Attachment 1: 10 Quality Indicators

Quality Indicator I

Name of the indicator	**Semirecumbent position in patients undergoing invasive mechanical ventilation**
Dimension	Effectiveness and risk
Justification	The semirecumbent position reduces the incidence of ventilator-associated pneumonia (VAP)
Formula	$\frac{\text{Time spent in semirecumbent position (hours)}}{\text{Duration of mechanical ventilation (MV) (hours)}}$ x100
Population	All patients requiring MV during the period reviewed Exclusion criteria: • Patients ventilated in prone position • Clinical contraindications
Explanation of the terminology	Semirecumbent position: 30-45° upright position of upper body
Type	Structure / process
Source of data	1) Structure: Query 2) Process: ICU-patient records, PDMS
Standard	1st step: - Structure: Standard yes / no; yes>95% 2nd step: - Process: Realisation yes / no > random testing on 1st day after admission; yes>70%
Comments:	The authors recommend measuring this indicator by means of daily or periodically sampling (e.g. all patients for one week/quarter, consider implementation into devices)

Quality Indicator II

Name of the indicator	**Monitoring sedation, analgesia, delirium**
Dimension	Effectiveness and risk
Justification	Inappropriate sedation (both over- and undersedation) or analgesia, as well as untreated delirium cause prolongation of mechanical ventilation and hospital stays, as well as increased morbidity, mortality and use of resources. The use of validated sedation scales for monitoring of sedation, analgesia and delirium has proven useful in the management of these patients, and their use is recommended in clinical practice guides.

Attachment to: Braun JP, Mende H, Bause H, Bloos F, Geldner G, Kastrup M, Kuhlen R, Markewitz A, Martin J, Quintel M, Steinmeier-Bauer K, Waydhas C, Spies C, NeQuI (quality network in intensive care medicine). Quality indicators in intensive care medicine: why? Use or burden for the intensivist. GMS Ger Med Sci. 2010;8:Doc22. DOI: 10.3205/000111, URN: urn:nbn:de:0183-0001111
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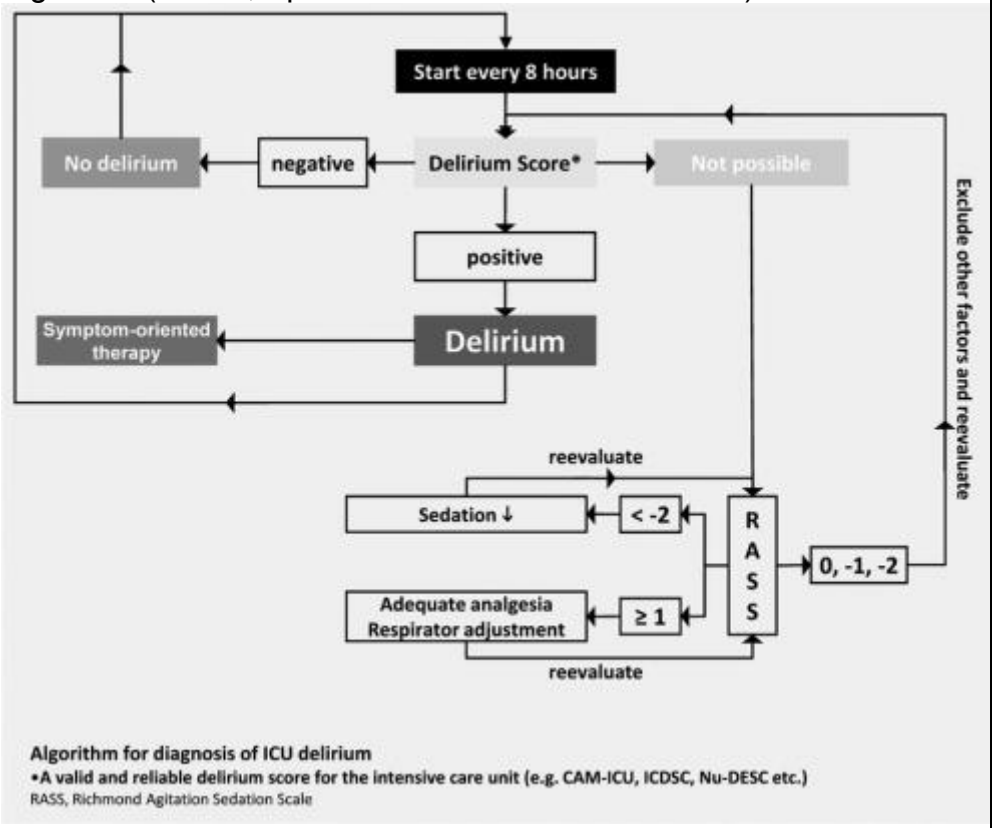
Formula	Sedation: Number of RASS assessments Default number of assessments [(days treated -1) x 3]	x100
Population	Every 8-hour period (generally) in ICU patients during the entire treatment period	
Explanation of the terminology	Monitoring: Assessment of depth of sedation and analgesia as well as presence of delirium according to validated scales for every 8-hour period or once the clinical situation changes,. Algorithm (Lütz A, Spies C et al. Crit Care Med 2009)  	
Type	1st step: Structure (sedation/analgesia/delirium): Standard yes / no 2nd step: Process: Sedation	
Source of data	1. Structure: Query 2. Process: Clinical records; patient data management systems (PDMS)	
Standard	1st step: Structure: Yes > 95 % 2nd step: Process: ≥ 70 %	

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Comments	Recommended scales (sometimes integrated into monitors and devices) RASS: Richmond Agitation and Sedation Scale NRS: Numeric Rating Scale or BPS: Behavioral Pain Scale CAM-ICU: Confusion Assessment Method - Intensive Care Unit or other validated delirium scale

Quality Indicator III

Name of the indicator	**Lung-protective ventilation**
Dimension	Effectiveness and risk
Justification	High pressure ventilation in patients with ALI/ARDS has been shown to be associated with higher incidences of ventilator-associated pneumonia (VAP), prolonged durations of ventilation, ICU- and hospital stay, as well as mortality. Lung-protective ventilation strategies may result in a 25% improvement of ALI/ARDS survival rate.
Ventilatory mode	Mechanically ventilated patients (ARDS, ALI)
Tidal volume	6 ml/kg ideal body weight
Plateau pressure	< 30 cm H_2O (depending on ventilator: peak pressure < 35 cm H_2O as an alternative)
PEEP	See table on PEEP-adjustment

Table on PEEP adjustment depending on FiO_2

FiO_2	0.3	0.4	0.4	0.5	0.5	0.6	0.7	0.7	0.7	0.8	0.9	0.9	0.9	1.0
PEEP	5	5	8	8	10	10	10	12	14	14	14	16	18	18-24

Population	All patients with ALI/ARDS and mechanical ventilation ≥ 24 hours
Explanation of the terminology	All days of mechanical ventilation in ALI/ARDS patients as well as over the entire treatment.
Type	Structure, process und outcome
Source of data	1st step: Structure: Standard yes / no; checked yes / no 2nd step: Peer review audits: Protective ventilation, tidal volume, plateau pressure (alternatively peak pressure), PEEP (alternatively: devices, PDMS) 3rd step: Outcome: Ventilator-associated pneumonia (VAP) according to ATS criteria
Standard::	1st step: Structure yes > 95 % 2nd step: Process: ≥ 70% protective ventilation 3rd step: Outcome: days with VAP

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Formula (process)	Duration of lung-protective mechanical ventilation in ALI/ARDS patients / Duration of mechanical ventilation in ALI/ARDS patients	x100
Type	Structure, process, outcome	
Source of data	1st step: Query 2nd step: Process: Peer review (alternatively: devices, PDMS) 3rd step: Outcome: KISS/SAR/-ICU-Surveillance (annual report)	

Quality Indicator IV

Name of the indicator	**Weaning protocols incorporating spontaneous breathing trials (SBT)**	
Dimension	Effectiveness and risk	
Justification	Ventilator-associated pneumonia (VAP) represents the most common nosocomial infection on the ICU and is frequently caused by insufficient weaning. The availability of a protocol for weaning from mechanical ventilation (MV) significantly shortens the total time under MV, thus **reducing the risk** of VAP. Weaning strategies in combination with targeted sedation depth are associated with decreased mortality on the ICU.	
	1. Structure: SBT performed once per day: yes/no 2. Process: Peer review 3. Outcome: VAP (according to ATS criteria)	
Population	All mechanically ventilated patients	
Formula (process)	Number of mechanically ventilated patients undergoing daily checks according to weaning protocols / Total number of mechanically ventilated patients	x100
Population	All days with mechanical ventilation during the period reviewed (minimum treatment duration = 24 hours)	
Population:	Patients in need of mechanical ventilation	
Type	Structure, process and outcome	
Source of data	1. Structure: Query 2. Process: Considering NIV during early patient visits: NIV indicated yes/no (clinical records, PDMS, peer review) 3. Outcome: Results from KISS/SARI -ICU Surveillance (annual reports)	
Standard: structure: yes/ no realisation: yes / no	1. Structure: Yes > 95 % 2. Process: > 70% positive answers ➢ missing values <20% Outcome: Days with ventilator-associated pneumonia (VAP)	

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Explanation of the terminology	• Weaning-trial: Scheduled attempt to disconnect the ventilator by means of a spontaneous breathing trial using any of the following: o T-tube test o Use of 7 cm H_2O pressure support ventilation (PSV) o Continuous positive airway pressure (CPAP) 5 cmH_2O • Synchronised intermittent mandatory ventilation (SIMV) is specifically excluded
Comments	The authors consider it more practical to measure the indicator by choosing „patients with MV“ to be the unit of analysis rather than “days of MV” because weaning tests are not usually registered in IT systems, and this approach facilitates the application of the exclusion criteria. We recommend evaluating whether the trial has been performed daily in those patients meeting the above-mentioned inclusion criteria.

Quality Indicator V

Name of the indicator	**Early and adequate initiation of antibiotic therapy**
Dimension	Effectiveness and risk
Justification	Early and adequate administration of antibiotics improves the prognosis in severe infection/sepsis. Surviving Sepsis Campaign Bundles recommend administration of antibiotics within 1 hour of diagnosing infection/sepsis (Grade C recommendation).
Formula	$\frac{\text{Number of patients with severe infection/sepsis administered antibiotics early (1h after diagnosis)}}{\text{Number of patients with infection or SIRS with assumed or proven infection with or without adequate microbial isolation}} \times 100$
Population	All patients with severe infection/sepsis discharged firm the ICU during the period reviewed
Explanation of the terminology	• Infection (CDC or ATS) • SIRS and assumed or proven infection with or without adequate microbial isolation • Early and adequate administration of antibiotics: within 1 hour after first diagnosis
Type	1. Structure: SIRS detection - yes / no and frequency 2. Process: Peer review audit
Source of data	Structure: Query, process: clinical records, PDMS (manufacturers of monitoring devices)

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Standard	1. Structure: Yes > 95 %; frequency: 3x/d (consider monitoring devices) 2. Process: Documentation of diagnosis and duration until administration of antibiotic(s) Diagnosis within 4 hours after first clinical signs of infection/SIRS Antibiotic administration: > 70% within 1 hour after first diagnosis

Quality Indicator VI

Name of the indicator	**Therapeutic hypothermia after cardiac arrest (CA)**
Dimension	Effectiveness and risk
Justification	Mild therapeutic hypothermia induced after cardiac arrest (CA) due to ventricular fibrillation (VF) or ventricular tachycardia (VT) without pulse in patients persisting in coma after recovering circulation has been show to improve neurologic prognosis and reduce mortality.
Formula	$\frac{\text{Number of patients with CA due to VF or VT without pulse and induced hypothermia}}{\text{Number of patients with CA due to VF or VT without pulse}} \times 100$
Population	All patients with CA due to VF or VT without pulse during the period reviewed • Inclusion criteria: o Persistence in coma after restoration of circulation o Observed loss of consciousness o Maximum of 15 minutes until initiation of sufficient CPR o Initial rhythm was VF or VT o Maximum of 60 minutes until ROSC • Exclusion criteria: o Cardiogenic shock o Malignant arrhythmias o Pregnancy o Coagulopathy
Explanation of the terminology	Therapeutic hypothermia: Induction of mild hypothermia (33± 1°C) within 12 hours of cardiac arrest
Type	1. Structure: Yes / No 2. Process: > 90 %
Source of data	1. Query 2. Process: Clinical records / PDMS, peer review, manufacturers of monitoring devices

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Standard	1. Structure: Yes > 90 % 2. Process: > 90 %
Comment	32-34°C, moderate!

Quality Indicator VII

Name of the indicator	**Early enteral nutrition**	
Dimension	Effectiveness and risk	
Justification	Early administration of enteral nutrition (EN) has been associated with a reduction in infectious complications and mortality in critically ill patients in the first 48 hours. It has not been associated to longer stays.	
Formula (Process)	$\frac{\text{Daily documented checks whether EN is applied}}{\text{Number of ICU patients in whom EN is indicated}}$	x100
Population	All patients discharged from the ICU during the period reviewed	
Explanation of the terminology	- Indication for EN: All patients without contraindications for EN in whom a complete oral diet is not possible	
Type	1. Structure: Yes / no (within the first 48 hours) 2. Process: Implementation rate	
Source of data	1. Query 2. Process: Clinical records / PDMS, peer review	
Standard	1. Structure: > 95% 2. Process: ≥ 70%	

Quality Indicator VIII

Name of the indicator	**Documentation of relative- / next-of-kin communication**
Justification	Trust building measure, decreases grief, reduces grief-associated morbidity (depression, PTSD)
Explanation of the terminology	Documentation of relative- / next-of-kin communication => all patients staying > 24 hours
Type	1. Structure: Yes > 100 % 2. Process: Clinical records / PDMS, peer review 70 %
Standard	At least once per ICU treatment at any critical event

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Quality Indicator IX

Name of the indicator	**Hand disinfection consumption**
Dimension	Effectiveness and risk
Justification	Hands are an important mechanism of transmission of nosocomial infections. Improved compliance with hand disinfection protocols before and after contact with patients can reduce nosocomial infection rates over 50% and diminishes the consumption of resources. Goal is to improve adherence to protocols on hand disinfection, which can be monitored indirectly by measuring the consumption of hand disinfection solution and individually audited by peer review processes.
Formula	Liters per 1,000 patient days
Population	The entire ICU staff during the period reviewed (physicians, care givers, support personnel)
Explanation of the terminology	 **1 = VOR Patientenkontakt** **2 = VOR einer aseptischen Tätigkeit** **3 = NACH Kontakt mit potentiell infektiösen Materialien** **4 = NACH Patientenkontakt** **5 = NACH Kontakt mit der unmittelbaren Patientenumgebung**

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	Bei der Einreibung des Hände-desinfektionsmittels Benetzungslücken vermeiden!  http://www.praxis-page.de/ash/
Type	Outcome
Source of data	Consumption of hand disinfection solution as reflected by ICU expenditures 3 – 5 mL / hand disinfection
Standard	80 – 100 liters / 1,000 patient days (ICU bed occupancy days)

Quality Indicator X

Name of the indicator	**ICU administration by an attending intensivist and provision of physical 24-hour ICU presence of at least one board certified intensivist**	
Dimension	Appropriateness, effectiveness and risk	
Justification	The physical presence of an intensivist in the ICU 24 hours per day guarantees the quality of care, decreasing mortality and stay among critically ill patients.	
Formula	$\frac{\text{Number of days without the physical presence of an intensivist 24 hours per day}}{365}$	x100
Population	All days of the year during the period reviewed	
Explanation of the terminology	• Intensivist: physician that is a certified intensive medicine specialist, excluding specialists in training • Physical presence is considered necessary	
Type	Structure: Query according to account of complex treatment	

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Source of data	Human resources departments and duty rosters
Standard (required for accounting of complex treatment)	100 %

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