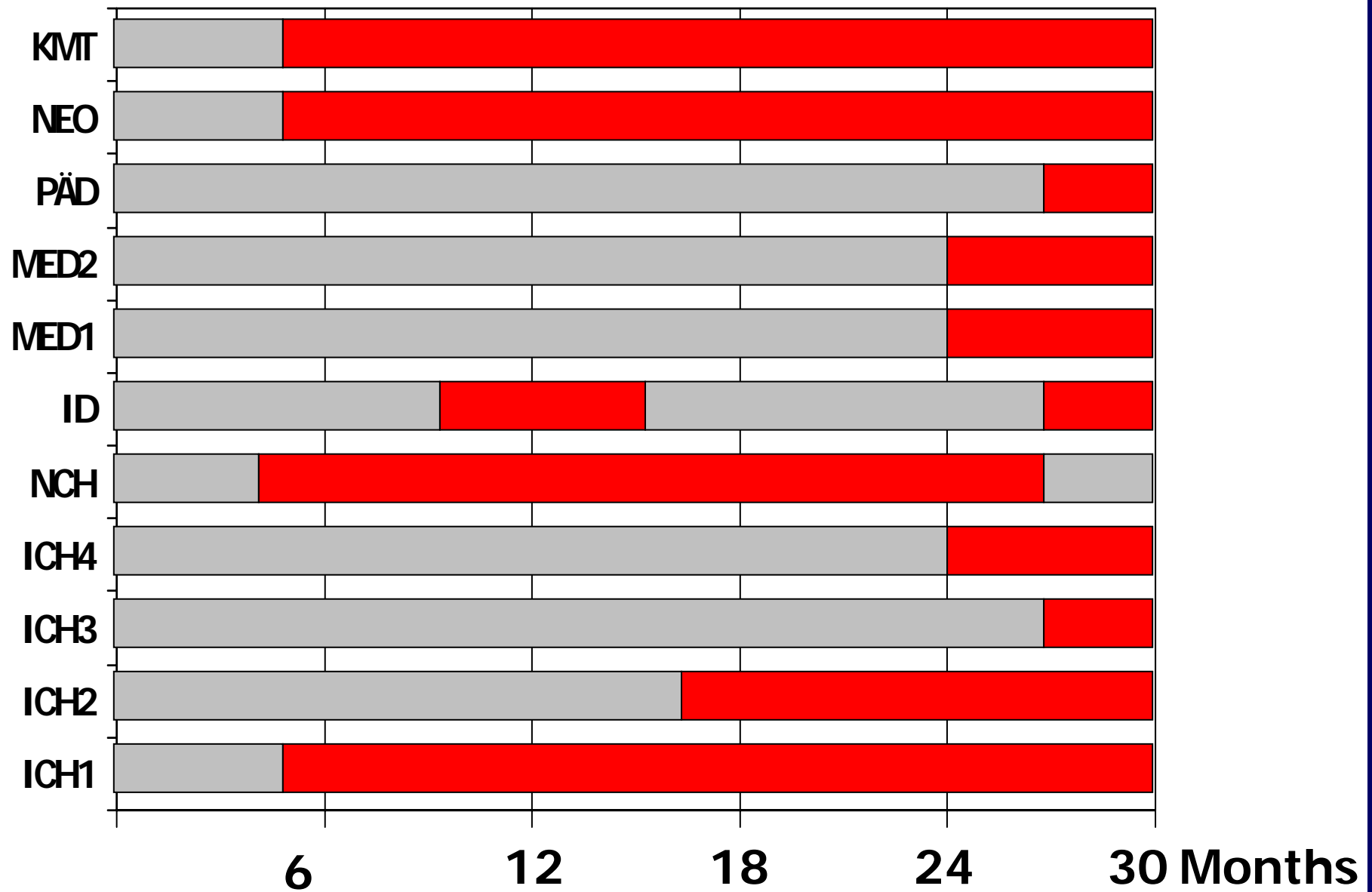


Charité - Zentralbereich Krankenhaushygiene und Infektionsprävention

www.nrz-hygiene.de



# Hanover Medical School



# ANALYSIS FOR OUR HOSPITAL DIRECTOR

Four ICUs were included in the analysis

1. Trauma ICU (T)
2. Neurosurgical ICU (NS)
3. Neonatal ICU (N)
4. Bone marrow transplant ICU (BMT)

For every ICU:

Comparison of the first and the second 12 surveillance months

## Basic situation for VAP rates

<b>ICU</b>	<b>VAP rate/1000 ventilator days</b>	<b>Median of the corresponding KISS component</b>	<b>KISS: 75th percentile</b>
<b>T</b>	<b>11.8</b>	<b>8.2</b>	<b>13.7</b>
<b>NS</b>	<b>5.0</b>	<b>9.1</b>	<b>12.9</b>
<b>N (&lt; 1000g)</b>	<b>0</b>	<b>3.9</b>	<b>6.1</b>
<b>N (&lt; 1500g)</b>	<b>0</b>	<b>0.1</b>	<b>0.7</b>
<b>BMT</b>	<b>4.8</b>	<b>6.3</b>	<b>8.2</b>

## Basic situation for CVC-BSI rates

ICU	CVC-BSI rate/ 1000 CVC days	Median of the corresponding KISS component	KISS: 75th percentile
T	<b>6.6</b>	1.5	2.4
NS	0	0.7	1.9
N (< 1000g)	6.6	8.1	10.7
N (< 1500g)	3.1	3.9	6.1
BMT	<b>21.0</b>	14.3	20.8

## CVC BSI

## VAP

	Cases 1st period	Cases 2nd period	Reduction	Cases 1st period	Cases 2nd period	Reduction
T	15	4	-11	20	19	-1
NS	0	1	+1	10	5	-5
N	7	6	-1	0	0	0
BMT	35	22	-13	8	8	0

**-24 BSI cases**

**- 6 VAP cases**

# Prolongation of ICU stay due to NI according to the data of the SIR 3 study (Multistate model)

In comparison to patients without NI:	Attributable length of stay	p value
First NI	5.2 d	< 0.0001
Pneumonia	6.1 d	< 0.0001
Urinary tract infections	-0.2 d	0.52
Primary sepsis	2.8 d	0.118
Surgical site infections	13.3 d	0.0933

Beyersmann et al. 2004, in press

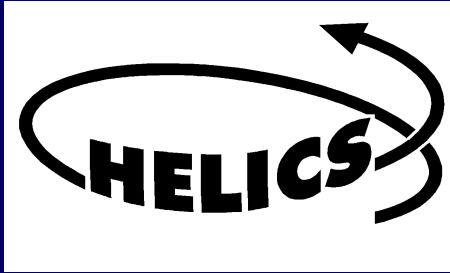
## Success

Reduction	n	Prolongation of stay per case in days	Total days
BSI cases	24	3	72
Pneumonia cases	6	6	36
total			108

**One ICU day: 1,200 €**

**108 ICU days: 130,000 €**

**Hospital charges for one infection control nurse per year:  
30,000 € - 35,000 €**



<http://helics.univ.lyon1.fr>

**= Hospitals in Europe Link for Infection Control  
through Surveillance**

**1994-96**

**Development of  
surveillance  
protocols**

**1998-99**

**Inventory  
in Europe**

**2000-2002**

**Harmonisation,  
Protocols  
for ICUs,  
SSI,  
prevalence**

**2003-2004**

**Establishment  
of 2  
surveillance  
systems**

# YEARS

	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	
Denmark	Green																								
Norway	Red						Red						Red					Red	Red	Red	Red	Red	Red	Red	Red
UK		Green														Green									
Italy				Green																					
Belgium					Green																				
Czechosl.					Green																				
Australia					Green																				
Thailand									Green																
Spain												Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
Mauritius														Green											
Germany																Green									
France													Red					Red						Red	
Switzerl.																		Red			Red				Red

# Uniform protocol for prevalence surveys

**H**ospitals in **E**urope **L**ink for **I**nfection **C**ontrol  
through **S**urveillance



A harmonised  
European protocol  
for prevalence surveys  
(Rossello J)