

LOWTeq*pdms*

**Entscheidungsunterstützung im PDMS –
zwischen künstlicher Intelligenz und menschlichem
Wissen**



Klinische Entscheidungsunterstützung – Definition

"Clinical Decision Support systems link health observations with health knowledge to influence health choices by clinicians for improved health care" (Dr. Robert Hayward, Centre for Health Evidence)

Klinische Entscheidungsunterstützung

- Unterstützt medizinisches Fachpersonal am “Point of care“
- Entscheidungsunterstützung ist nicht gleich CPOE

Andere Einsatzzwecke

- Datenvalidität, Datenvollständigkeit
- Umsetzung von Standards und Richtlinien
- Care Bundles
- Diagnosenfindung (DDSS)
- Intelligentes Alarming
- ...



Ventilator Associated Pneumonia Pathway

(for Adult Patients on Mechanical Ventilation >3 days)

Clinical Diagnosis	CPIs points	0	1	2
	Tracheal secretions	rare	abundant	abundant + purulent
Infiltrate on chest X-ray	none	diffuse	localized	
Temperature (°C) (°F)	36.5-38.4 97-100.9	38.5-38.9 101-102	< 36 or > 39 < 97 or > 102	
WBC count (1000/mm ³)	4-11	< 4 or > 11	< 4 or > 11 + > 500 bands	
PaO ₂ /FIO ₂	With clinical ARDS or with P/F > 240		Without clinical ARDS and with P/F < 240	

Note: If Clinical Pulmonary Infection Score (CPIS) is < 6, consider alternative diagnoses
CPIS has not been validated in immunosuppressed patients

Microbiology	Obtain Protected Alveolar Lavage (PAL) or Bronchial Alveolar Lavage (BAL) prior to starting antibiotics (suctioned sputum is suboptimal but acceptable in select patients)
	<ul style="list-style-type: none"> Order Gram stain and culture, Chest X-ray (if not previously obtained) Begin empiric antibiotics after cultures sent

Empiric Antibiotics	<p>Piperacillin/Tazobactam (4.5 gm IV q6h)* PLUS Tobramycin[†] (7mg/kg dosing weight IV q24h) *</p> <p><u>For patients at risk for Gram positive infections or if Gram positive cocci present on Gram stain.</u> Begin Vancomycin 15mg/kg IV q12h*</p> <p><u>For Penicillin Allergy:</u> Cefepime (2gm IV q8h*) or Aztreonam[‡] (2gm IV q8h*)</p> <p>It is NOT recommended that levofloxacin be used for routine empiric treatment And should be limited to <u>patients who cannot receive aminoglycosides</u> Levofloxacin (750mg IV/po daily*)</p>
	<p>* Dosing recommendations for empiric antibiotics for patients w/o renal insufficiency. Please consult pharmacy to dose if patient's Cl_{cr} < 60 ml/min.</p> <p>† For tobramycin, order 4 & 12 hour random levels after 1st dose.</p> <p>‡ Aztreonam provides only Gram (-) aerobic coverage, additional agents may be necessary to extend coverage for GPC and anaerobes</p>

Ventilator Associated Pneumonia Guidelines

American Thoracic Society/Infectious Disease Society of America, *Am J Respir*

Crit Care Med 2005; 171: 388-416.

Datenvalidität

eAR demo, demo (Patienten-ID: 0005380236 Fallnummer: 0000940727) 31887

Verwaltung Bearbeiten Eingabeformulare Geräteanbindung Ansicht Hilfe

Narkoseprotokoll Seite 01 Narkoseprotokoll Seite 02 Form:Two

06.06.11 20 18 5.59
Luft (l/min) 5.59
O2 (l/min) 5.41
Isofluran 1.6
O2 (vol%) 95

Cis-Atracurium 8mg
Fentanyl 0.5mg
Midazolam 5mg
Propofol 1% 20ml
Succinylcholin 2% 130mg

Metamizol 2,5g

Medikamente

Jonosteril 1000ml1000 KRIST: 1000

TeF 97 95 95
DS 45 74 9
SpO2
eCO2
AMV/AF
Peak | Peep | Plateau 13/6/13
FiO2 | Mean | EE -/8/-
Beatungsmodus

ZVD Wedge HF 8R
150 150-40
100 100-37
50 50-34

Rhythmus Blockbilder
Aktionen
Blutverlust Ausscheidung

Stationen: U, A, B, C, AW, Tb, H

Workstation: ZOP1 - eAR Protokollnummer: 31887 Benutzer: Administrator - 06.Jun.2011 Standard: Kein Standard Eingabemodus 30.01.13 17:06

Protokoll verlassen

Steps

- Aktionenvalidierung
- Validierung weiterer Informationen**
- Laufende Parameter stoppen
- Ende

Validierung weiterer Informationen

Validierungsprozess abgeschlossen

geplante OP ok	✓
Dringlichkeit fehlt (iMedOne)	⚠
ASA fehlt (iMedOne)	⚠
OP-Verfahren ok	✓
Anästhesist fehlt (Anästhesie - Personal)	⚠
Verfahren ok	✓
Zugang fehlt (Anästhesie - Zugänge)	⚠
'Postoperative Weiterbetreuung' und/oder 'Übergabe an' fehlt (Anästhesie - Postoperativ)	⚠
AVBs bzw. Eintrag 'kein AVB' fehlt (DGAI-Kerndatensatz - AVB)	⚠
Monitoring fehlt (Anästhesie - Monitoring)	⚠
Diskomfort-Merkmale fehlen (DGAI-Kerndatensatz - Diskomfort)	⚠

< Prev
Next >
Finish
Cancel

Interne Standards

The screenshot displays the e.ICR demo software interface for patient ID 0005283182. The main window is titled "Patient Status" and contains several panels:

- Overview:** Shows a patient diagram with question marks and a table of medical devices:

AW	29.Nov.2011 - 09:45
ART	Central venous catheter 02 29.Nov.2011 - 10:52
ZVK	Shaldon catheter 17.Nov.2011 - 11:20
	Urine catheter (DK/SPK)
- Chronological overview:** A list of actions with dates:

Action	Date
Category: Urinary catheters	
Duration: Last 436 days	
Übernahme mit Dauerkatheter tr...	21.Nov.11, ...
Category: Enteral drains	
Duration: Last 439 days	
Magensonde	18.Nov.11, ...
Duration: Last 437 days	
Verbandwechsel Magensonde	20.Nov.11, ...
	21.Nov.11, ...
	24.Nov.11, ...
	16.Nov.11, ...
	17.Nov.11, ...
	18.Nov.11, ...
	18.Nov.11, ...
	20.Nov.11, ...
	22.Nov.11, ...
	28.Nov.11, ...
- Decision Support:** A dialog box titled "Please choose a question" with the following steps:
 1. Please choose a question
 2. Attempt for collecting and smoothing relevant data
 3. Missing values input
 4. Decision Support ResultsThe "Available questions" dropdown is set to "Weaning-1" with a description: "Check patient's possible weaning".
- Dauer der Antibiotika-Therapie:** A list of antibiotics and their durations:

Antibiotic	Duration
Imipenem	2 Days
Anidulafungin	1 Day
Metronidazol	7 Days
Piperacillin/Tazobactam	9 Days
Vancomycin	6 Days
Ceftazidim	1 Day
Moxifloxacin	2 Days

The status bar at the bottom shows: workstation: Bett 01 - e.ICR. Protocol number: 1534 user: Administrator - 16.Nov.2011 entry mode 1/30/13 5:43 PM

Interne Standards

e.IcR demo, demo (Patienten-ID: 0005283182 Fallnummer: 0000935357) 1534

Administration Edit Data Input Forms Devices Window Help

Overview Chronological overview Airway Ventilation mode Arterial line Central venous catheter Enteral tubes Swann Ganz catheters Urinary catheters Renal replacement therapy Dauer der Antibiotika-Therapie

Overview

29.Nov.2011 - 09:45
Central venous catheter 02
29.Nov.2011 - 10:52
Shaldon catheter
17.Nov.2011 - 11:20
Urine catheter (DK/SPK)

AW
ART
ZVK

Chronological overview

Action Date

- Category: Urinary catheters
 - Duration: Last 436 days
 - Übernahme mit Dauerkatheter tr...21.Nov.11, ...
- Category: Enteral drains
 - Duration: Last 439 days
 - Magensonde 18.Nov.11, ...
 - Duration: Last 437 days
 - Verbandswechsel Magensonde 20.Nov.11, ...

Decision Support

Attempt for collecting and smoothing relevant data

Steps

- Please choose a question
- Attempt for collecting and smoothing relevant data**
- Missing values input
- Decision Support Results

Collecting and smoothing data from the database...		
Parameter	Value	Value
FIO2	Value missing	
PEEP	Value missing	
Sofa Value	Value missing	
Ramsay Score	3.0	
PO2	77.37	
Temperature	37.12	
Minute volume	7.77	

Dauer der Antibiotika-Therapie

Antibiotic

- Imipenem: 2 Day
- Anidulafungin: 1 Day
- Metronidazol: 7 Day
- Piperacillin/Tazobactam: 9 Day
- Vancomycin: 6 Day
- Ceftazidim: 1 Day
- Moxifloxacin: 2 Days

workstation: Bett 01 - e.IcR. Protocol number: 1534 user: Administrator - 16.Nov.2011 entry mode

1/30/13 5:43 PM

Interne Standards

e.ICR demo, demo (Patienten-ID: 0005283182 Fallnummer: 0000935357) 1534

Administration Edit Data Input Forms Devices Window Help

Home | Overview | Chronological overview | Airway | Ventilation mode | Arterial line | Central venous catheter | Enteral tubes | Swann Ganz catheters | Urinary catheters | Renal replacement therapy | Dauer der Antibiotika-Therapie

Patient Status -

Overview

Chronological overview

Decision Support

Missing values input

Dauer der Antibiotika-Therapie

Antibiotic

workstation: Bett 01 - e.ICR. Protocol number: 1534 user: Administrator - 16.Nov.2011 entry mode

1/30/13 5:43 PM

The screenshot displays the LOWTeqcdss software interface for patient management. The main window is titled 'e.ICR demo, demo (Patienten-ID: 0005283182 Fallnummer: 0000935357) 1534'. The interface includes a menu bar (Administration, Edit, Data Input Forms, Devices, Window, Help) and a toolbar with various icons. A navigation pane on the left shows 'Patient Status' with sub-panels for Overview, Chronological overview, Airway, Ventilation mode, Arterial line, Central venous catheter, Enteral tubes, Swann Ganz catheters, Urinary catheters, Renal replacement therapy, and Dauer der Antibiotika-Therapie. The 'Overview' panel shows a patient diagram with question marks and a table of medical devices: AW (Central venous catheter 02), ART (Shaldon catheter), and ZVK (Urine catheter (DK/SPK)). The 'Chronological overview' panel shows a list of actions with dates, including 'Urine catheters', 'Enteral drains', and 'Magensonde'. A 'Decision Support' dialog box is open, showing 'Steps' (1. Please choose a question, 2. Attempt for collecting and smoothing relevant data, 3. Missing values input, 4. Decision Support Results) and a 'Missing values input' table with fields for FiO2 (0.5), PEEP (10), Sofa Value (1), Ramsay Score (3), PO2 (77.36), Temperature (37.12), and Minute volume (7.77). The 'Dauer der Antibiotika-Therapie' panel lists antibiotics and their durations: Imipenem (2 Day), Anidulafungin (1 Day), Metronidazol (7 Day), Piperacillin/Tazobactam (9 Day), Vancomycin (6 Day), Cefazidim (1 Day), and Moxifloxacin (2 Days). The status bar at the bottom shows 'workstation: Bett 01 - e.ICR. Protocol number: 1534 user: Administrator - 16.Nov.2011 entry mode' and the system clock '1/30/13 5:43 PM'.

Interne Standards

e.IcR demo, demo (Patienten-ID: 0005283182 Fallnummer: 0000935357) 1534

Administration Edit Data Input Forms Devices Window Help

Overview Chronological overview Airway Ventilation mode Arterial line Central venous catheter Enteral tubes Swann Ganz catheters Urinary catheters Renal replacement therapy Dauer der Antibiotika-Therapie

Overview

Overview

29.Nov.2011 - 09:45
Central venous catheter 02
29.Nov.2011 - 10:52
Shaldon catheter
17.Nov.2011 - 11:20
Urine catheter (DK/SPK)

AW
ART
ZVK

Chronological overview

Chronological overview

Action Date

Category: Urinary catheters
Duration: Last 436 days
Übernahme mit Dauerkatheter tr... 21.Nov.11, ...

Category: Enteral drains
Duration: Last 439 days
Magensonde 18.Nov.11, ...
Duration: Last 437 days
Verbandswechsel Magensonde 20.Nov.11, ...

21.Nov.11, ...
e 24.Nov.11, ...
ne... 16.Nov.11, ...
17.Nov.11, ...
he... 18.Nov.11, ...
ne... 18.Nov.11, ...
01 20.Nov.11, ...
ne... 22.Nov.11, ...
ne... 28.Nov.11, ...

Decision Support

Steps

1. Please choose a question
2. Attempt for collecting and smoothing relevant data
3. Missing values input
4. **Decision Support Results**

Decision Support Results

Decision advice generation complete

Details	
Ramsay Score too high	3
Main Result	
Is the patient weanable?	No

Save decision advice

< Prev Next > Finish Cancel

Dauer der Antibiotika-Therapie

Antibiotic

- Imipenem: 2 Day
- Anidulafungin: 1 Day
- Metronidazol: 7 Day
- Piperacillin/Tazobactam: 9 Day
- Vancomycin: 6 Day
- Ceftazidim: 1 Day
- Moxifloxacin: 2 Days

workstation: Bett 01 - e.IcR. Protocol number: 1534 user: Administrator - 16.Nov.2011 entry mode

1/30/13 5:43 PM

Care Bundles



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Implement the IHI Ventilator Bundle



Last Modified: 08/02/2011

By definition, ventilator-associated pneumonia (VAP) is an airways infection that must have developed more than 48 hours after the patient was intubated. Preventing pneumonia of any variety seems at first blush to be a laudable goal. However, there are some reasons to be particularly concerned about the impact of pneumonia associated with ventilator use.

VAP is the leading cause of death amongst hospital-acquired infections, exceeding the rate of death due to central line infections, severe sepsis, and respiratory tract infections in the non-intubated patient. Perhaps the most concerning aspect of VAP is the high associated mortality. Hospital mortality of ventilated patients who develop VAP is 46 percent compared to 32 percent for ventilated patients who do not develop VAP. [1]

In addition, VAP prolongs time spent on the ventilator, length of ICU stay, and length of hospital stay after discharge from the ICU. [2] Strikingly, VAP adds an estimated cost of \$40,000 to a typical hospital admission. [3]

Reducing mortality due to ventilator-associated pneumonia requires an organized process that guarantees early recognition of pneumonia and consistent application of the best evidence-based practices.

The IHI Ventilator Bundle is a series of interventions related to ventilator care that, when implemented together, will achieve significantly better outcomes than when implemented individually.

The key components of the IHI Ventilator Bundle are:

- Elevation of the Head of the Bed
- Daily "Sedation Vacations" and Assessment of Readiness to Extubate
- Peptic Ulcer Disease Prophylaxis
- Deep Venous Thrombosis Prophylaxis
- Daily Oral Care with Chlorhexidine

More on This Topic

- [Effect of Nonpayment for Preventable Infections in US Hospitals](#)
- [Profiles in Improvement: Katharine Luther, Vice President, IHI](#)
- [Using Care Bundles to Improve Health Care Quality](#)

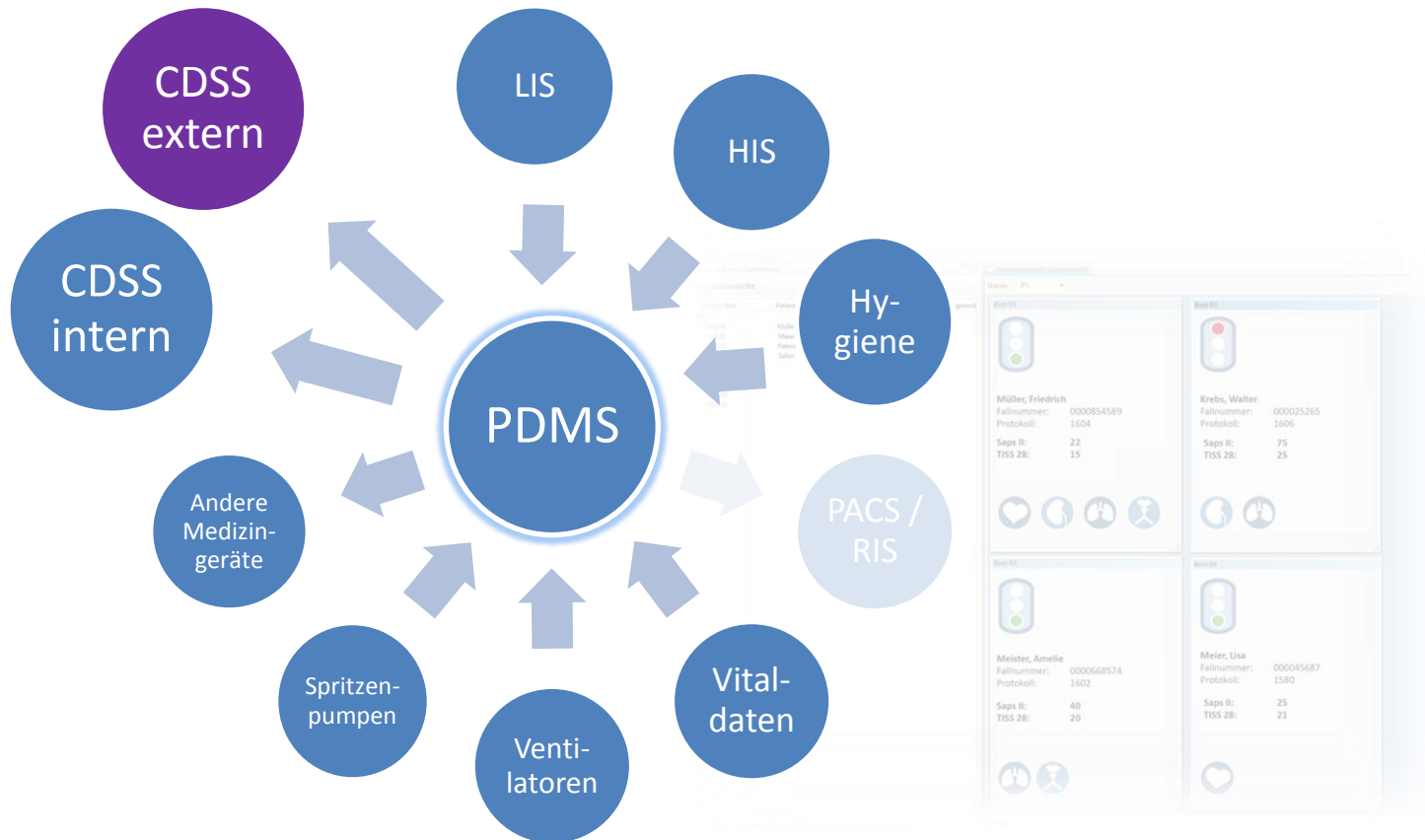
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- [Ventilator Bundle Checklist](#)
- [What Is a Bundle?](#)

<http://www.ihl.org/knowledge/Pages/Changes/ImplementtheVentilatorBundle.aspx>

Zusammenspiel PDMS und klinische Entscheidungsunterstützung



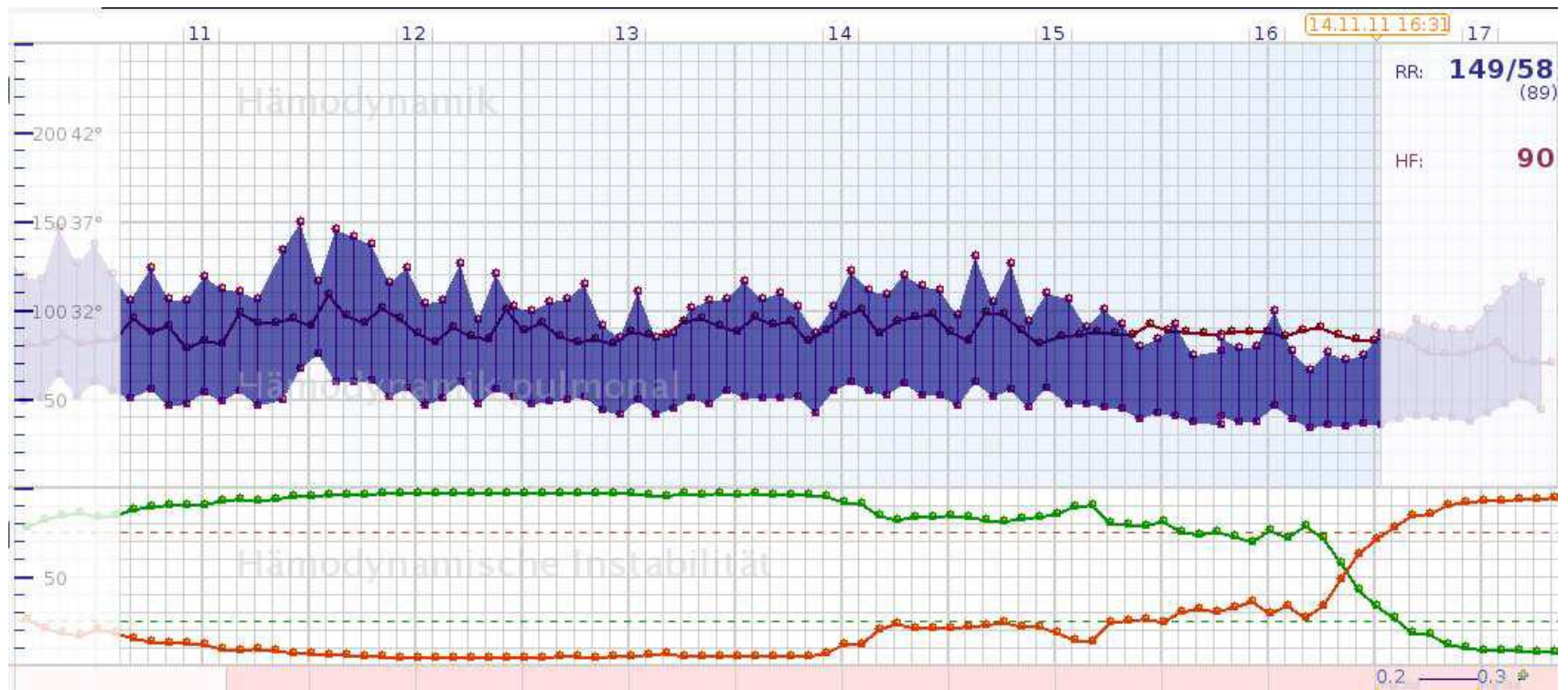
i.DS

Es gibt weitere Möglichkeiten...

```
23 #An object of type DataComplete tells if for the weaning relevant data is complete.
24 declare DataComplete
25     value: boolean
26 end
27
28 #declare any global variables here
29 global VpUniversalResult universalResult
30
31 // ----- Initialisation Rule(s) -----
32 rule "Always insert initial $weanable and $dataComplete, and report-details value" salience 100
33     when
34
35     then
36         universalResult.setComplete(false);
37         Weanable $weanable = new Weanable();
38         $weanable.setValue(false);
39         insert($weanable);
40         DataComplete $dataComplete = new DataComplete();
41         $dataComplete.setValue(false);
42         insert($dataComplete);
43         LinkedHashMap<String, String> map = new LinkedHashMap<String, String>();
44         map.put("details", "");
45         universalResult.addResultItem(map);
46 end
47
```

LOWTeq*cdss*

i.DS



Was kann ein PDMS leisten?

Automated reminders increase adherence to guidelines for administration of prophylaxis for postoperative nausea and vomiting

Fabian O. Kooij^{a,b}, Toni Klok^a, Markus W. Hollmann^b and Jasper E. Kal^a

Background and objective Correct identification of patients at high risk for postoperative nausea and vomiting (PONV), prescription of PONV prophylaxis and correct administration of medication are all important for effective PONV prophylaxis. This has been acknowledged by development of guidelines throughout the world. We studied the effect of introducing patient-specific automated reminders on timely administration of PONV prophylaxis medication during general anaesthesia.

Methods During the visit to the preoperative screening clinic, patients at high risk for PONV were identified and PONV prophylaxis was prescribed. To study the effect of patient-specific decision support [a pop-up window reminding the (surge) anaesthetist that PONV prophylaxis

respectively. In the control period, 236 patients receiving general anaesthesia were scheduled to receive PONV

prophylaxis. Of these, 93 (39%) received both dexamethasone and granisetron in the correct timeframe. This increased to 464 (79%) out of 591 patients in the decision support period and decreased back to 99 (41%) out of 243 patients in the postdecision support period ($P < 0.001$).

Conclusion Decision support is effective in improving administration and timing of PONV prophylaxis medication. After withdrawal of decision support, adherence decreased to predecision support levels. *Eur J Anaesthesiol* 27:187–191 © 2010 European Society of Anaesthesiology.

Was kann ein PDMS leisten?

ANESTHESIA

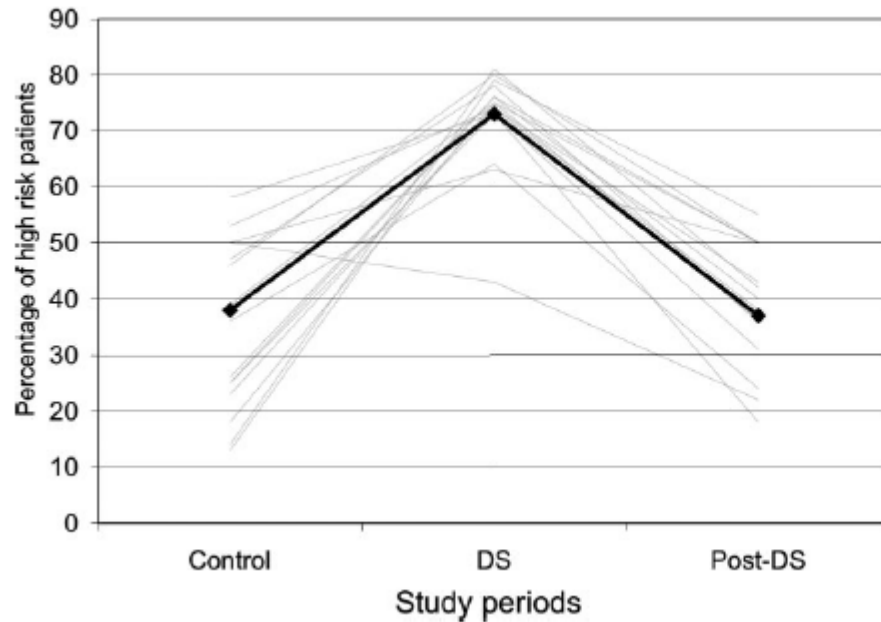


Figure 2. Guideline adherence per anesthesiologist. Shown is the percentage of high-risk patients that was prescribed postoperative nausea and vomiting prophylaxis by each individual anesthesiologist. The thick line (marked \blacklozenge) is the overall average (DS: decision support).

Was kann es *nicht* leisten?





**Vielen Dank
für Ihre Aufmerksamkeit.**