



Erfahrungen mit einem Computer-gestützten System zur automatischen Überwachung und Erfassung von nosokomialen Infektionen an Intensivstationen – MONI

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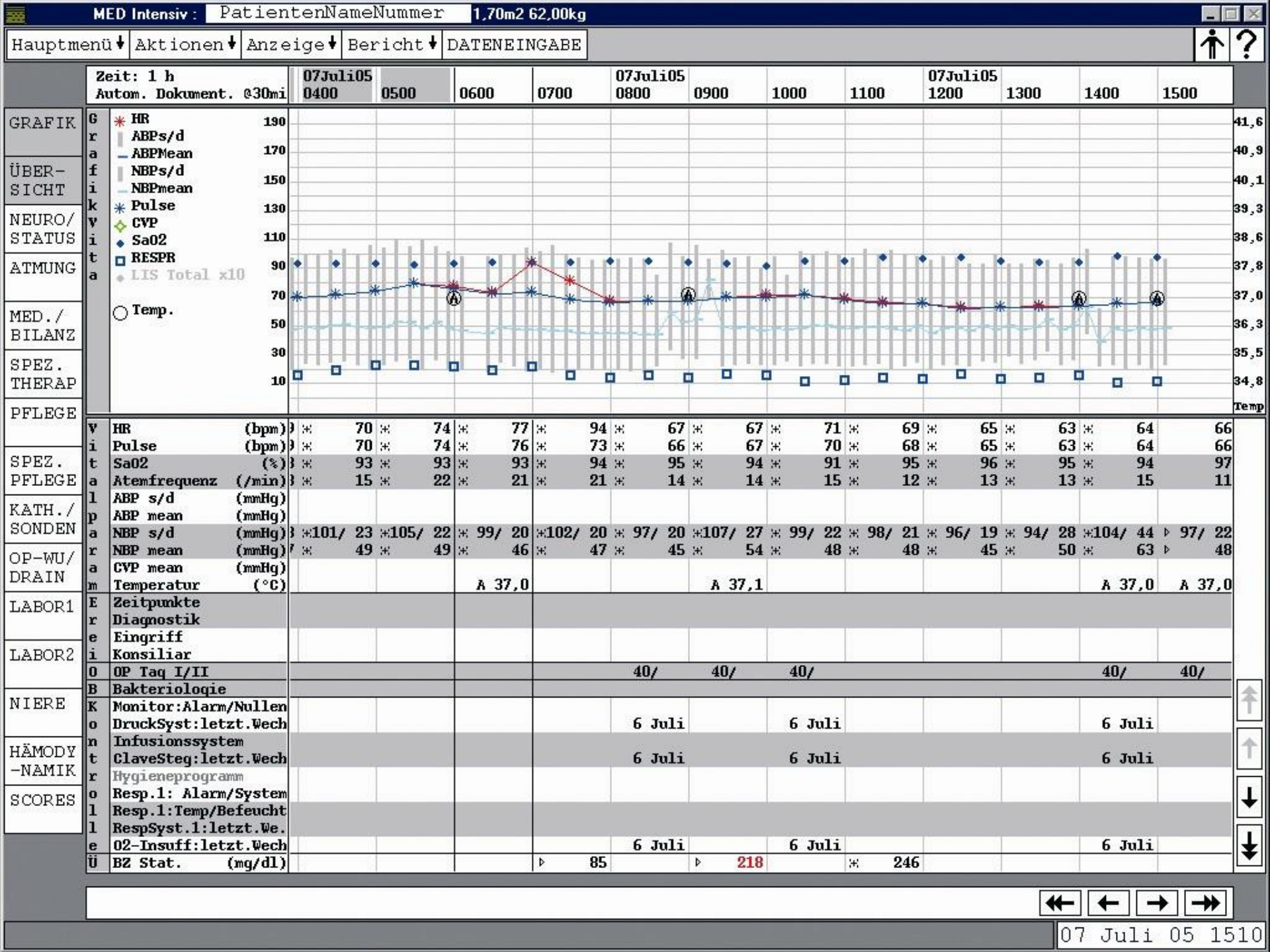
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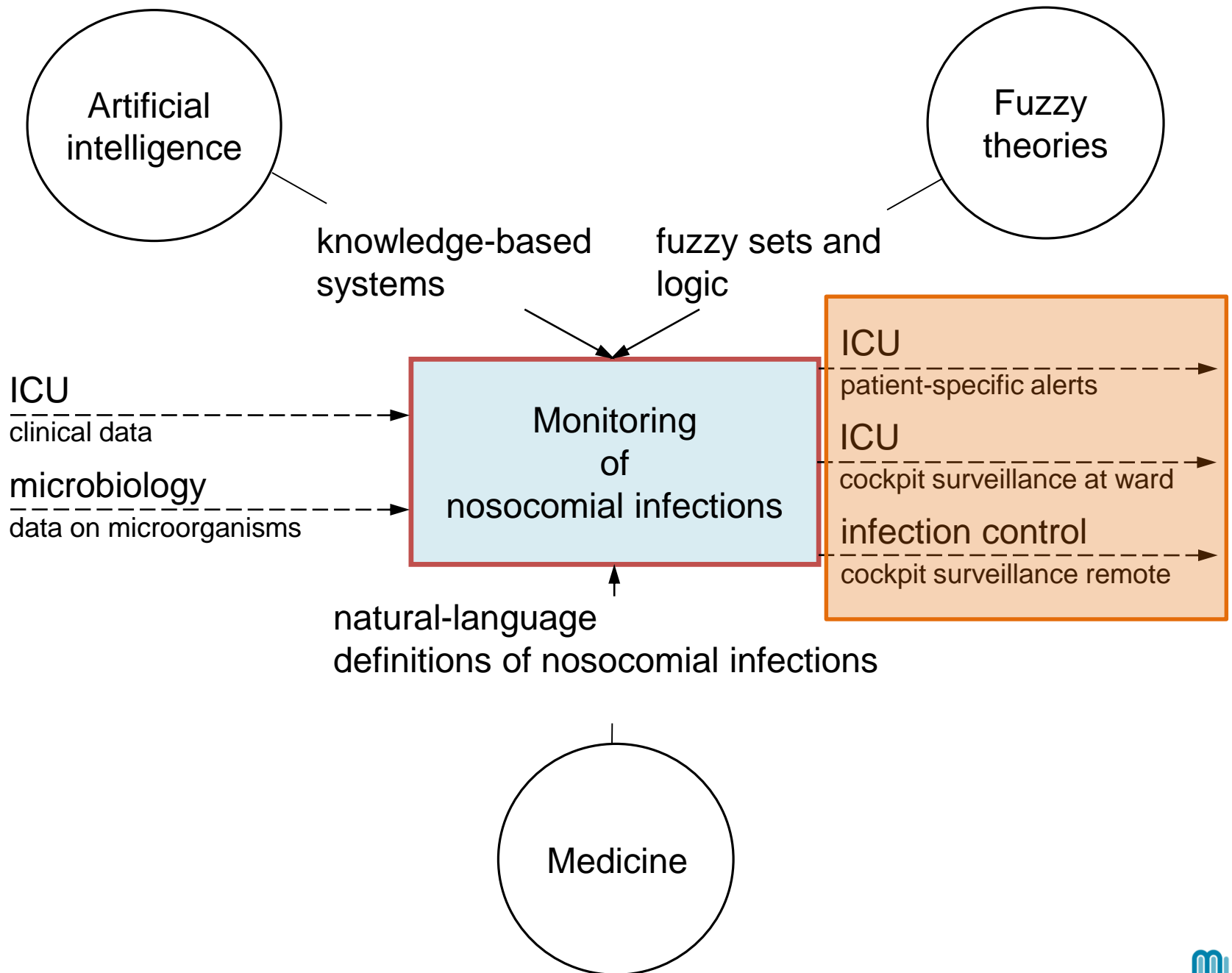
ICU Wards at the Vienna General Hospital

- 13B1
- 13B2
- 13C1
- 13C2
- 13C3
- 13H1
- 13H3
- 13I1
- 13I2
- 13I3
- transplant ICU
- neurosurgery ICU
- NICU 9C
- NICU E10
- NICU E12





↑ ↑ ↓ ↓





Hospital in Europe
Link for Infection Control through
Surveillance

Surveillance of Nosocomial Infections in Intensive Care Units

Protocol

Version 6.1

(Based on Version 5.0 including technical amendments)

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ICU_v6_1

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TECHNICAL DOCUMENT

Surveillance of surgical site infections in European hospitals – HAISSI protocol

Protocol version 1.02

www.ecdc.europa.eu

INFECTION SITE: Symptomatic urinary tract infection

CODE: UTI-SUTI

DEFINITION: A symptomatic urinary tract infection must meet at least one of the following criteria:

Criterion 1: Patient has at least *one* of the following signs or symptoms with no other recognized cause: fever ($>38^{\circ}\text{C}$), urgency, frequency, dysuria, or suprapubic tenderness *and* patient has a positive urine culture, that is, $\geq 10^5$ microorganisms per cm^3 of urine with no more than two species of microorganisms.

Criterion 2: Patient has at least *two* of the following signs or symptoms with no other recognized cause: fever ($>38^{\circ}\text{C}$), urgency, frequency, dysuria, or suprapubic tenderness *and* at least *one* of the following:

- positive dipstick for leukocyte esterase and/or nitrate
- pyuria (urine specimen with ≥ 10 wbc/mm^3 or ≥ 3 $\text{wbc}/\text{high power field}$ of unspun urine)
- organisms seen on Gram stain of unspun urine
- at least *two* urine cultures with repeated isolation of the same

uropathogen (gram-negative bacteria or *S. saprophyticus*) with $\geq 10^2$ colonies/ml in nonvoided specimens

- $\leq 10^5$ colonies/ml of a single uropathogen (gram-negative bacteria or *S. saprophyticus*) in a patient being treated with an effective antimicrobial agent for a urinary tract infection
- physician diagnosis of a urinary tract infection
- physician institutes appropriate therapy for a urinary tract infection.

Criterion 3: Patient ≤ 1 year of age has at least *one* of the following signs or symptoms with no other recognized cause: fever ($>38^{\circ}\text{C}$), hypothermia ($<37^{\circ}\text{C}$), apnea, bradycardia, dysuria, lethargy, or vomiting *and* patient has a positive urine culture, that is, $\geq 10^5$ microorganisms per cm^3 of urine with no more than two species of microorganisms.

Criterion 4: Patient ≤ 1 year of age has at least *one* of the following signs or symptoms with no other recognized cause: fever ($>38^{\circ}\text{C}$), hypothermia ($<37^{\circ}\text{C}$), apnea, bradycardia, dysuria, lethargy, or vomiting *and* at least *one* of the following:

- positive dipstick for leukocyte esterase and/or nitrate
- pyuria (urine specimen with ≥ 10

wbc/mm^3 or >3 $\text{wbc}/\text{high power field}$ of unspun urine)

- organisms seen on gram stain or unspun urine
- at least *two* urine cultures with repeated isolation of the same uropathogen (gram-negative bacteria or *S. saprophyticus*) with $\geq 10^2$ colonies/ml in nonvoided specimens
- $\leq 10^5$ colonies/ml of a single uropathogen (gram-negative bacteria or *S. saprophyticus*) in a patient being treated with an effective antimicrobial agent for a urinary tract infection
- physician diagnosis of a urinary tract infection
- physician institutes appropriate therapy for a urinary tract infection.

COMMENTS:

- A positive culture of a urinary catheter tip is *not* an acceptable laboratory test to diagnose a urinary tract infection.
- Urine cultures must be obtained using appropriate technique, such as clean catch collection or catheterization.
- In infants, a urine culture should be obtained by bladder catheterization or suprapubic aspiration; a positive urine culture from a bag specimen is unreliable and should be confirmed by a specimen aseptically obtained by catheterization or suprapubic aspiration.

Bloodstream Infections (BSI)

CODE: BSI

BSI-A:

- 1 positive blood culture for a recognised pathogen

or

- Patient has at least one of the following signs or symptoms: fever ($>38^{\circ}\text{C}.$), chills, or hypotension and 2 positive blood cultures for a common skin contaminant (from 2 separate blood samples drawn within 48 hours).

skin contaminants = coagulase-negative staphylococci, *Micrococcus sp.*, *Propionibacterium acnes*, *Bacillus sp.*, *Corynebacterium sp.*

BSI-B: Patient has at least one of the following signs or symptoms: fever ($>38^{\circ}\text{C}.$), chills, or hypotension

And either

- 1 positive blood culture with a skin contaminant in patient with an intravascular line in place and in whom the physician instituted appropriate antimicrobial therapy.

or

- positive blood Antigen test (e.g. *H.influenzae*, *S.pneumoniae*, *N. meningitidis* or Group B *Streptococcus*)

Comment:

BSI-A is the definition used by the majority of NI surveillance networks in Europe. BSI-B extends this definition to the CDC definition of laboratory-confirmed bloodstream infection. Networks should specify in the network data (table icu_net, see 6.3.1) whether only BSI A or both BSI B and BSI A are included in the surveillance (i.e. networks using CDC definition of laboratory confirmed bloodstream infection [$\text{CDC}_{\text{LCBI}} = \text{BSI-A+B}$]). If this is the case, then BSI A and BSI B categories should be specified in the data collection.

- bloodstream infection with
 - recognized pathogen
 - clinical signs and growth of same skin contaminant from two separate blood samples
 - clinical signs and growth skin contaminant from blood and intravascular line in place and AB Therapy
 - clinical signs and positive antigen test from blood

Bloodstream infection with clinical signs and growth of same skin contaminant from two separate blood samples

- Patient has at least one of the following signs or symptoms: fever ($>38^{\circ}\text{C}.$), chills, or hypotension and 2 positive blood cultures for a common skin contaminant (from 2 separate blood samples drawn within 48 hours).

skin contaminants = coagulase-negative staphylococci, *Micrococcus sp.*, *Propionibacterium acnes*, *Bacillus sp.*, *Corynebacterium sp.*



BSI-A2

1
←

clinical_signs_of_BSI (t-1d, t, t+1d)

^

same_skin_contaminant_from_two_separate_blood_samples

Decomposition—clinical signs

clinical_signs_of_BSI (t-1d, t, t+1d)[yesterday, today, tomorrow]

=

clinical_signs_of_BSI (t-1d)

=

∨

clinical_signs_of_BSI (t)

=

∨

clinical_signs_of_BSI (t+1d)

=

fever (t-1d)

∨

hypotension (t-1d)

∨

leucopenia (t-1d)

∨

leucocytosis (t-1d)

∨

CRP increased (t-1d)

fever (t)

∨

hypotension (t)

∨

leucopenia (t)

∨

leucocytosis (t)

∨

CRP increased (t)

fever (t+1d)

∨

hypotension (t+1d)

∨

leucopenia (t+1d)

∨

leucocytosis (t+1d)

∨

CRP increased (t+1d)

Clinical signs—fever

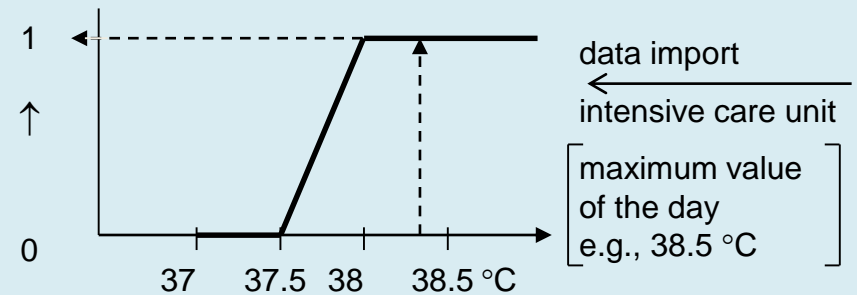
fever (t-1d) \Leftarrow ...

fever (t) \Leftarrow

body temperature \uparrow

\vee

thermoregulation applied

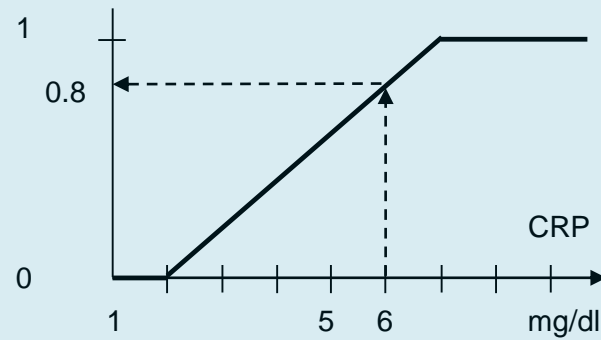


fever (t+1d) \Leftarrow ...

Clinical Signs—CRP Increased

CRP increased (t-1d) \Leftarrow ...

CRP increased (t) \Leftarrow



data import

intensive care unit

[maximum value
of the day
e.g., 5 mg/dl]

CRP increased (t+1d) \Leftarrow ...

Decomposition—skin contaminant

same_skin_contaminant_from
two_separate_blood_samples ⇐

first blood culture

- coagulase-negative staphylococci
- *Micrococcus* sp.
- *Propionibacterium acnes*
- *Bacillus* sp.
- *Corynebacterium* sp.

^ (within 48 hours)

data import
microbiology ←

second blood culture

- coagulase-negative staphylococci
- *Micrococcus* sp.
- *Propionibacterium acnes*
- *Bacillus* sp.
- *Corynebacterium* sp.

Cockpit Surveillance at the infection control unit

Moni-IV - Surveillance

Patientendaten Surveillance Ausgabe Hilfe

Surveillance

☒ retrospektiv ☐ aktuell Datum: 2005-05-02 anzeigen ☐ Diagnosen ☐ aktuelle Param. ☒ alle Parameter drucken

Patienten

- 13B1
- 13B3
- 13C1
- 13C2
- 13H1
- 13H3
- 13I1
- 13I2
- 13I3
- Neurochir. ICU
- Transplant ICU

Parameter

Catheter-Associated Symptomatic Urinary Tract Infection completely fulfilled (100%)

Moni-IV - [Surveillance]

Patientendaten Surveillance Ausgabe Hilfe

☒ retrospektiv ☐ aktuell Datum: 2005-06-14 anzeigen

☐ Diagnosen ☐ aktuelle Param. ☒ alle Parameter drucken

Patienten

[2005-05-17 -]

- (2005-06-06 - 2005-06-08) (keine Mibil)
- (2005-06-01 - 2005-06-05) (keine Mibil)
- (2005-06-10 - 2005-06-12) (keine Mibil)
- (2005-06-10 - 2005-06-11) (keine Mibil)
- (2005-06-08 - 2005-06-09) (keine Mibil)
- (2005-06-03 - 2005-06-05) (keine Mibil)
- (2005-06-06 - 2005-06-07) (keine Mibil)
- (2005-06-06 - 2005-06-08) (keine Mibil)
- (2005-06-12 - 2005-06-13) (keine Mibil)
- (2005-06-13 -) (keine Mibil)
- (2004-06-09 -)
- (2004-06-21 -) (keine Mibil)
- (2005-06-03 - 2005-06-04) (keine Mibil)
- (2005-06-02 - 2005-06-03) (keine Mibil)
- (2005-06-02 - 2005-06-03) (keine Mibil)
- (2005-06-01 - 2005-06-03) (keine Mibil)
- (2005-04-18 - 2005-06-07)
- (2005-06-13 -) (keine Mibil)
- [2005-05-17 -]**
- (2005-03-23 - 2005-06-01) (Aufenthalt unterbr.!)
- (2005-05-27 - 2005-06-06) (keine Mibil)
- Transplant ICU**

Parameter

- 2005-06-05 (NCHINT)
- 2005-06-04 (NCHINT)
- 2005-06-03 (NCHINT)
- 2005-06-02 (NCHINT)
- 2005-06-01 (NCHINT)
- Messwerte
- Interpretationen und Diagnosen
 - UTI-B-k:** 100 %
 - KiSeps (t-1d - t+1d): 100 %
 - KiSeps (t-1d): 80 % (2005-06-15 10:42:46)
 - KiSeps: 100 %
 - KiSeps (t+1d): 80 % (2005-06-15 10:42:46)
 - KiPneu (t-1d - t+1d): 47 % (2005-06-15 10:42:46)
 - KiPneu (t-1d): 47 % (2005-06-15 10:42:46)
 - KiHwI:** t-1d - t+1d: 100 %
 - KiHwI (t-1d): 80 % (2005-06-15 10:42:46)
 - KiHwI: 100 %
 - KiHwI (t+1d): 80 % (2005-06-15 10:42:46)
 - andere HwI-Befunde: 100 %
 - Pyurie:** t-1d - t+1d: 100 %
 - Harnkatheter:** t-2d - t: 100 %
 - Harnkatheter: 100 %
 - ZVK (t-2d - t): 100 %
 - ZVK: 100 %
 - Beatmung: 100 %
 - Schockindex (t-1d) - Schock: 92 % (2005-06-15 10:42:46)
 - Fieber:** t-1d: 80 % (2005-06-15 10:42:46)
 - Fieber (t+1d): 80 % (2005-06-15 10:42:46)
 - Thermoregulation (t-1d): 100 %
 - Thermoregulation (t+1d): 100 %
 - CRP:** 100 % (2005-06-15 10:42:46)
 - Hypotonie (t-1d): 80 % (2005-06-15 10:42:46)
 - Adaptierter-Murray-Score-Erhöhung (t-1d): 47 % (2005-06-15 10:42:46)
- 2005-05-31 (NCHINT)
- 2005-05-30 (NCHINT)

Backtracking of the Logical Chain of Reasoning patient has urinary catheter

Moni-IV

Patientendaten Surveillance Ausgabe Hilfe

zurück vor Erklärung

UTI-B-k 2005-06-01: [REDACTED] (17.5.2005 -): NCHINT

Regel: H3: UTI-B-k (kathassoz. sympt. Harnwegsinfektion) (Gewicht: 100)

Bezeichnung	Zutreffen %	Herkunft	ermittelt	Bemerkung
UTI-B-k	100	Moni-IV: Inferenz	2005-06-14 09:39:08	

Bedingungen:

Bezeichnung	Zutreffen %	Herkunft	ermittelt	Bemerkung
UND	100	Moni-IV: Inferenz	2005-06-14 09:39:08	
HarnKath (t-2d - t)	100	Import: CareVue	2005-06-14 09:17:43	2005-05-30 00:00:00 - Harnkatheter 1 Ch/Material 14 Silikon(2005-05-30 06:00:00 - H...
KH-Hwl (t-1d - t+1d)	100	Moni-IV: Inferenz	2005-06-14 09:39:08	
andere Hwl-Befunde	100	Moni-IV: Inferenz	2005-06-14 09:39:08	

Elevated CRP as a Clinical Sign present (100%)

Moni-IV Patientendaten Surveillance Ausgabe Hilfe

KliHWI 2005-06-01: [REDACTED] (17.5.2005 -); NCHINT

Regel: KliHWI: KliHWI (Gewicht: 100)

Bezeichnung	Zutreffen %	Herkunft	ermittelt	Bemerkung
KliHWI	100	Moni-IV: Inferenz	2005-06-14 09:39:08	

Bedingungen:

Bezeichnung	Zutreffen %	Herkunft	ermittelt	Bemerkung
ODER	100	Moni-IV: Inferenz	2005-06-14 09:39:08	
Fieber				
CRPEth	100	Moni-IV: Daten-Symbo...	2005-06-14 09:39:08	

Elevated CRP is Present

6 mg/dl is measured

Moni-IV

Patientendaten Surveillance Ausgabe Hilfe

zurück vpr Erklärung

CRP 2005-06-01: [REDACTED] (17.5.2005 -); NCHINT

Daten-Symbol-Konversion: Fuzzy-Set: CRPErh

Bezeichnung	Zutreffen %	Herkunft	ermittelt	Bemerkung
CRP	100	Moni-IV: Daten-Symbo...	2005-06-14 09:39:08	

quantitativer Wert:

Bezeichnung	Wert	Herkunft	ermittelt	Bemerkung
CRP	6 mg/dl	Import: CareVue	2005-06-14 09:17:43	2005-06-01 07:00:00 Serum: CRP: 6 mg/dl

Other Signs of Urinary Tract Infection

Pyurie

Moni-IV

Patientendaten
Surveillance
Ausgabe
Hilfe

zurück

vor

Erklärung

andere HWI-Befunde
2005-06-01: [REDACTED] (17.5.2005 -); NCHINT

Regel: HWIBef: andere HWI-Befunde (Gewicht: 100)

Bezeichnung	Zutreffen %	Herkunft	ermittelt	Bemerkung
andere HWI-Befunde	100	Moni-IV: Inferenz	2005-06-14 09:39:08	

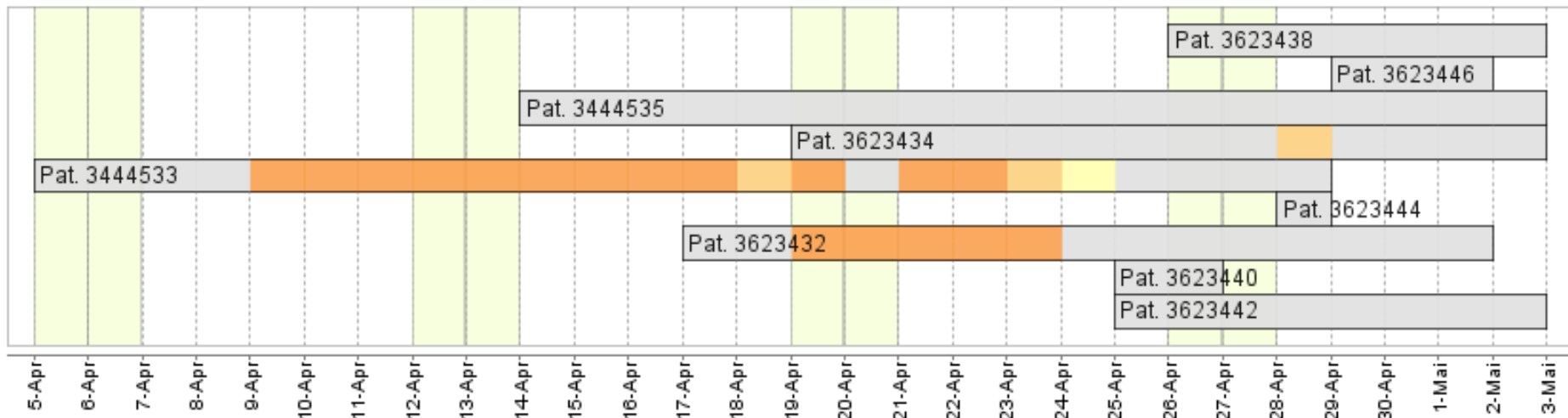
Bedingungen:

Bezeichnung	Zutreffen %	Herkunft	ermittelt	Bemerkung
ODER	100	Moni-IV: Inferenz	2005-06-14 09:39:08	
<div> <div>Hamteststreifen</div> <div>Pyurie</div> </div>	100	Import: CareVue	2005-06-14 09:17:43	2005-06-01 06:00:00 - Ham: U-Ery/Leuko: 10 2005-06-02 06:00:00 - Ham: U-Ery/Leuko: 25
Gram-Färbung				
2HaKw>10 ²				
HaKw<10 ⁵				

Neues MONI : MONI ICU und MONI N-ICU „The Next Generation“

von 2008-04-01 bis 2008-05-04 Anzeigen Standardansicht Grafik ausblenden fixe Tagesbreite

Dep. 21



Stationen/Patienten

Dep. 21

Pat.	3623438
Pat.	3623446
Pat.	3444535
Pat.	3623434
Pat.	3444533
Pat.	3623444
Pat.	3623432



Berechnung



Surveillance



Übersicht



Statistik



Verwaltung



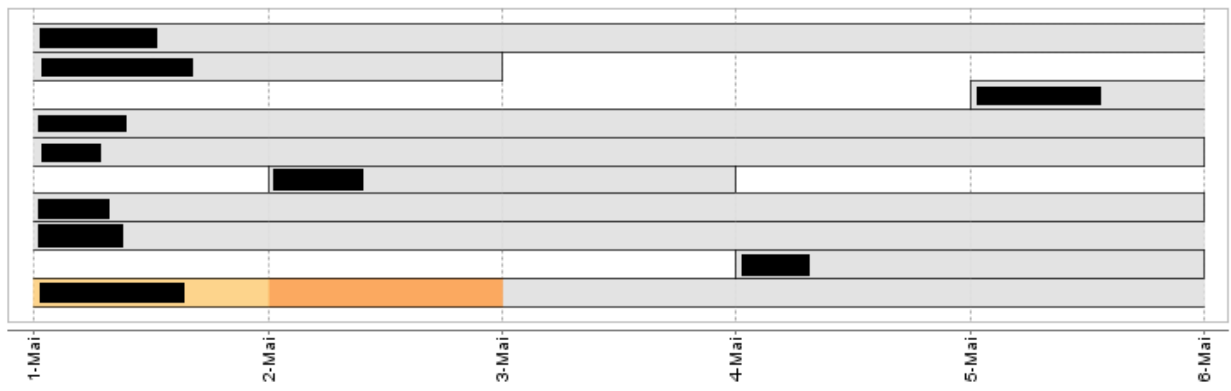
Hilfe



Abmelden

von 2008-05-01 bis 2008-05-05 Anzeigen Standardansicht Grafik ausblenden fixe Tabellenbreite

13c3



Aufenthalt
10% - 50%
50% - 90%
90% - 100%

- Stationen/Patienten
- 13b1
 - 13b3
 - 13c1
 - 13c2
 - 13c3
-
- 13h1
 - 13h3
 - 13i1

2008-05-10	
2008-05-09	
2008-05-08	
2008-05-07	
2008-05-06	
2008-05-05	
2008-05-04	
2008-05-03	
2008-05-02	
2008-05-01	
Messwerte	
Interpretationen und Diagnosen	
CRI2 (generalisierte ZVK-assoz. Infektion)	80 % ▶
Fieber	80 % ▶
Hypotonie	80 % ▶
klin. Anzeichen für Entzündung bei HWI	80 % ▶
klin. Anzeichen für Entzündung bei Sepsis	80 % ▶
CRP erhöht	37 % ▶
Schock	100 % ▶
max. Körpertemperatur	37,4 °C ▶
Blutdruck-Profil (unterer Grenzwert)	86 mmHg ▶
Blutdruck-Profil (oberer Grenzwert)	88,33 mmHg ▶
Blutdruck-Profil (21:00 (Vortag) bis 3:00)	86,11 mmHg ▶
Blutdruck-Profil (0:00 bis 6:00)	85,89 mmHg ▶
Blutdruck-Profil (3:00 bis 9:00)	89,67 mmHg ▶
Blutdruck-Profil (6:00 bis 12:00)	93,83 mmHg ▶

CRI2 (generalisierte ZVK-assoz. Infektion)	
<input checked="" type="checkbox"/> UND	80 %
<input checked="" type="checkbox"/> NICHT	100 %
pos. Blutkultur	
klin. Anzeichen für Entzündung bei Sepsis	80 % ▶
<input checked="" type="checkbox"/> ODER	100 %
quant. Kultur Katheterspitze	100 % ▶
semiquant. Kultur Katheterspitze	100 % ▶
klin. Anzeichen für Entzündung bei Sepsis	
<input checked="" type="checkbox"/> ODER	80 %
Fieber	80 % ▶
Hypotonie	80 % ▶
Leukopenie	
Leukocytose	
CRP erhöht	37 % ▶
Hypotonie	
<input checked="" type="checkbox"/> ODER	100 %
Blutdruck-Abfall	
Schock	100 % ▶
Schock	
Schockindex	0,8 ▶



Berechnung



Surveillance



Übersicht



Statistik



Verwaltung



Hilfe



Abmelden

von 2008-05-01 bis 2008-05-05 Anzeigen Standardansicht Grafik einblenden fixe Tabellenbreite

Stationen/Patienten

13b1
13b3
13c1
13c2
13c3
13h1
13h3
13i1
NICU_E10



NICU_E9

2008-05-01

Messwerte

Interpretationen und Diagnosen

lab: Interleukin 8: Min. 262 mg/dl
lab: Glukose: Max. 226 mg/dl
BSI-1 (KISS) 100 %
BSI-1 (Alert) 100 %
1 klin. Anz. f. Sepsis (KISS) 100 %
1 klin. Anz. f. Sepsis (Alert) 26 %
2 Labor- und klin. Anz. f. Sepsis (KISS) 100 %
2 Labor- und klin. Anz. f. Sepsis (Alert) 100 %
neue Hyperglykämie (KISS) 100 %
neue Hyperglykämie (Alert) 26 %
laborchem. Zeichen für Pneumonie (KISS) 100 %
laborchem. Zeichen für Pneumonie (Alert) 100 %
laborchem. Zeichen für Entzündung (KISS) 100 %
laborchem. Zeichen für Entzündung (Alert) 100 %
Interleukin 8 erhöht 100 %
Hyperglykämie (KISS) 100 %
Hyperglykämie (Alert) 26 %

BSI-1 (KISS)

UND
mibi: pos. Blutku., Liquor: keine KNS
2 Labor- und klin. Anz. f. Sepsis (KISS)

2 Labor- und klin. Anz. f. Sepsis (KISS)

MIND 2
path. Körpertemp.
path. Herzfrequenz (Definition)
metabolische Azidose (KISS)
neue Hyperglykämie (KISS)
laborchem. Zeichen für Entzündung (KISS)

laborchem. Zeichen für Entzündung (KISS)

Interleukin 8 erhöht

Interleukin 8 erhöht

lab: Interleukin 8: Min. 262 mg/dl

lab: Interleukin 8: Min.

lab: Interleukin 8 262 mg/dl
lab: Interleukin 8 262 mg/dl
lab: Interleukin 8 262 mg/dl

MONI: Evaluierung

2 ICUs:	n	without HCAI	with HCAI
patients	89		
ICU stays	93	75	18*
LOS (days)	median:7 shortest:1 longest:40		
patient days	1005	918	88

* comprising 30 HCAI episodes: 12 with one, 1 with two, 4 with three and 1 with four distinct infection episodes during one stay

HCAI condition correctly or falsely identified by MONI and by the human expert

MONI reported:	HCAIs present	HCAIs absent
HCAIs present	26 (86.7%)	1* (1.3%)
HCAIs absent	4** (13.3%)	75 (98.7%)
human expert reported:		
HCAI present	12 (40%)	5*** (6.4%)
HCAI absent	18**** (60%)	73 (93.6%)

* A CRI episodes was falsely detected. The underlying cause was elevated CRI as a result of leukemia.

** 3 PN episodes and 1 CRI episode not reported due to missing import of electronic microbiology report

*** human expert misinterpreted or wrongly reported 4 UTI episodes and 1 BSI episode.

**** human expert missed 3 UTI episodes, 3 BSI episodes, 11 CRI episodes and 1 PN episode

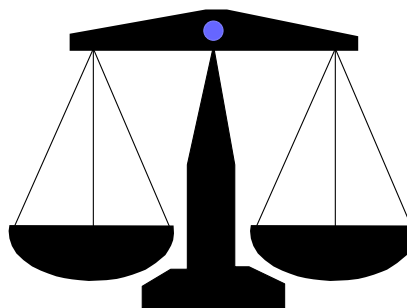
Surveillance - Zeitbedarf

2 ICUs

alle ICUs

	Conventional surveillance	MONI-ICU surveillance
Time spent	82.5 h (100%)	12.5 h (15.2%)

**Erfolge
bei der
Infektions-
prävention**



**Aufwand
für die
Surveillance**



Herzlichen Dank!