Attachment 1

Quality Indicators in Intensive Care Medicine

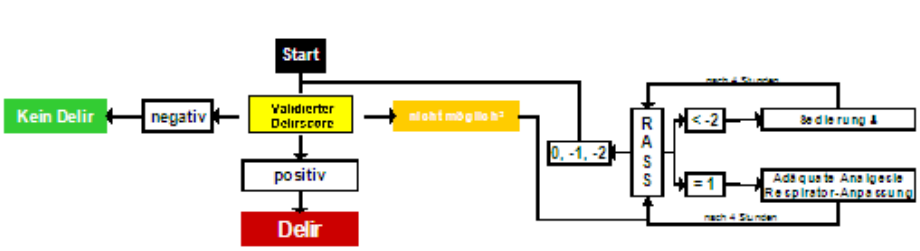
Number	**Quality Indicators I–X**
I	**Daily multiprofessional ward rounds with the documentation of daily therapy goals**
II	**Monitoring sedation, analgesia, delirium**
III	**Lung protective ventilation**
IV	**Weaning and other measures to prevent ventilator associated pneumonias**
V	**Early and adequate initiation of antibiotic therapy**
VI	**Therapeutic hypothermia after cardiac arrest (CA)**
VII	**Early enteral nutrition**
VIII	**Documentation of structured relative-/next-of-kin communication**
IX	**Hand disinfectant consumption (BQS Indikator 2010)**
X	**Direction of the ICU by a specialist dedicated intensivist with no other clinical duties in a department. Presence of an specialist ICU-physician during daytime and presence of experienced intensive care physicians and nurses over the course of 24 hours a day.**

Quality Indicators I–X

Quality Indicator I

Name of the indicator	**Daily multi-professional ward rounds with the documentation of daily therapy goals**
Dimension	Effectiveness and risk
Justification	The multi-professional ward round, consisting at least of nurses and physicians of a ward with written definition of daily goals for every patient improves communication among all acting groups involved in ICU treatment. The agreement over daily (short term) and long term goals in a patient improves treatment quality by increasing safety and a more effective implementation of treatment measures. (Length of stay, hospital mortality)
Formula	$\frac{\text{Documented daily rounds with definition of therapy goals}}{\text{Days treated}}$ x100
Population	All patients in the ICU
Explanation of the terminology	The daily definition of therapy goals for the ensuing 24 hours influences the daily routine in a way that all participating professions agree over intended and achievable goals. Improvement of communication by this joint visitation may be supported by documentation forms including checklists as been suggested by the existing literature. These should be incorporated in existing documentation systems. When defining daily goals the following aspects of treatment could be included: • Agreement over communication (consultations/relatives/other treatment institutions) • Therapeutic goals/change of therapeutic goals • Goals in analgesia/sedation/delirium management • Ventilator therapy/Weaning/respiratory therapy • Circulation/fluid management • Nutrition • Infection management • Necessity of catheters and other invasive measures • Definition of preventive measures (Anticoagulation/pressure ulcers/Stress ulcer prophylaxis/mobilisation/special physiotherapy measures) • Planned measures (Diagnostic/therapeutic) • Agreement over medication
Type	Structure/Process
Source of data	Clinical records/PDMS
Standard	1. Structure: Standard yes/no; yes >95 2. Process: Implementation yes/no; yes >70%
Literature	[7, 14–19]

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.
Formula	$\frac{\text{Sedation: Number of RASS assessments}}{\text{Default number of assessments [(days treated –1) x3]}}$ 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. 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%
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 ICDSC: Intensive Care Delirium Screening Checklist
Literature	[8]

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
Formula (process)	$\frac{\text{Duration of lung-protective mechanical ventilation in ALI/ARDS patients}}{\text{Duration of mechanical ventilation in ALI/ARDS patients}}$ 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)
Literature	[20–26]

Quality indicator IV

Name of the indicator	**Weaning and other measures to prevent ventilator associated pneumonias (short: Weaning/VAP Bundle)**
Dimension	Effectiveness and risk
Justification	Ventilator associated pneumonias are a large problem in intensive care medicine. Pathogens typically get into the subglottic respiratory tract via aspiration of nasopharyngeal colonization (micro aspiration). The quality indicator IV should result in the prevention and reduction of ventilator associated pneumonias. It is measured by two processes in daily routine care: a) Measures to reduce the length of ventilator support (including non-invasive ventilation and weaning) and b) Measures aiming at reduction of micro aspiration of pathogenic agents Measures effective with this regard are: a) Weaning protocol/concept in combination with sedation goals. In every mechanically ventilated patient (controlled ventilation) a daily evaluation for weaning possibility should be performed. This has to be seen in the context of QI II. This represents a daily sedation goal a their documentation. and b) Measures to reduce micro aspiration of pathogenic agents. These include measures which either combined (as in a VAP-bundle) or alone were shown to be able to reduce the incidence of VAP. The reported bundle differs in their combination so that in the face of the effectiveness of bundles the single included measures are less important. The bundles have proven to be relevant with regard to patients outcome. We recommend a combination of at least three single measures to be included as a standard in a single ICU. • Body positioning protocol to avoid excessive times of flat supine position in a patient • Hand disinfection before and after manipulating the airways • Oral hygiene and decontamination (with either antiseptic or antiinfective solutions) • Avoidance of micro aspiration by measuring cuff pressure, subglottic suctioning etc.
	Structure: daily documentation of goals for ventilatory support /Weaning: yes/no and documentation of measures as part of a VAP-bundle: yes/no Process: Peer review Outcome: VAP-incidence: (ATS definitions)
Population	All mechanically ventilated patients
Formula (process) QI IVa	$\frac{\text{Number of mechanically ventilated patients with daily documentation of a weaning trial (begin or ongoing) has been started}}{\text{Total number of all mechanically ventilated patients}}$ x100
Formula (process) QI IVb	$\frac{\text{Number of mechanically ventilated patients with daily protocol of VAP-bundle}}{\text{Total number of all mechanically ventilated patients}}$ x100
Type	Structure, process and outcome
Source of data	1. Structure: Query 2. Process: Morning round (Visitation) Check: NIV-indication yes/no (Patient file, PDMS, Peer Review), VAP-Bundle implemented 3. Outcome: Results of the KISS/SARI-ICU Surveillance (annual report)
Standard: Struktur: ja/nein Umsetzung: ja/nein	1. Structure: yes >95% 2. Process: >70% Number of positive answers ➢ Missing values <20% 3. Outcome: Days with ventilator associated pneumonias: 18 Events per 1.000 days of mechanical ventilation (plus 20 VAP ventilator days per 100 days of mechanical ventilation) Length of mechanical ventilation after diagnosis of VAP <= 10 days

Explanation of the terminology	• *Weaning trial:* Planned intention to disconnect the patient from ventilatory support by beginning a spontaneous breathing trial with one of the following methods: o T-piece o Pressure support ventilation (support pressure 7cmH_2O o Continoous positive airway pressure of 5cmH_2O (CPAP) • Synchronised intermittent mandatory ventilation (SIMV) is excluded • Non-invasive ventilation includes measures for ventilatory support without translaryngeal devices • Body position protocols are effective in VAP-prevention. However in the literature conflicting results have been published showing different measures with their effect on VAP incidence (Upper body elevation, prone positioning ar lowering of the upper body) The avoidance of excessive times of flat supine position are probably the effect of these single measures evaluated.
Comments	In the view of the authors it seems more practicable to define this indicator with patients on mechanical ventilation rather than days on mechanical ventilation, especially since weaning trials are not routinely detected by IT-systems and this also helps keeping the exclusion criteria. Measures for point 2, 4, 5 can be extracted from the patients file measures under point 3 should be defined in a standard be checked there. QI IVa: We recommend evaluation if daily trials have been attempted and if they were attempted in patients meeting inclusion criteria for such a trial. QI IVb: For the measures included in the VAP-bundle there is published evidence that showed an effect on VAP incidence. These measures are also included in published VAP bundles. Single measures not mentioned in the QI IV have not been proven to influence VAP. Therefore only measures with a proven effect are included.
Literature	[24, 27–40]

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	$\frac{\text{Number of patients with severe infection/sepsis administered antibiotics early (1 h after diagnosis)}}{\text{Number of patients with infection or SIRS with assumed or proven infection with or without adequate microbial isolation}} \times 100$
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)
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
Literature	[22, 41–46]

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
Standard	1. Structure: Yes >90% 2. Process: >90%
Comment	32–34°C, moderate!
Literature	[12, 47–50]

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%
Literature	[51–54]

Quality Indicator VIII

Name of the indicator	**Documentation of structured relative-/next-of-kin communication**
Dimension	Effectiveness and risk
Justification	Communication between relatives of a patient and the ICU staff is of great importance as a trust building measure which decreases grief and reduces grief-associated morbidity (depression, PTSD). To get sustainable results out of communication processes their documentation is a basic requirement.
Explanation of the terminology	Documentation of relative-/next-of-kin communication of all patients staying longer than 48 hours in the ICU. Each communication should be documented including participants. It should take place at least once every week and include the following aspects: 1. Actual state of the patient 2. Current treatment plan 3. Following an initial question for a written preformed patient will or letter of attorney the will of a patient should be asked from their relatives with regard to the current status and treatment plan. Especially if the patient is not able to speak for himself. 4. Mentioning of short and mid term treatments. 5. Prognosis of the current disease process by the treating team.
Type	1. Structure: Yes > 100 % 2. Process: Clinical records/PDMS, peer review 70 %
Standard	At least once per week of ICU treatment and/or at any critical event structured and documented communication
Literature	[55-60]

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** 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 litres/1,000 patient days (ICU bed occupancy days)
Comments	HandKISS ICU Data – Prof: Gastmeier **Abschnitt A.1 - Referenzdaten Gesamt** **Stratifizierung: Alle** Tabelle A.1.1: Intensivstationen

Art der Station	Anzahl Krh.	Anzahl Stat.	Patienten-tage	Jahres-verbrauch Liter	Verbrauch ml / Pat.-Tag				Anz. HD / Pat.-Tag *1*2
					MW *1	Q1	Median	Q3	
Innere	34	39	132.100	8.573	65	40	59	84	22
Interdisziplinär	93	106	431.940	33.125	77	45	66	86	26
Chirurgie	25	36	136.008	10.822	80	51	78	102	27
andere operative Fächer	11	15	54.963	3.173	58	38	56	74	19
andere konserv. Fächer	7	8	30.299	1.664	55	28	59	87	18
Pädiatrie	12	12	38.194	2.924	77	51	107	127	26
Neonatologie	23	25	84.758	8.621	102	65	88	162	34
Alle Abteilungen	**118**	**241**	**908.262**	**68.902**	**76**	**45**	**68**	**98**	**25**

Literature	[61–66] http://whqlibdoc.who.int/publications/2009/9789241597906_eng.pdf

Quality Indicator X

Name of the indicator	**Direction of the ICU by a specially trained certified intensivist with no other clinical duties in a department. Presence of a certified ICU-physician during daytime and presence of experienced intensive care physicians and nurses over the course of 24 hours a day.**
Dimension	Effectiveness and risk
Justification	Presence of a certified intensive care specialist in the core working period of a day secures quality of treatment and reduces mortality and length of stay. High quality treatment of patients in the intensive care unit requires the presence of experienced physicians and nurses 24 hours a day. For two ventilated patients at least one nurse is required.
Formula	$\frac{\text{Number of days with completed structural requirement}}{365}$ x100
Population	All days of the evaluated time over a year
Explanation of the terminology	Presence of an experienced and certified intensive care physician is considered necessary. Literature shows outcome relevant structural requirements which are represented by the QI X. The ICU should be staffed with a core team of physicians and nurses with no other responsibilities which knows the actual problems of the treated patients.
Type	Structure (Query on structure via the OPS-Code)
Source of data	Personnel department and staff rotation plan
Standard	97%
Literature	[13, 67–70] http://www.divi-org.de/fileadmin/pdfs/struktur/Langversion_201105.pdf