Catalogue of Patient Safety Indicators

Safety Improvement for Patients in Europe

SimPatIE - Work Package 4

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Preface

A set of 42 patient safety indicators (PSI) are established as part of the work done by work package 4 in the SimPatIE-project. This catalogue contains the descriptions of the PSIs. The work done to establish the PSIs is described in detail in the report: “Establishing a set of Patient Safety Indicators”. The report is available at www.simpatie.org.

Contents

Institution-Wide PSIs

Measuring Hospital Standardised Mortality Rates

PSI 1: Measuring Hospital Standardised Mortality Rates	
Origin: PSI by SimPatIE	
Dimension	**Description**
Description of Specific Aspects of Patient Safety	Hospital Standardised Mortality Ration (HSMR) was first developed to monitor the quality of care delivered. Yet, death is the ultimate harm to a patient regarding patient safety. Thus HSMR is an adequate PSI (1;2).
Level of Determination of Patient Safety	Safety is assessed at the aggregated patient level.
Aim of the PSI	The PSI aims at surveillance of institution-wide in-hospital mortality.
Source(s)	HSMR was developed by B. Jarman, London.
Extent of Clinically Testing	Since 1999 HSMR has been used in all National Health Service hospitals in England, and the results have been published. The method has also been used and tested in Sweden where it was applied to the national patients' registry. Registration of death is statutory, which increases the data registrations and makes the registration specific. By testing the method predictive differences in HSMR was found, they were: the number of in-hospital doctors per 100 beds, number of GPs per 100000 habitants in the area of interest, the number of acute admissions, and the part of patients suffering from comobidity like pneumonia and heart insufficiency (1).
Evidence of Clinically use of Standards	No evidence of clinically use of standards was found.
PSI category	Institution-Wide PSI.
Data definitions	Individual patient registration of age, sex, postal code, one primary and up to six secondary ICD-9 discharge diagnosis, kind of hospitalisation (elective or acute), date of admission and discharge, information on where the patient is discharged to and finally whether the patient is discharged alive. HSMR can be assessed for all diagnosis, for separate diagnosis, for departments and for the whole hospital. Organisational registration of number of beds, number of doctors and nurses employed in the hospitals in the area, number of GPs in the area and information on socio economics in the background population of the area.
Numerator Description	Numbers of deaths given a specific diagnose.
Denominator Description	The total number of admissions given the specific diagnosis stratified by age (10 years intervals), sex, elective/acute admission and total time

	of hospitalisation.
Data Source	Administrative data.
Identifying the institutional context	This PSI is relevant to quality improvement and accreditation.
Care Setting	The PSI applies institution-wide.
Professionals Responsible for Health Care	All authorised health care workers.
Lowest Level of Health Care Delivery Addressed	Individual clinical units or departments.
Allowance for Patient Factors	Age (10 years intervals), sex, comorbidity.
Stratification by Vulnerable Populations	Age (10 years intervals), sex, elective/acute admission and total time of hospitalisation.
Standard of Comparison	No time frame of the comparison set. Hospital-wide surveillance.
Scoring	Only the 85 primary admission diagnoses contributing to 80% of all in-hospital deaths are counted. All transfers between hospitals are excluded. To know about differences in primary illness and comorbidity the 15 most often discharge diagnosis (covering chronic diseases and acute cause of admission) are to be found as the primary diagnosis related to 50% of all in hospital deaths (Please see (1) for further definition) For each of the 85 included primary discharge diagnoses the yearly cumulative mortality proportion (CMP) of the hospital is assessed, that is dividing the number of deaths given a specific diagnoses by the total number of admissions given the specific diagnosis stratified by age (10 years intervals), sex, elective/acute admission and total time of hospitalisation. The expected yearly CMP is assessed for each stratum multiplied by the total strata specific CMP. HSMR is assessed as the ratio of the observed versus the expected CMP for each of the primarily discharge diagnosis multiplied by 100. By means of stepwise regression analysis risk factors for differences in HSMR are identified. The steps are: 1) general hospital data (e.g. part of acute admitted patients 2) individual hospital data (e.g. number of beds) 3) society related data (e.g. number of GPs per 100000 habitants in the area). Please see (1) for further scoring advise.

Death in Low-Mortality DRGs

PSI 2: Death in Low-Mortality DRGs	
Origin: Review of an AHRQ PSI (3)	
Dimension	**Description**
Description of Specific Aspects of Patient Safety	Death in patients admitted to hospital for an extremely low-mortality condition or procedure might happen due to adverse events. Thus this theme is suitable as a measure of patient safety.
Aim of the PSI	This PSI is intended to flag cases of in-hospital deaths in patients unlikely to die during hospitalisation.
Level of Determination of Patient Safety	Safety is assessed at the aggregated patient level.
Source(s)	This indicator was originally proposed by Hannan et al. as a criterion for targeting "cases that would have a higher percentage of quality of care problems than cases without the criterion as judged by medical record review" (3).
Extent of Clinically Testing	The AHRQ project team developing this PSI conducted empirical analyses on this PSI. The team concluded: "Deaths in low-mortality DRGs generally performs well on several different dimensions including reliability, bias, relatedness of indicators and persistence over time". The AHRQ project team reviewed the literature and found a two-stage implicit review of randomly selected deaths by Hannan et al. They found that "patients in low-mortality DRGs (<0.5%) were 5.2 times more likely than all other patients who died (9.8% versus 1.7%) to have received "care that departed from professionally recognised standards," after adjusting for patient demographic, geographic, and hospital characteristics. In 15 of these 26 cases (58%) of substandard care, the patient's death was attributed at least partially to that care. The association with substandard care was stronger for the DRG-based definition of this indicator than for the procedure-based definition (5.7% versus 1.7%, OR=3.2)"(3). The AHRQ PSI software was applied to Veteran Affairs (VA) administrative data to identify potential instances of compromised patient safety; determine occurrence rates of PSI events in the VA; and examine the construct validity of the PSIs. The study population was 97% male, with a mean age of 65 years, 54% were age 65 and older. Mean length of stay was 7.1.days. All together 11411 PSI events were identified, 46% of PSI events occurred in surgical hospitalisation and 54% in medical hospitalisation. The observed PSI rate per 1000 discharges was 3.23 for death in low-mortality DRGs. This PSI was significantly associated with the AHRQ PSI for failure to rescue. Statistically significant differences were found for hospitalisations with this PSI event and those without PSI events for longer lengths of stay and costs (4). The performance of the AHRQ PSIs was analysed to: 1) provide a

	descriptive analysis of the incidence of PSI events from 2001 to 2004 in the VA; 2) examine trends in national PSI rates at the hospital discharge level over time; and 3) assess whether hospital characteristics (teaching status, number of beds, and degree of quality improvement implementation) and baseline safety-related hospital performance predict future hospital safety-related performance. Risk-adjusted rates of the PSI for iatrogenic pneumothorax and failure to rescue demonstrated no clear trend in the rate over time. It was concluded, that the PSI is a useful tool for tracking and monitoring patient safety events. Future research should investigate whether trends reflect better or worse care or increased attention to documenting patient safety events (5). The Agency for Healthcare Research and Quality PSI algorithms were applied to administrative data across four years of 1.92 million discharges from children's hospitals. The mean risk-adjusted rates of PSI events ranged from 0.1 events per 1000 discharges for a foreign body left in during a procedure to 140 events per 1000 discharges for failure to rescue. The researchers concluded: “PSIs derived from administrative data are indicators of patient safety concerns and can be relevant as screening tools for children's hospitals; however, cases identified by these indicators do not always represent preventable events. Some, such as a foreign body left in during a procedure, iatrogenic pneumothorax, infection attributable to medical care, decubitus ulcer, and venous thrombosis, seem to be appropriate for paediatric care and may be directly amenable to system changes. In their present form, two of the indicators, namely, failure to rescue and death in low-mortality DRGs, are inaccurate for the paediatric population, do not represent preventable errors in the majority of paediatric cases, and should not be used to estimate quality of care or preventable deaths in children's hospitals”(6). Administrative data from community hospitals in 16 US states with reliable race/ethnicity measures using the AHRQ PSIs was analysed to determine whether racial and ethnic differences in patient safety events disappear when income (a proxy for socioeconomic status) is taken into account. Deaths in low-mortality DRGs occur significantly less often among Hispanic people and Asian Pacific Islander than among white. It was concluded that: ”The AHRQ PSIs are a broad screen for potential safety events that point to needed improvement in the quality of care for specific populations” (7). The results suggest that this PSI may be useful as a measure of patient safety – Though special thoughts should be given to application of this PSI to the paediatric population. (3-6). AHRQ is determining the feasibility and practicality in a project concerning validation of selected AHRQ Quality Indicators (8).
Evidence of Clinically use of Standards	No evidence of clinically use of standards was found.
PSI category	Disease Disease Specific PSI

Data definitions	In-hospital deaths per 1000 patients in DRGs with less than 0.5% mortality.
Numerator Description	Discharges with dispositions of "deceased".
Denominator Description	Patients, 18 years and older or MDC (pregnancy, childbirth and puerperium), in DRGs with less than 0.5% mortality rate, based on NIS 2003 low-mortality DRG. If a DRG is divided into "without/with complications", both DRGs must have mortality rates below 0.5% to qualify for inclusion. Exclude cases with any code for trauma, immunocompromised state, or cancer.
Data Source	Administrative data.
Identifying the institutional context	The impact of deaths in low-mortality DRGs related to adverse events makes this PSI important in quality improvement policies.
Care Setting	The PSI applies for quality health care.
Professionals Responsible for Health Care	All authorised health care workers.
Lowest Level of Health Care Delivery Addressed	Individual clinical department.
Allowance for Patient Factors	No risk adjustment described.
Stratification by Vulnerable Populations	Because the denominator includes many heterogeneous patients cared for by different services, this PSI should be stratified by DRG type i.e., adult medical, paediatric medical, adult surgical, paediatric surgical, psychiatric, obstetric and neonatal (3;4).
Standard of Comparison	No specific standards given.
Scoring	AHRQ has PSI software for scoring. This indicator should be evaluated separately by type of DRG when used as an indicator of quality. For example, the PSI Software reports the low-mortality DRG rate for all the included DRGs and separately by DRG type: adult medical, adult surgical (with and without an operating room procedure), paediatric medical, paediatric surgical (with and without an operating room procedure), and obstetric and psychiatric (3).

Patients Experiencing Adverse Events

PSI 3: Patients experiencing Adverse Events	
Origin: PSI by SimPatIE	
Dimension	**Description**
Description of Specific Aspects of Patient Safety	The ultimate goal is to achieve the best care and outcome for patients each time they are in touch with the health care system. The frequency of adverse events is cause for serious concern. A comprehensive approach to reduce adverse events involves not just health care organisations but patients as well as patients are an important source of observations and information about adverse events, though. All though it is a known fact within patient safety experts that patients comprehend adverse events as errors, patient's experiences of adverse events is considered important as a source for identifying areas for improvement. Thus patient's experience of adverse events is an important measure of patient safety.
Aim of the PSI	This PSI aims at surveillance of patient's experience of the presence of adverse events (e.g. in diagnosing, medication, procedure, and communication).
Level of Determination of Patient Safety	Safety is assessed at the aggregated patient level.
Source(s)	This PSI is derived from the section on patient safety of the Danish national patient survey: Patient's experiences in hospital (9).
Extent of Clinically Testing	By using a questionnaire attitudes and responses to adverse events were investigated from the patient's and the staff's point of view. Patients were asked about their experiences with adverse events and staffs management of adverse events. Comparison of responses to the same questions was made between the two groups. Twenty percent of patient had experienced minor adverse events and eight percent large adverse events during hospitalisation (9). Another Danish study using mailed questionnaires estimated the incidence of medical errors; also the extent of agreement between patients and staff of the type of error was investigated. Errors were described in free text by informants and rated in categories by a risk manager. Of the staff 44% had experienced an error within the last three months in ambulatory or in-patient care, whereas 13% of the patients had experienced an error. The most frequent error experienced by staff was: "wrong medicine" and by patients "delayed diagnosis". By the descriptions the risk manager found that 44% of the patient reported errors could be classified as dissatisfaction. The researchers concluded that patients typically find it difficult to distinguish between an error and their dissatisfaction, highlighting a need for firm criteria if patients are to report errors as a basis for improvements. Comparison of error rates between patients and staff – and indeed between hospitals - will be misleading until these criteria are reliable and validated (10).

	This PSI has not been clinically applied.
Evidence of Clinically use of Standards	No evidence of clinically use of standards was found.
PSI category	Institution-Wide PSI.
Data definitions	Number of patients experiencing an adverse event per 1000 discharges.
Numerator Description	Number of patients experiencing an adverse event during hospitalisation.
Denominator Description	Number of patient's discharges from hospital
Data Source	Patient's Experiences (Satisfaction) Survey.
Identifying the institutional context	The qualitative and quantitative consequences of adverse events make this PSI important in quality improvement policies.
Care Setting	The PSI applies institution-wide.
Professionals Responsible for Health Care	All authorised health care workers.
Lowest Level of Health Care Delivery Addressed	Individual clinical department.
Allowance for Patient Factors	No risk adjustment described.
Stratification by Vulnerable Populations	No stratification.
Standard of Comparison	No specific time standards given, but comparison every second year has shown to be good.
Scoring	Scoring according to the manual of the Patient's Experiences (Satisfaction) Survey.

Patients Informed about an Adverse Event by the Staff

PSI 4: Patients Informed about and Adverse Event by the Staff	
Origin: PSI by SimPatIE	
Dimension	**Description**
Description of Specific Aspects of Patient Safety	Once a serious adverse event has happened it is important to identify it and take adequately care of the patient and make adequate improvements. A feature of a positive and highly developed safety culture is awareness regarding unsafe act and procedures and openness. Thus patient's way of finding out about an adverse event is an important measure of patient safety culture. It is known facts among patient safety experts, that patient comprehend adverse events as errors.
Aim of the PSI	This PSI aims at surveillance how patients get to know about adverse events.
Level of Determination of Patient Safety	Safety is assessed at the aggregated patient level.
Source(s)	This PSI is derived from the section on patient safety of the Danish national patient survey: Patient's experiences in hospital, question 19 (9;11).
Extent of Clinically Testing	Attitudes and responses to adverse events have been investigated from Danish patient's and the staff's point of view, using a questionnaire survey. Patients were asked about their experiences with adverse events and staffs handling of adverse events. Comparison of responses to the same questions was made between the two groups. The researchers concluded that healthcare staff should, to a larger extent, inform openly about adverse events and their medical consequences. Information should be communicated direct to the patient and their relatives and written in the patient's record (12). This PSI has not been clinically applied.
Evidence of Clinically use of Standards	No evidence of clinically use of standards was found.
PSI category	Institution-Wide PSI.
Data definitions	Patients informed about the adverse event by the staff per 1000 patient experienced adverse events.
Numerator Description	Number of patients informed about the adverse event by the staff
Denominator Description	Number of patients experiencing an adverse event during hospitalisation.
Data Source	Patient's Experiences (Satisfaction) Survey.
Identifying the institutional context	The impact of high quality incident management makes this PSI important in cultural improvement policies.

Care Setting	The PSI applies for institution-wide quality incident management especially relating to awareness, openness and communication.
Professionals Responsible for Health Care	All authorised health care workers.
Lowest Level of Health Care Delivery Addressed	Individual clinical department.
Allowance for Patient Factors	No risk adjustment described.
Stratification by Vulnerable Populations	No stratification.
Standard of Comparison	No specific time standards given, but comparison every second year has shown to be.
Scoring	Scoring according to the manual of the Patient's Experiences (Satisfaction) Survey.

Patients Experiences of Adverse Event Management

PSI 5: Patients Experiences of Adverse Event Management	
Origin: PSI by SimPatIE	
Dimension	**Description**
Description of Specific Aspects of Patient Safety	Once a serious adverse event has happened it is important to identify it and take adequately care of the patient and make the necessary preventive improvements. All though it is a known fact within patient safety experts that patients comprehend adverse events as errors, patients experiences of adverse event management is considered important as a source for identifying areas for improvement. Thus patient's impressions of adverse event management are an important measure of patient safety and the related culture.
Aim of The Specific Indicator	This PSI aims at surveillance of patient's negative experiences with adverse event management following an adverse event.
Level of Determination of Patient Safety	Safety is assessed at the aggregated patient level.
Source(s)	This PSI is derived from the section on patient safety of the Danish national patient survey: Patient's experiences in hospital, question 20 (9;11).
Extent of Clinically Testing	Attitudes and responses to adverse events have been investigated from Danish patient's and the staff's point of view, using a questionnaire survey. Patients were asked about their experiences with adverse events and staffs management of adverse events. Comparison of responses to the same questions was made between the two groups. The researchers concluded that healthcare staff should, to a larger extent, inform openly about adverse events and their medical consequences. Information should be communicated direct to the patient and their relatives and written in the patient's record (13). This PSI has not been clinically applied.
Evidence of Clinically use of Standards	No evidence of clinically use of standards was found.
Indicator category	Theme Related PSI: "Medication Errors".
Data definitions	Patients experiencing an adverse event finding staff's management of the incident "bad" and "extremely bad" measured on a 5-point Likert scale per 1000 discharges.
Numerator Description	Number of patients, having experienced an adverse event, finding staff's incident management "bad" or "extremely bad" measured on a 5-point Likert scale ranging from excellent, good, and neutral to bad and extremely bad.
Denominator Description	Number of patients experiencing an adverse event during hospitalisation.
Data Source	Patient's Experiences (Satisfaction) Survey.

Identifying the institutional context	The impact of high quality patient safety management makes this indicator important in cultural and clinical improvement policies.
Care Setting	The indicator applies for high quality adverse event management.
Professionals Responsible for Health Care	All authorised health care workers.
Lowest Level of Health Care Delivery Addressed	Individual clinical department.
Allowance for Patient Factors	No risk adjustment described.
Stratification by Vulnerable Populations	No stratification.
Standard of Comparison	No specific time standards given, but comparison every second year has shown to be good.
Scoring	Scores are obtained on a 5-point Likert scale ranging from excellent, good, and neutral to bad and extremely bad. The numbers of scores of "bad" and "extremely bad" are cumulated. Scoring according to the manual of the Patient's Experiences (Satisfaction) Survey.

Transition of Care - Patient's Understanding of the Purpose of their Medication

PSI 6: Transition of Care – Patient's Understanding of their Medication	
Origin: PSI by SimPatIE	
Dimension	**Description**
Description of Specific Aspects of Patient Safety	Communication and transfer of information between healthcare settings and between professionals and patients are essential aspects of patient safety. Especially care transition processes are known to be vulnerable regarding patient safety. Understanding the purpose of the medication can impact compliance. Adherence to medications is important as lack of compliance can have fatal consequences for the patient.
Aim of the PSI	This PSI aims at highlighting the quality of staff patient communication regarding patients understanding of the purpose of their medication when leaving hospital.
Level of Determination of Patient Safety	Safety is assessed at the aggregate patient level.
Source(s)	This PSI is derived from the "Care Transitions Measure" question 3. Please see www.caretransitions.org Dr. Coleman and colleagues have designed a measure to assess the quality of care transitions: the Care Transitions Measure (CTM ©). The CTM exists in two forms a 15-item uni-dimensional version and a three-item version (CTM-3), which is a subset of the 15 items version. The primary objective of the development of CTM was a measure that is both substantively and methodologically consistent with the concept of patient-centeredness, and useful for the purpose of performance measurement and subsequent public reporting. CTM assesses health care professionals accomplished essential care processes (14).
Extent of Clinically Testing	CTM is used in 15 different countries. Specific CTM items were developed; pilot tested, and refined using focus groups. By standard qualitative analytic techniques applied to the written interview transcripts, four key domains were found for the CTM. The domains were: 1) information transfer; 2) patient and caregiver preparation; 3) self-management support; and 4) empowerment to assert preferences. Psychometric testing of the CTM included content and construct validity, intra-item variation, and floor/ceiling properties. High internal consistency and reliability were found. Also applicability for assessment across multiple sites of care: hospital to home, hospital to skilled nursing facility, skilled nursing facility to home was good. CTM demonstrated power to discriminate between: 1) patients discharged from hospital that did/did not experience a subsequent emergency visit or readmission for their index condition, and 2)

	health care facilities with differing levels of commitment to care coordination. The researchers concluded: "CTM may serve to fill an important gap in health system performance evaluation by measuring the quality of care delivered across settings" (14). The developer of TCM-3 have studied the differential item function by gender, self rated health, age, educational level and ethnicity. It was found that these variables do not bias the responses on TCM-3. No risk adjustment was found necessary (15-17) Specifications are given for the use of CTM-3 in five domains: 1) Survey Instrument, 2) Sampling, 3) Survey administration 4) Scoring and patient mix adjustment and 5) Reporting data (15). Dr. Coleman and his colleagues also developed a 4-week Care Transition Intervention program, which was tested in a randomised controlled trial. Patients with complex care needs received either treatment as usual or the CTM-intervention: specific tools, support by a "Transition Coach," and self-management skills. Patients in the CTM-program were significantly less likely to be readmitted and they were more likely to achieve self-identified personal goals around symptom management and functional recovery. Findings were sustained for as long as six months after the program ended (18).
Evidence of Clinically use of Standards	No evidence of clinically use of standards was found.
PSI category	Institution-Wide PSI.
Data definitions	Patient's agreement that they understand the purpose for taking their medicine measured on a 5-point Likert scale per 100 discharges.
Numerator Description	Number of patients agreeing that they understand the purpose of taking their medication rated as "Agree" or "Strongly agree" measured on a 5-point Likert scale ranging from "Strongly Disagree", "Disagree", "Don't know/Don't remember/Not applicable" to "Agree" and "Strongly Agree".
Denominator Description	Number of discharges from acute care hospitals. Exclude: - Psychiatric patients/ Patients with cognitive disorders - Paediatric patients under age 18 years - Patients who die in hospital - Patients who did not stay at least one night in hospital - Other patients as required by law or regulation in the state in which the hospital operates
Data Source	The Care Transitions Measure (CTM-3) Question 3.
Identifying the institutional context	The impact of high quality communication and information makes this PSI important in safety improvement policies.

Care Setting	The PSI applies institution-wide.
Professionals Responsible for Health Care	All authorised health care workers.
Lowest Level of Health Care Delivery Addressed	Individual clinical department.
Allowance for Patient Factors	No risk adjustment described.
Stratification by Vulnerable Populations	No stratification.
Standard of Comparison	Yearly. Please see (15).
Scoring	Scores are obtained and scored on a 5-point Likert scale ranging from “Strongly Disagree”, “Disagree”, “Don’t know/Don’t remember/Not applicable” to “Agree” and “Strongly Agree”. Scores of “Agree” and “Strongly Agree”. Scores are cumulated and frequencies calculated. Specifications are given for the use of CTM-3 in five domains: 1) Survey Instrument, 2) Sampling, 3) Survey administration 4) Scoring and patient mix adjustment and 5) Reporting data (15).

Institution-Wide use of Cultural Assessment

PSI 7: Institution-Wide use of Cultural Assessment	
Origin: PSI by SimPatIE	
Dimension	**Description**
Description of Specific Aspects of Patient Safety	Focus of the works of patient safety has shifted over the time from investigation of the epidemiology of adverse events and introduction of innovations aimed at prevention to investigation of shared attitudes, beliefs, values and assumptions that underlie how people perceive and act upon safety. It is thought important to try to grasp these shared characteristics to initiate fundamental and sustained changes to patient safety. Thus cultural surveillance is important in developing patient safety.
Aim of the PSI	This PSI aims at surveillance of the use of regular yearly cultural assessment within the hospital.
Level of Determination of Patient Safety	Safety is assessed at the aggregate institutional level.
Source(s)	PSI is by SimPatIE.
Extent of Clinically Testing	We found no evidence for the use of an indicator for monitoring the frequency of the use of culture assessments. It is an acknowledged fact in the literature, that measuring the safety gives the management/organisations a baseline for developing the culture. Results of regular measures give the management/organisations the opportunity to plan and carry out adequate changes to develop patient safety. A systematic literature review of ten studies was conducted to review the evidence for a relationship between organisational culture and health care performance. The reviewer's found a considerable variation in the design, study setting, and quality of reporting and aspects of culture/performance considered. Researchers of four of the studies found supportive evidence for an association between culture and performance are linked (19). A recent study revealed that the overall unit based safety climate significantly predicted nurse back injuries, medication errors and urinary tract infections. A more positive safety culture was associated with fewer incidents (20). Numerous articles give a general introduction and presentation to evaluation of safety culture within health care (21-24). Also in recent years a large number of quantitative tools with differing characteristics have been developed to access the generic concept of culture (22;25-27). The instruments vary in focus, aim, method, application and validity. Not surprisingly, there is not one best

	instrument, as they all have strengths and weaknesses. The important thing is for organisations to select the instrument that is most appropriate for their purposes and validated in a relevant setting.
Evidence of Clinically use of Standards	Though cultural assessment is in use in numerous hospitals in Europe, we have not found specific scientific evidence describing use of cultural assessment as a PSI.
PSI category	Institution-Wide PSI.
Data definitions	The yearly number of units assessing the patient safety culture per total number of units in the hospital.
Numerator Description	The yearly number of units assessing patient safety culture using a quantitative measure
Denominator Description	Total number of units in the hospital
Data Source	Yearly observational cross-sectional survey on the unit wise use of cultural assessment. The instrument chosen must be suitable, and it must be validated in a relevant setting.
Identifying the institutional context	The assessment of patient safety culture is important in general organisational and clinical improvement policies.
Care Setting	The PSI applies for institution-wide high quality culture related to patient safety.
Professionals Responsible for heath care	Not applicable as all hospital staff form, interact and influence the safety culture.
Lowest Level of Health Care Delivery Addressed	Individual clinical units or departments.
Allowance for Patient Factors	Not applicable.
Stratification by Vulnerable Populations	Not applicable.
Standard of Comparison	Yearly monitoring. Comparison with the previous measures. Benchmarking.
Scoring	Frequencies are counted by observation.

Surveying the Development of the Patient Safety Culture

PSI 8: Surveying the Development of the Patient Safety Culture	
Origin: PSI by SimPatIE	
Dimension	**Description**
Description of Specific Aspects of Patient Safety	Patient safety culture has been shown to be related to health care performance. A more positive/developed safety culture is associated with fewer incidents. Classification of patient safety culture can be seen in terms of steps on an evolutionary ladder. Each level has distinct characteristics and is a progression on the one before. The more developed the culture the higher on the ladder (28;29). A recent study revealed that the overall unit based safety climate significantly predicted nurse back injuries, medication errors and urinary tract infections (30). A systematic literature review also found evidence for a relationship between organisational culture and health care performance in four of ten studies (19). Thus the development of the patient safety culture is an appropriate measure of patient safety.
Aim of the PSI	The PSI continuously surveys the development of the patient safety culture.
Level of Determination of Patient Safety	Safety culture is assessed at the aggregated unit level.
Source(s)	PSI by SimPatIE. Choice of survey instrument is made by the unit, department or institution.
Extent of Clinically Testing	In recent years a large number of quantitative tools with differing characteristics have been developed to access the generic concept of culture within health care (22;25-27). The instruments vary in focus, aim, method, application and validity. Not surprisingly, there is not one best instrument, as they all have strengths and weaknesses. The important thing is for organisations to select the instrument that is most appropriate for their purposes and validated in relevant setting. The enclosed overview shows the subjects covered for some well known internationally used patient safety culture assessment instruments. Three systematic literature reviews concerning quantitative instruments for measuring culture were identified. The first review compared nine different surveys according to their general characteristics, dimensions covered, psychometric performance, and their use in studies of patient safety culture/climate surveys. It was found, that all surveys used Likert scales, mostly to measure attitudes of individuals. Nearly all covered five common dimensions of patient safety climate: leadership, policies and procedures, staffing, communication, and reporting. The strength of psychometric testing varied. While all

	had been used to compare units within or between hospitals, only one described the association between organisational climate and patient outcomes (31). The second review of 13 instruments focused on the cultural dimensions addressed, the number of items for each questionnaire, the measurement scale adopted, examples of studies that had used the tool, the scientific properties of the instrument, and its strengths and limitations. The instruments varied considerably in terms of their grounding in theory, format, length, scope, and scientific properties. The reviewers concluded, that the choice of instrument should be determined by how organisational culture is conceptualised, the purpose of surveying, intended use of the results, and availability of resources (19). The third systematic review of 12 studies was undertaken to study sample and questionnaire design characteristics (source, no of items, scale type), construct validity (content validity, factor structure and internal reliability, concurrent validity), within group agreement, and level of analysis. There was a lack of explicit theoretical framework for most instruments; some did not even report standard psychometric criteria. The reviewers concluded: "More consideration should be given to psychometric factors in the design of healthcare safety climate instruments, especially as these are beginning to be used in large scale surveys across healthcare organisations" (32).
Evidence of Clinically use of Standards	Though surveying the patient safety culture systematically is done in numerous hospitals in Europe, we have not found specific scientific evidence describing clinical use of the measures as a PSI.
PSI category	Institution-Wide PSI.
Data definitions	The development in the unit wise overall mean score of patient safety culture described as a percentage of improvement/relapse in relation to last measure.
Numerator Description	The unit wise difference in the present and the previous overall mean score of patient safety culture times 100
Denominator Description	The previous overall mean score of patient safety culture for the unit
Data Source	Quantitative measure of patient safety culture. The instrument chosen must be chosen according to the organisations resources, aims, needs and other patient safety and quality improvement activities, and the instrument chosen must be validated in a relevant setting.
Identifying the institutional context	The development of the patient safety culture makes this PSI important regarding improvement policies.
Care Setting	The PSI applies for institution-wide culture related to patient safety.

Professionals Responsible for heath care	Not applicable as all hospital staff form, interact and influence the safety culture.
Lowest Level of Health Care Delivery Addressed	Unit.
Allowance for Patient Factors	Not applicable.
Stratification by Vulnerable Populations	Not applicable.
Standard of Comparison	Yearly monitoring. Comparison of the development can be made between units within the hospital.
Scoring	Scoring on the assessment instrument is made according to the manual of the chosen instrument.

Decubitus Ulcer

PSI 38: Decubitus Ulcer	
Review of OECD PSI/AHRQ/CIHI PSI (3;33)	
Dimension	**Description**
Description of Specific Aspects of Patient Safety	Decubitus ulcers or bedsores are a common complication of inadequate care for immobilised patients. The occurrence of a decubitus ulcer in a hospitalised patient has a serious negative impact on the individual's health and often leads to a much prolonged hospital stay. Decubitus ulcers can be prevented with good quality nursing care. Thus, the indicator has great clinical plausibility as a patient safety measure.
Aim of the PSI	This PSI is intended to flag cases of in-hospital decubitus ulcers.
Level of Determination of Patient Safety	Safety is assessed at the aggregated patient level.
Source(s)	This indicator was originally proposed by Iezzoni et al. as part of the Complications Screening Program (CSP 6, "cellulitis or decubitus ulcer"). Needleman and Buerhaus identified decubitus ulcer as an "outcome potentially sensitive to nursing" The American Nurses Association, its State associations, and the California Nursing Outcomes Coalition have identified the total prevalence of inpatients with Stage I, II, III, or IV pressure ulcers as a "nursing-sensitive quality indicator for acute care settings" (3).
Extent of Clinically Testing	The OECD Health Care Quality Indicators (HCQI) Project was initiated to implement quality measures for international benchmarking of medical care at the health system level. Five priority areas including patient safety were selected. International expert panels were formed to identify clinically important, scientifically sound, and feasible measures based on a structured consensus process. The consensus process was successfully completed in all five priority areas leading to a recommendation of 86 indicators of which 21 covered patient safety (34). The project team developing the AHRQ PSI conducted extensive empirical analyses on this PSI. The team concluded that this PSI generally performs well on several different dimensions, including reliability, bias, relatedness of indicators, and persistence over time. (3). While the indicator was found to be well operationalised, the biggest threat to construct validity is the inability to precisely distinguish between pre-existing and hospital-acquired decubitus ulcers on the basis of administrative data (33) The AHRQ PSI software was applied to Veteran Affairs (VA) administrative data to identify potential instances of compromised patient safety; determine occurrence rates of PSI events in the VA; and examine the construct validity of the PSIs. The study population

	was 97% male, with a mean age of 65 years, 54% were age 65 and older. Mean length of stay was 7.1.days. All together 11411 PSI events were identified, 46% of PSI events occurred in surgical hospitalisation and 54% in medical hospitalisation. The observed PSI rate per 1000 discharges was 15.41 the highest of all for decubitus ulcer. This PSI was not significantly associated with any other PSI studied. Statistically differences were found for hospitalisations with this PSI events and those without PSI events for longer lengths of stay, higher mortality and higher costs (4). The performance of the AHRQ PSIs was analysed to: 1) provide a descriptive analysis of the incidence of PSI events from 2001 to 2004 in the VA; 2) examine trends in national PSI rates at the hospital discharge level over time; and 3) assess whether hospital characteristics (e.g., teaching status, number of beds, and degree of quality improvement implementation) and baseline safety-related hospital performance predict future hospital safety-related performance. Risk-adjusted rates of the PSI for iatrogenic pneumothorax and failure to rescue demonstrated a consistent rate over time. After accounting for patient and hospital characteristics, hospitals' baseline risk-adjusted PSI rates were the most important predictors of the 2004 risk-adjusted rates for eight PSIs among these decubitus ulcer. It was concluded, that the PSIs are useful tools for tracking and monitoring patient safety events. Future research should investigate whether trends reflect better or worse care or increased attention to documenting patient safety events (5). Administrative data from community hospitals in 16 US states with reliable race/ethnicity measures using the AHRQ PSIs was analysed to determine whether racial and ethnic differences in patient safety events disappear when income (a proxy for socioeconomic status) is taken into account. No differences in the occurrence of this PSI event were found according to race. It was concluded that: ”The AHRQ PSIs are a broad screen for potential safety events that point to needed improvement in the quality of care for specific populations” (7). AHRQ is determining the feasibility and practicality in a project concerning validation of selected AHRQ Quality Indicators (8). The results suggest that this PSI may be useful as a measure of patient safety (3-5;7;8;33;34).
Evidence of Clinically use of Standards	No evidence of clinically use of standards was found.
PSI category	Institution-wide PSI.
Data definitions	Cases of decubitus ulcer per 1000 discharges with a length of stay greater than 4 days.
Numerator Description	Discharges with ICD-9-CM code of decubitus ulcer in any secondary diagnosis field.
Denominator Description	All medical and surgical discharges 18 years and older defined by specific DRGs.

	Exclude cases: – with length of stay of less than 5 days – with ICD-9-CM code of decubitus ulcer in the principal diagnosis field – MDC 9 (Skin, Subcutaneous Tissue, and Breast) – MDC 14 (pregnancy, childbirth, and puerperium) – with any diagnosis of hemiplegia, paraplegia, or quadriplegia – with an ICD-9-CM diagnosis code of spina bifida or anoxic brain damage – with an ICD-9-CM procedure code for debridement or pedicle graft before or on the same day as the major operating room procedure (surgical cases only) – admitted from a long-term care facility (Admission Source=3) – transferred from an acute care facility (Admission Source=2)
Data Source	Administrative data.
Identifying the institutional context	The impact of decubitus makes this PSI important for both financial and quality improvement policies.
Care Setting	The PSI applies for high quality nursing care.
Professionals Responsible for Health Care	Nurses.
Lowest Level of Health Care Delivery Addressed	Individual clinical department.
Allowance for Patient Factors	Risk adjustment for : Age, sex, DRG, comorbidity categories
Stratification by Vulnerable Populations	No stratification.
Standard of Comparison	No specific standards given.
Scoring	AHRQ has PSI software for scoring.

Theme Related PSIs*:* "Infection Control"

Selected Infections due to Medical Care

PSI 9: Selected Infections due to Medical Care	
Origin: Review of a common OECD/AHRQ PSI (3;33)	
Dimension	**Description**
Description of Specific Aspects of Patient Safety	Many infections acquired in the course of medical care are preventable by proper hygiene, rational use of antibiotics and other measures. Infections related to medical care can be a very serious problem in some cases leading to pain, other discomfort or even death. Thus the occurrence of infections in the course of medical care is an important measure of safety.
Aim of the PSI	This PSI is intended to flag cases of infection due to medical care, primarily those related to intravenous (IV) lines and catheters. This PSI is defined on a provider level by including cases based on secondary diagnosis associated with the same hospitalisation. Patients with potential immuno-compromised states (e.g., AIDS, cancer, and transplant) are excluded, as they may be more susceptible to such infections. This PSI includes children and neonates. It should be noted that high-risk neonates are at particularly high risk for catheter-related infections.
Level of Determination of Patient Safety	Safety is assessed at the aggregated patient level.
Source(s)	This PSI was originally proposed by Iezzoni et al. as part of the Complications Screening Program (CSP 11, "miscellaneous better physician skill mix, or more experienced complications"). The University Health System Consortium adopted the CSP indicator for major and minor surgery patients. A much narrower definition, including only "other infection after infusion, injection, transfusion, vaccination", was proposed by Miller et al. in the "Patient Safety Indicator Algorithms and Groupings". The American Nurses Association and its State have identified the number of laboratory-over time confirmed bacteremic episodes associated with central lines per critical care patient day as a "nursing-sensitive quality indicator for acute care settings." (3;33).
Extent of Clinically Testing	The OECD Health Care Quality Indicators (HCQI) Project was initiated to implement quality measures for international benchmarking of medical care at the health system level. Five priority areas including patient safety were selected. International expert panels were formed to identify clinically important, scientifically sound, and feasible measures based on a structured consensus process. The consensus process lead to a recommendation of 86 indicators of

	which 21 covers aspects of patient safety (34). The project team developing the AHRQ PSI conducted extensive empirical analyses on this PSI. The team concluded that this PSI generally performs well on several different dimensions, including reliability, bias, relatedness of indicators, and persistence over time (3). The AHRQ PSI software was applied to Veteran Affairs (VA) administrative data to identify potential instances of compromised patient safety; determine occurrence rates of PSI events in the VA; and examine the construct validity of the PSIs. The study population was 97% male, with a mean age of 65 years, 54% were age 65 and older. All together 11411 PSI events were identified, 46% of PSI events occurred in surgical hospitalisation and 54% in medical hospitalisation. The observed PSI rate per 1000 discharges was 2.37 for selected infections due to medical care. This PSI was significantly associated with the AHRQ PSIs for complications of anesthesia, foreign body left during procedure and iatrogenic pneumothorax. Statistical significantly differences were found for hospitalisations with PSI events and those without PSI events for longer lengths of stay, mortality and higher costs (4). The performance of the AHRQ PSIs was analysed to: 1) provide a descriptive analysis of the incidence of PSI events from 2001 to 2004 in the VA; 2) examine trends in national PSI rates at the hospital discharge level over time; and 3) assess whether hospital characteristics (teaching status, number of beds, and degree of quality improvement implementation) and baseline safety-related hospital performance predict future hospital safety-related performance. Risk-adjusted rates of the PSI for iatrogenic pneumothorax and failure to rescue demonstrated a consistent rate over time. After accounting for patient and hospital characteristics, hospitals' baseline risk-adjusted PSI rates were the most important predictors of the 2004 risk-adjusted rates for eight PSIs (decubitus ulcer, failure to rescue, iatrogenic pneumothorax, infection resulting from medical care, postoperative hemorrhage or hematoma, postoperative respiratory failure, postoperative pulmonary embolism or deep vein thrombosis and accidental puncture/laceration). It was concluded, that the PSIs are useful tools for tracking and monitoring patient safety events. Future research should investigate whether trends reflect better or worse care or increased attention to documenting patient safety events (5). Administrative data from community hospitals in 16 US states with reliable race/ethnicity measures using the AHRQ PSIs was analysed to determine whether racial and ethnic differences in patient safety events disappear when income (a proxy for socioeconomic status) is taken into account. Infections due to medical care occur significantly more often among other races than among white. It was concluded that: ”The AHRQ PSIs are a broad screen for potential safety events that point to needed improvement in the quality of care for specific populations” (7). The results suggest that this PSI may be useful as a measure of patient

	safety (3-5;7;33;34). AHRQ is determining the feasibility and practicality in a project concerning validation of selected AHRQ Quality Indicators (8).
Evidence of Clinically use of Standards	No evidence of clinically use of standards was found.
PSI category	Theme Related PSI: "Infection Control".
Data definitions	Discharges with ICD-9-CM code of 999.3 or 996.62 in any secondary diagnosis field per 100 discharges.
Numerator Description	Discharges with ICD-9-CM code of 999.3 or 996.62 in any secondary diagnosis field.
Denominator Description	All medical and surgical discharges defined by specific DRGs. Exclude cases with any: – ICD-9-CM code of 9993 or 99662 in the hospital diagnosis field. – Diagnosis code for immuno-compromised state or cancer.
Data Source	Administrative data.
Identifying the institutional context	As infections also prolong pain and suffering and the duration of hospitalisation, this PSI also has important economic and legal policy implications.
Care Setting	The PSI applies for high quality nursing care.
Professionals Responsible for Health Care	Nurses.
Lowest Level of Health Care Delivery Addressed	Individual clinical unit or department.
Allowance for Patient Factors	Risk Adjustment for: Age, sex, DRG, comorbidity categories.
Stratification by Vulnerable Populations	No stratification.
Standard of Comparison	No specific standards given. Hospital-wide surveillance.
Scoring	AHRQ has PSI software for scoring.

Hospital Acquired-Infection Registration – Post Operative Wound Infections

PSI 10: Hospital Acquired-Infection Registration – Post Operative Wound Infections	
Origin: PSI by SimPatIE	
Dimension	**Description**
Description of Specific Aspects of Patient Safety	Hospital acquired infections are a major problem, leading to prolonged hospital stay increased morbidity and mortality for patients and to increased costs for the health care system. Among 1510 patients the overall prevalence of hospital-acquired infections (HAI) was found to be 10%. The distribution of the most frequent HAIs was urinary tract infection (34%), postoperative wound infection (19%), pneumonia (12%) and septicaemia (9%), respectively. A total of 456 patients (30%) received antibiotics on the prevalence day. The antibiotics were given as prophylaxis to 64 (14%) of these patients (35) Consequently, Hospital Acquired-Infection Registration (HAIR) is a suitable patient safety measure.
Aim of the PSI	The PSI aims at surveillance of post operative wound infections.
Level of Determination of Patient Safety	Safety is assessed at the aggregated patient level.
Source(s)	This method was developed by A. Leth and J.K. Moller in the Department of Clinical Microbiology, Aarhus University Hospital, DK (35;36).
Extent of Clinically Testing	Registration of HAI was compared with conventional manual registration (the gold standard i.e. reference method) by chart reviews of nosocomial infections in patients from surgical and medical departments. By combining selected infection parameters from various electronic hospital registries, the computer detected postoperative wound infections with a sensitivity of 94% and a specificity of) 91% (35;36).
Evidence of Clinically use of Standards	No evidence of clinically use of standards was found.
PSI category	Theme Related PSI: “Infection Control”.
Data definitions	Cases of post operative wound infection
Numerator Description	Discharges with code for postoperative wound infections (ICD-10). Patients admitted less than two days, except for readmission are excluded.
Denominator Description	All elective surgical discharges age 18 and older defined by specific DRGs and an ICD-10 code for an operating room procedure. Patients admitted less than two days, except for readmission are excluded.
Data Source	HAIR is based on selected laboratory and administrative data, including individual use of antimicrobial agents.

Identifying the institutional context	This PSI is relevant to quality improvement, accreditation and cost containment, as prolonged hospital stays due to infections have considerable economic impact.
Care Setting	The PSI applies for high quality surgical site preparation, careful and sterile surgical techniques and high quality post-op care.
Professionals Responsible for Health Care	Surgeons and nurses.
Lowest Level of Health Care Delivery Addressed	Individual clinical units or departments.
Allowance for Patient Factors	No risk adjustment described.
Stratification by Vulnerable Populations	No stratification
Standard of Comparison	No time comparison specified.
Scoring	Type of surgical procedure must be registered, and one or more of the following criteria: – culture positive swab from wound/drainage – discharge code for postoperative wound infection (ICD-10) – relevant antibiotic treatment prescribed after surgery and not for other infections.

Wound Infection

PSI 11: Wound Infection	
Origin: Review of a OECD PSI (33)	
Dimension	**Description**
Description of Specific Aspects of Patient Safety	The occurrence of a wound infection can have clinical consequences ranging from insignificant inflammation to considerable pain and suffering, wound disruption, septicaemia and death. Due to infection re-operation and prolonged hospitalisation might required. The incidence of wound infection can be reduced by proper pre-, intra- and post-operative care, in particular strict hygiene. Various clinical work processes are proven to be linked to wound infections. Thus wound infection is a suitable measure of patient safety.
Aim of the PSI	This PSI is intended to flag cases of wound infections.
Level of Determination of Patient Safety	Safety is assessed at the aggregated patient level.
Source(s)	Origin the Complications Screening Programme.
Extent of Clinically Testing	The OECD Health Care Quality Indicators (HCQI) Project was initiated to implement quality measures for international benchmarking of medical care at the health system level. Five priority areas including patient safety were selected. International expert panels were formed to identify clinically important, scientifically sound, and feasible measures based on a structured consensus process. The consensus process was successfully completed in all five priority areas leading to a recommendation of 86 indicators of which 21 cover patient safety (34). The Complications Screening Program (CSP) aims to identify 28 potentially preventable complications of hospital care using computerised discharge abstracts, including demographic information, diagnosis and procedure codes. A study was set up to validate the CSP as a quality indicator. Explicit process of care criteria were used to determine whether hospital discharges flagged by the CSP experienced more process problems than unflagged discharges. The CSP was applied to computerised hospital discharge abstracts from Medicare beneficiaries > 65 years old admitted in 1994 to hospitals in California and Connecticut for major surgery or medical treatment. The final sample included 740 surgical and 416 medical discharges. Rates of process problems were high, ranging from 24.4 to 82.5% across CSP screens for surgical cases. Problems were lower for medical cases, ranging from 2.0 to 69.1% across CSP screens. Problem rates were 45.7% for surgical and 5.0% for medical controls. Rates of problems did not differ significantly across flagged and unflagged discharges. The researchers concluded: “The CSP did not flag discharges with significantly higher rates of explicit process problems than unflagged

	discharges" (37). Another study of the CSP was undertaken to study the accuracy of computer algorithms on administrative data to identify hospital complications. The assessment was based on a medical records indicator differentiating hospital-acquired conditions from pre-existing comorbidities. Indicators for identifying potential hospital complications were applied to all secondary diagnoses for all 1997-1998 discharges. The researchers concluded: "Current complication algorithms identify many cases where the condition was actually present on hospital admission. This fact, coupled with the known variability in coding between institutions, makes comparisons between hospitals on many of the complications problematic. Collection of the present-on-admission flag significantly reduces the noise in monitoring complication rates (38). The results suggest that this PSI may be useful as a measure of patient safety (33;37).
Evidence of Clinically use of Standards	No evidence of clinically use of standards was found.
PSI category	Theme Related PSI: "Infection Control".
Data definitions	Cases of wound infection.
Numerator Description	Patients experiencing a wound infection (ICD-9 998.51 and 998.52). Secondary diagnosis only.
Denominator Description	All hospitalised patients.
Data Source	Administrative data.
Identifying the institutional context	The impact of wound infections makes this PSI important for both financial and quality improvement policies.
Care Setting	The PSI applies for high quality nursing care.
Professionals Responsible for Health Care	Nurses.
Lowest Level of Health Care Delivery Addressed	Individual clinical department.
Allowance for Patient Factors	No risk adjustment described.
Stratification by Vulnerable Populations	No stratification.
Standard of Comparison	No specific standards given.
Scoring	No specific standards for scoring given.

Ventilator Pneumonia

PSI 12: Ventilator Pneumonia	
Origin: Review of a OECD PSI (33)	
Dimension	**Description**
Description of Specific Aspects of Patient Safety	Ventilator-associated pneumonia (VAP) is a leading cause of morbidity and mortality in the Intensive Care Unit (ICU). Incidence of VAP varies greatly, ranging from 6-52% of intubated patients depending on patient risk factors. Overall VAP is associated with an attributable mortality of up to 30%. Given the consequences of VAP, VAP rates appear to be a suitable patient safety measure (33).
Aim of the PSI	This PSI is intended to flag cases of ventilated inpatients developing pneumonia.
Level of Determination of Patient Safety	Safety is assessed at the aggregated patient level.
Source(s)	The Joint Commission on Accreditation of Healthcare Organizations (JCAHO) Indicator Measurement System: Infection Control (39). Similar national organisations, responding to the same issue are Australian Incident Monitoring System and the National Patient Safety Agency in the UK (33).
Extent of Clinically Testing	The OECD Health Care Quality Indicators (HCQI) Project was initiated to implement quality measures for international benchmarking of medical care at the health system level. Five priority areas including patient safety were selected. International expert panels were formed to identify clinically important, scientifically sound, and feasible measures based on a structured consensus process. The consensus process was successfully completed in all five priority areas leading to a recommendation of 86 indicators of which 21 cover patient safety (33). The results suggest that this PSI may be useful as a measure of patient safety (33).
Evidence of Clinically use of Standards	No evidence of clinically use of standards was found.
PSI category	Theme Related PSI: “Infection Control”.
Data definitions	
Numerator Description	Number of ventilated inpatients developing pneumonia.
Denominator Description	Number of inpatient (ICU and Non-ICU) ventilator days.
Data Source	Administrative data.
Identifying the institutional context	The impact of pneumonia makes this PSI important for both financial and quality improvement policies.

Care Setting	The PSI applies for high quality intensive nursing care.
Professionals Responsible for Health Care	Nurses.
Lowest Level of Health Care Delivery Addressed	Individual clinical department.
Allowance for Patient Factors	No risk adjustment described.
Stratification by Vulnerable Populations	No stratification.
Standard of Comparison	No specific standards given.
Scoring	No specific scoring standards given.

Hand Hygiene – Measuring the Alcohol Consumption

PSI 13: Hand Hygiene – Measuring the Alcohol Consumption	
Origin: PSI by SimPatIE	
Dimension	**Description**
Description of Specific Aspects of Patient Safety	Improved adherence to hand hygiene (i.e. hand washing or use of alcohol-based hand rubs) has been shown to terminate outbreaks in health care facilities, to reduce transmission of antimicrobial resistant organisms (e.g. methicillin resistant staphylococcus aureus) and reduce overall infection rates (40;41) also it is the cheapest way of preventing nosocomial infections. Hand disinfection has been shown to be the most effective method of hand hygiene (42). The patient harm of bad hand hygiene makes surveillance of the alcohol consumption a suitable patient safety measure.
Level of Determination of Patient Safety	Safety is assessed at the aggregated patient level.
Aim of the PSI	The PSI aims at monitoring the alcohol consumption used for hand hygiene.
Source(s)	This PSI is part of the Accréditation des médecins Programme by Haute Autorité de Santé in France.
Extent of Clinically Testing	This PSI is in use in numerous hospitals in Scandinavia, England, France and other parts of Europe. Never the less no specific scientific evidence describing clinical testing and validation of the PSI was identified. The Antimicrobial Resistance Prevention and Control study assessed the organisation, components and human resources of infections control programmes in European hospitals. A questionnaire survey of policies and procedures implemented in 2001 for the surveillance and control of nosocomial infection and antibiotic resistance was completed by 169 acute-care hospitals from 32 European countries, categorised by five geographical regions. A formal (Infection control) IC programme existed in 72% of hospitals, and a multidisciplinary IC committee was operational in 90%. Written guidelines promoted hand hygiene for healthcare workers in 89% of hospitals, education in 85%, and audit in 46%. Guidelines recommended use of alcohol-based solutions (70%) and/or medicated/antiseptic soap (43%) for decontamination of non-soiled hands. Use of alcohol-based solutions varied according to region, from 41% in southern Europe to 100% in northern Europe, compared with use of medicated soap from 77% in southern Europe to 11% in northern Europe ($p < 0.01$). These findings showed that IC programmes in European hospitals suffer from major deficiencies in human resources and policies. (43).
Evidence of Clinically use of Standards	This PSI has been used in Aarhus University Hospital, Denmark together with another five PSIs related to hand hygiene. The standard

	used for this PSI within the first year of monitoring was and increase in the use for hand disinfection at 50%.
PSI category	Theme Related PSI: "Infection Control".
Data definitions	Litre of alcohol consumption used for hand hygiene pr. patient in a bed unit.
Numerator Description	Alcohol consumption (Litre) relating to hand hygiene.
Denominator Description	The number of patient per bed unit.
Data Source	Registration of bought/delivered alcohol for hand hygiene.
Identifying the institutional context	This PSI is relevant to quality improvement, accreditation and cost containment, as prolonged hospital stays due to infections have considerable economic impact.
Care Setting	The PSI generally applies for high quality hygiene related to patient contact.
Professionals Responsible for Health Care	All health care providers dealing with patients in bed units.
Lowest Level of Health Care Delivery Addressed	Individual clinical units or departments.
Allowance for Patient Factors	No patient factors involved.
Stratification by Vulnerable Populations	No stratification.
Standard of Comparison	The time frame is monthly monitoring.
Scoring	No specified scoring advice.

Hand Hygiene – Staff's Compliance with Guidelines for use of Jewellery

PSI 14: Hand Hygiene – Staff's Compliance with Guidelines for us of Jewellery	
Origin: PSI by SimPatIE	
Dimension	**Description**
Description of Specific Aspects of Patient Safety	Improved adherence to hand hygiene has been shown to terminate outbreaks in health care facilities, to reduce transmission of antimicrobial resistant organisms and reduce overall infection rates (40;41). Also it is the cheapest way of preventing nosocomial infections. Surgical wound infection may be caused by transfer of bacteria from the hands of the surgical team during operative procedures. The wearing of finger rings and nail polish is thought to reduce the efficacy of the scrub as they are thought to harbour bacteria in microscopic imperfections of nail polish and on the skin beneath finger rings. The patient harm of bad hand hygiene makes surveillance of Staff's Compliance with Guidelines for us of Jewellery a suitable patient safety measure.
Level of Determination of Patient Safety	Safety is assessed at the aggregated patient level.
Aim of the PSI	The PSI aims at monitoring presence of hand- and arm jewellery among health care staff.
Source(s)	Surveillance of hand hygiene is commonly known in Europe. This PSI has been used in Aarhus University Hospital, Denmark together with another five indicators related to hand hygiene.
Extent of Clinically Testing	Though this indicator is in use in numerous hospitals in Scandinavia, England and other parts of Europe, we have not found specific scientific evidence describing clinical testing of the indicator. A randomised controlled trail from 2001determined risk factors for hand contamination and compared the efficacy of three randomly allocated hand hygiene agents in a group of surgical intensive care unit nurses. Cultured samples of one of the nurses' hands before and samples of the other hand after hand hygiene were made and compared. Ring wearing was found to be associated with 10-fold higher median skin organism counts; contamination with Staphylococcus aureus, gram-negative bacilli, or Candida species; and a stepwise increased risk of contamination with any transient organism as the number of rings worn increased (44). A Cochrane Review from 2000 was performed to assess the effect of removal of finger rings and nail polish by the surgical scrub team, on postoperative wound infection rates. The researchers concluded: "Given the lack of evidence for either the safety or the harm associated with nail polish and finger rings, health care organisations must continue to develop institutional policies based on expert opinions"(45).

Evidence of Clinically use of Standards	The standard used in Aarhus University Hospital; Denmark for this indicator was: 98% of health care staff do not use hand and arm jewellery on duty.
PSI category	Theme Related PSI: "Infection Control".
Data definitions	Presence of hand- and arm jewellery per 1000 health care staff.
Numerator Description	Number of staff wearing hand- and/or arm jewellery.
Denominator Description	Total number of health care staff present on the day of observation in the unit/department.
Data Source	An unannounced observational cross-sectional survey on the prevalence of hand- and arm jewellery worn by health care staff.
Identifying the institutional context	This PSI is relevant to quality improvement, accreditation and cost containment, as prolonged hospital stays due to infections have considerable economic impact.
Care Setting	The PSI generally applies for high quality hygiene related to patient contact by all health care workers.
Professionals Responsible for Health Care	All health care providers in contact with patients in bed units.
Lowest Level of Health Care Delivery Addressed	Individual clinical units or departments.
Allowance for Patient Factors	No patient factors involved.
Stratification by Vulnerable Populations	No stratification.
Standard of Comparison	The timeframe is yearly monitoring.
Scoring	No scoring advice given.

Theme Related PSIs: "Surgical Complications"

Complications of Anesthesia

PSI 15: Complications of Anesthesia	
Origin: Review of a common OECD/AHRQ/CIHI PSI (3;33)	
Dimension	**Description**
Description of Specific Aspects of Patient Safety	Death due to anaesthesia has become rare, by contrast morbid events, i.e. complications related to anaesthetic care such as anaesthetic overdose, reaction, or endotrachial tube misplacement are much more prevalent causing harm to the patient to a different extend. Thus complications due to anesthesia are a relevant measure of patient safety.
Aim of the PSI	The PSI aims at surveillance of complications of anesthesia.
Level of Determination of Patient Safety	Safety is assessed at the aggregated patient level.
Source(s)	A subset of this AHRQ indicator was originally proposed by Iezzoni et al. as part of Complications Screening Program (CSP) (CSP 21, "Complications relating to anesthetic agents and other CNS depressants"). The CPS definition also included poisoning due to centrally acting muscle relaxants and accidental poisoning by nitrogen oxides, which are omitted from this AHRQ PSI. The CPS definition excludes other codes included in this PSI, namely, poisoning by other and unspecified general anesthetics and external cause of injury codes for "endotracheal tube wrongly place during anesthetic procedure" and adverse effects of anesthetics in therapeutic use. Organisations responding to the same indicator theme are Australian Incident Monitoring System and the National Patient Safety Agency in the UK (3;33)
Extent of Clinically Testing	The OECD Health Care Quality Indicators (HCQI) Project was initiated to implement quality measures for international benchmarking of medical care at the health system level. Five priority areas including patient safety were selected. International expert panels were formed to identify clinically important, scientifically sound, and feasible measures based on a structured consensus process. The consensus process lead to a recommendation of 86 indicators of which 21 covers aspects of patient safety (34). The project team developing the AHRQ PSI conducted extensive empirical analyses on this PSI. The team concluded that this PSI generally performs well on several different dimensions, including reliability, bias, relatedness of indicators, and persistence over time. The literature review of the AHRQ project team focused on the validity of complication indicators based on ICD-9-CM diagnosis or

	procedure codes. Results of the literature review indicate no published evidence for the sensitivity or predictive value of this indicator based on detailed chart review or prospective data collection (3). The AHRQ PSI software was applied to Veteran Affairs (VA) administrative data to identify potential instances of compromised patient safety; determine occurrence rates of PSI events in the VA; and examine the construct validity of the PSIs. The study population was 97% male, with a mean age of 65 years, 54% were age 65 and older. All together 11411 PSI events were identified, 46% of PSI events occurred in surgical hospitalisation and 54% in medical hospitalisation. The observed PSI rate per 1000 discharges was 0.56 for complications of anesthesia. This PSI was significantly associated with the AHRQ PSI for "Technical Difficulty with Procedure". No significant differences were found for hospitalisations with PSI events and those without PSI events for longer lengths of stay, higher mortality, and higher costs (4). The performance of the AHRQ PSIs was analysed to: 1) provide a descriptive analysis of the incidence of PSI events from 2001 to 2004 in the VA; 2) examine trends in national PSI rates at the hospital discharge level over time; and 3) assess whether hospital characteristics (teaching status, number of beds, and degree of quality improvement implementation) and baseline safety-related hospital performance predict future hospital safety-related performance. Risk-adjusted rates of the PSI for iatrogenic pneumothorax and failure to rescue demonstrated a consistent rate over time. After accounting for patient and hospital characteristics, hospitals' baseline risk-adjusted PSI rates were the most important predictors of the 2004 risk-adjusted rates for eight PSIs (decubitus ulcer, failure to rescue, iatrogenic pneumothorax, infection resulting from medical care, postoperative hemorrhage or hematoma, postoperative respiratory failure, postoperative pulmonary embolism or deep vein thrombosis and accidental puncture/laceration). It was concluded, that the PSIs are useful tools for tracking and monitoring patient safety events. Future research should investigate whether trends reflect better or worse care or increased attention to documenting patient safety events (5). Administrative data from community hospitals in 16 US states with reliable race/ethnicity measures using the AHRQ PSIs was analysed to determine whether racial and ethnic differences in patient safety events disappear when income (a proxy for socioeconomic status) is taken into account. Complications of anesthesia occur significantly more often among black and Hispanic people than among white. It was concluded that: "The AHRQ PSIs are a broad screen for potential safety events that point to needed improvement in the quality of care for specific populations" (7). AHRQ is determining the feasibility and practicality in a project concerning validation of selected AHRQ Quality Indicators (8). The results suggest that this PSI may be useful as a measure of patient safety (3-5;7;8;33;34).

Evidence of Clinically use of Standards	No evidence of clinically use of standards was found.
PSI category	Theme Related PSI**:** "Surgical Complication".
Data definitions	Cases of anesthetic overdose, reaction, or endotrachial tube misplacement per 1000 surgery discharges with an operating room procedure.
Numerator Description	Discharges with ICD-9-CM diagnosis codes for anesthesia complications in any secondary diagnosis field.
Denominator Description	All surgical discharges, 18 years and older **or** MDC 14 (pregnancy, childbirth, and puerperium), defined by specific DRGs and an ICD-9-CM code for an operating room procedure. Exclude cases with: – ICD-9-CM diagnosis codes for anesthesia complications in the principal diagnosis field – codes for self-inflicted injury, poisoning due to anesthetics (E8551, 9681-4, 9687) and any diagnosis code for active drug dependence, or active non-dependent abuse of drugs.
Data Source	Administrative data. Ideally, this PSI is used with a coding designation that distinguishes conditions present on admission from those that develop in-hospital.
Identifying the institutional context	This PSI is relevant to quality improvement, accreditation and cost containment, as complications due to anesthetic overdose, reaction, or endotrachial tube misplacement can have considerable economic impact.
Care Setting	The PSI applies for high quality anaesthesia care.
Professionals Responsible for Health Care	Anaesthesiologists.
Lowest Level of Health Care Delivery Addressed	Individual clinical units or departments.
Allowance for Patient Factors	Risk adjustment for age, sex, DRG, comorbidity categories.
Stratification by Vulnerable Populations	No stratification.
Standard of Comparison	No specific standards given. Hospital-wide surveillance.
Scoring	AHRQ has PSI software for scoring.

Foreign Body left during Procedure

PSI 16: Foreign Body left during Procedure	
Origin: Review of a common OECD/AHRQ/CIHI PSI (3;33)	
Dimension	**Description**
Description of Specific Aspects of Patient Safety	Although surgeons and operating room teams rely on the practice of counts of sponges, sharp and instrument as a means to eliminate detained foreign bodies, practices are not standardised and every single events may signal a serious system failure that should be addressed. Thus foreign body left during procedure is a suitable measure of patient safety.
Aim of the PSI	This PSI is intended to flag cases of a foreign body accidentally left in a patient during a procedure.
Level of Determination of Patient Safety	Safety can be assessed at the individual and the aggregated patient level. Though due to the rarity of foreign body left during procedure and the severity of the event, safety is recommended assessed at the individual patient level.
Source(s)	This indicator was originally proposed by Iezzoni et al. as part of the Complications Screening Program (CSP "sentinel events"). It was also included as one component of a broader indicator ("adverse events and iatrogenic complications") in AHRQs original HCUP Quality Indicators. It was proposed by Miller et al. in the "Patient Safety Indicator Algorithms and Groupings." The PSI is defined on both a provider level (by restricting cases to those included both medical and surgical patients, but flagged by a secondary diagnosis or procedure code) and an area level (by including all cases). Organisations responding to the same theme are Australian Incident Monitoring System and National Patient Safety Agency in the UK (3;33).
Extent of Clinically Testing	The OECD Health Care Quality Indicators (HCQI) Project was initiated to implement quality measures for international benchmarking of medical care at the health system level. Five priority areas including patient safety were selected. International expert panels were formed to identify clinically important, scientifically sound, and feasible measures based on a structured consensus process. The consensus process lead to a recommendation of 86 indicators of which 21 covers aspects of patient safety (34). The project team developing the AHRQ PSI conducted extensive empirical analyses on this PSI. The team concluded that this PSI generally performs well on several different dimensions, including reliability, bias, relatedness of indicators, and persistence over time (3). The AHRQ PSI software was applied to Veteran Affairs (VA) administrative data to identify potential instances of compromised

	patient safety; determine occurrence rates of PSI events in the VA; and examine the construct validity of the PSIs. The study population was 97% male, with a mean age of 65 years, 54% were age 65 and older. All together 11411 PSI events were identified, 46% of PSI events occurred in surgical hospitalisation and 54% in medical hospitalisation. The observed PSI rate per 1000 discharges was 0.17 for foreign body left during procedure. This PSI was significantly associated with the AHRQ PSIs for selected infections due to medical care and technical difficulty with procedure. Statistical significantly differences were found for hospitalisations with PSI events and those without PSI events for longer lengths of stay and higher costs (4). The performance of the AHRQ PSIs was analysed to: 1) provide a descriptive analysis of the incidence of PSI events from 2001 to 2004 in the VA; 2) examine trends in national PSI rates at the hospital discharge level over time; and 3) assess whether hospital characteristics (teaching status, number of beds, and degree of quality improvement implementation) and baseline safety-related hospital performance predict future hospital safety-related performance. Risk-adjusted rates of the PSI for iatrogenic pneumothorax and failure to rescue demonstrated a consistent rate over time. Future research should investigate whether trends reflect better or worse care or increased attention to documenting patient safety events (5). Administrative data from community hospitals in 16 US states with reliable race/ethnicity measures using the AHRQ PSIs was analysed to determine whether racial and ethnic differences in patient safety events disappear when income (a proxy for socioeconomic status) is taken into account. No differences in the occurrence of this PSI event were found according to race. It was concluded that: ”The AHRQ PSIs are a broad screen for potential safety events that point to needed improvement in the quality of care for specific populations” (7). The results suggest that this PSI may be useful as a measure of patient safety (3-5;7;8;33;34). AHRQ is determining the feasibility and practicality in a project concerning validation of selected AHRQ Quality Indicators (8).
Evidence of Clinically use of Standards	No evidence of clinically use of standards was found.
PSI category	Theme Related PSI**:** “Surgical Complication”.
Data definitions	Discharges with foreign body accidentally left in during procedure per 1000 discharges.
Numerator Description	Discharges with ICD-9-CM codes for foreign body left in during procedure in any secondary diagnosis field.
Denominator Description	All medical and surgical discharges, 18 years and older **or** MDC 14 (pregnancy, childbirth, and puerperium), defined by specific DRGs. Exclude cases with ICD-9-CM codes for foreign body left in during procedure in the principal diagnosis field.

Data Source	Administrative data.
Identifying the institutional context	Complications due to foreign bodies left during procedure make this PSI important for both financial and quality improvement policies.
Care Setting	The PSI applies for high quality surgical care.
Professionals Responsible for Health Care	Surgeons.
Lowest Level of Health Care Delivery Addressed	Individual clinical units or departments.
Allowance for Patient Factors	Risk Adjustment for: Age, sex, DRG, comorbidity categories when restricting cases to those included both medical and surgical patients, but flagged by a secondary diagnosis or procedure code. No risk adjustment when including all cases.
Stratification by Vulnerable Populations	No stratification.
Standard of Comparison	No specific standards given.
Scoring	AHRQ has PSI software for scoring.

Postoperative Pulmonary Embolism or Deep Vein Thrombosis

PSI 17: Postoperative Pulmonary Embolism or Deep Veins Thrombosis	
Origin: Review of OECD/AHRQ/CIHI PSI (3;33)	
Dimension	**Description**
Description of Specific Aspects of Patient Safety	The occurrence of postoperative pulmonary embolism (PE) or deep vein thrombosis (DVT) can range from mild symptoms to devastating clinical consequences including pain, respiratory distress, and death. PE/DVT can be prevented through the appropriate use of anticoagulants and other preventive measures. Thus PE or DVT is a suitable measure of patient safety.
Aim of the PSI	This PSI is intended to capture cases of PE or DVT.
Level of Determination of Patient Safety	Safety is assessed at the aggregated patient level.
Source(s)	This indicator was originally proposed by Iezzoni et al. as part of the Complications Screening Program: CSP 22, "venous thrombosis and pulmonary embolism" and it was one of AHRQs original HCUP Quality Indicators for major surgery and invasive vascular procedure patients. (3;33).
Extent of Clinically Testing	The OECD Health Care Quality Indicators (HCQI) Project was initiated to implement quality measures for international benchmarking of medical care at the health system level. Five priority areas including patient safety were selected. International expert panels were formed to identify clinically important, scientifically sound, and feasible measures based on a structured consensus process. The consensus process lead to a recommendation of 86 indicators of which 21 covers aspects of patient safety (34). The project team developing the AHRQ PSI conducted extensive empirical analyses on this PSI. The team concluded that this PSI generally performs well on several different dimensions, including reliability, bias, relatedness of indicators, and persistence over time (3). The AHRQ PSI software was applied to Veteran Affairs (VA) administrative data to identify potential instances of compromised patient safety; determine occurrence rates of PSI events in the VA; and examine the construct validity of the PSIs. The study population was 97% male, with a mean age of 65 years, 54% were age 65 and older. All together 11411 PSI events were identified, 46% of PSI events occurred in surgical hospitalisation and 54% in medical hospitalisation. The observed PSI rate per 1000 discharges was 13.00 for postoperative PE or DVT. This PSI was significantly associated with the AHRQ PSI for failure to rescue. Statistical significantly differences were found for hospitalisations with PSI events and those without PSI events for longer lengths of stay, mortality and higher costs (4).

	The performance of the AHRQ PSIs was analysed to: 1) provide a descriptive analysis of the incidence of PSI events from 2001 to 2004 in the VA; 2) examine trends in national PSI rates at the hospital discharge level over time; and 3) assess whether hospital characteristics (teaching status, number of beds, and degree of quality improvement implementation) and baseline safety-related hospital performance predict future hospital safety-related performance. Risk-adjusted rates of the PSI for iatrogenic pneumothorax and failure to rescue demonstrated a consistent rate over time. After accounting for patient and hospital characteristics, hospitals' baseline risk-adjusted PSI rates were the most important predictors of the 2004 risk-adjusted rates for eight PSIs among these also this one. It was concluded, that the PSIs are useful tools for tracking and monitoring patient safety events. Future research should investigate whether trends reflect better or worse care or increased attention to documenting patient safety events (5). Administrative data from community hospitals in 16 US states with reliable race/ethnicity measures using the AHRQ PSIs was analysed to determine whether racial and ethnic differences in patient safety events disappear when income (a proxy for socioeconomic status) is taken into account. Postoperative PE or DVT occurs significantly more often among African American, Non-Hispanic than among white. It was concluded that: ”The AHRQ PSIs are a broad screen for potential safety events that point to needed improvement in the quality of care for specific populations” (7). AHRQ is determining the feasibility and practicality in a project concerning validation of selected AHRQ Quality Indicators (8). The results suggest that this PSI may be useful as a measure of patient safety (3-5;7;8;33;34).
Evidence of Clinically use of Standards	No evidence of clinically use of standards was found.
PSI category	Theme Related PSI**:** “Surgical Complication”.
Data definitions	Cases of deep vein thrombosis or pulmonary embolism per 1000 surgical discharges with an operating room procedure.
Numerator Description	Discharges with ICD-9-CM codes for deep vein thrombosis or pulmonary embolism in any secondary diagnosis field.
Denominator Description	All surgical discharges age 18 and older defined by specific DRGs and an ICD-9-CM code for an operating room procedure. Exclude cases: – with ICD-9-CM codes for deep vein thrombosis or pulmonary embolism in the principal diagnosis field – where a procedure for interruption of vena cava is the only operating room procedure – where a procedure for interruption of vena cava occurs before or on the same day as the first operating room procedure

	Note: If day of procedure is not available in the input data file, the rate may be slightly lower than if the information was available. – With obstetrical patients in MDC 14 (Pregnancy, Childbirth and the Puerperium
Data Source	Administrative data.
Identifying the institutional context	Because PE/DVT can cause unnecessary prolongation of hospital stays as well as unnecessary pain, suffering and death, this PSI is important in financial and quality policies.
Care Setting	The PSI applies for high quality surgical care.
Professionals Responsible for Health Care	Surgeons.
Lowest Level of Health Care Delivery Addressed	Individual clinical units or departments.
Allowance for Patient Factors	Risk adjustment for age, sex, DRG, comorbidity categories.
Stratification by Vulnerable Populations	No stratification.
Standard of Comparison	No specific standards given.
Scoring	AHRQ has PSI software for scoring.

Postoperative Sepsis

PSI 18: Postoperative Sepsis	
Origin: Review of a common OECD/AHRQ PSI (3;33)	
Dimension	**Description**
Description of Specific Aspects of Patient Safety	The occurrence of sepsis following surgery is a severe complication with a mortality rate of up to 30%. Even less severe cases will require prolonged ICU treatment for organ failure. As many cases of postoperative sepsis can be prevented through the appropriate use of prophylactic antibiotics, good surgical site preparation, careful and sterile surgical techniques and good post-op care this postoperative sepsis is a suitable measure of patient safety.
Aim of the PSI	This PSI is intended to flag cases of nosocomial postoperative sepsis.
Level of Determination of Patient Safety	Safety is assessed at the aggregated patient level.
Source(s)	This indicator was originally proposed by Iezzoni et al. as part of the Complications Screening Program: CSP 7 "Septicamia" Needlemann and Buerhaus identified sepsis as an "Outcome Potential Sensitive to Nursing" using the same CSP definition (3;33).
Extent of Clinically Testing	The OECD Health Care Quality Indicators (HCQI) Project was initiated to implement quality measures for international benchmarking of medical care at the health system level. Five priority areas including patient safety were selected. International expert panels were formed to identify clinically important, scientifically sound, and feasible measures based on a structured consensus process. The consensus process lead to a recommendation of 86 indicators of which 21 covers aspects of patient safety (34). The project team developing the AHRQ PSI conducted extensive empirical analyses on this PSI. The team concluded that this PSI generally performs well on several different dimensions, including reliability, bias, relatedness of indicators, and persistence over time (3). The AHRQ PSI software was applied to Veteran Affairs (VA) administrative data to identify potential instances of compromised patient safety; determine occurrence rates of PSI events in the VA; and examine the construct validity of the PSIs. The study population was 97% male, with a mean age of 65 years, 54% were age 65 and older. All together 11411 PSI events were identified, 46% of PSI events occurred in surgical hospitalisation and 54% in medical hospitalisation. The observed PSI rate per 1000 discharges was 6.13 for postoperative sepsis. This PSI was significantly associated with the AHRQ PSI for postoperative respiratory failure. Statistical significantly differences were found for hospitalisations with PSI events and those without PSI events for longer lengths of stay, mortality and higher costs (4).

	The performance of the AHRQ PSIs was analysed to: 1) provide a descriptive analysis of the incidence of PSI events from 2001 to 2004 in the VA; 2) examine trends in national PSI rates at the hospital discharge level over time; and 3) assess whether hospital characteristics (teaching status, number of beds, and degree of quality improvement implementation) and baseline safety-related hospital performance predict future hospital safety-related performance. Risk-adjusted rates of the PSI for iatrogenic pneumothorax and failure to rescue demonstrated a consistent rate over time. After accounting for patient and hospital characteristics, hospitals' baseline risk-adjusted PSI rates were the most important predictors of the 2004 risk-adjusted rates for eight PSIs. It was concluded, that the PSIs are useful tools for tracking and monitoring patient safety events. Future research should investigate whether trends reflect better or worse care or increased attention to documenting patient safety events (5). Administrative data from community hospitals in 16 US states with reliable race/ethnicity measures using the AHRQ PSIs was analysed to determine whether racial and ethnic differences in patient safety events disappear when income (a proxy for socioeconomic status) is taken into account. Postoperative sepsis occurs significantly more often among other races than among white. It was concluded that: ”The AHRQ PSIs are a broad screen for potential safety events that point to needed improvement in the quality of care for specific populations” (7). AHRQ is determining the feasibility and practicality in a project concerning validation of selected AHRQ Quality Indicators (8). The results suggest that this PSI may be useful as a measure of patient safety (3-5;7;8;33;34).
Evidence of Clinically use of Standards	No evidence of clinically use of standards was found.
PSI category	Theme Related PSI**:** “Surgical Complication”.
Data definitions	Cases of sepsis per 1000 elective surgery patients with an operating room procedure and a length of stay of four days or more.
Numerator Description	Discharges with ICD-9-CM code for sepsis in any secondary diagnosis field
Denominator Description	All elective* surgical discharges age 18 and older defined by specific DRGs and an ICD-9-CM code for an operating room procedure. *Elective - Admission type # is recorded as elective (Admission Type = 3) Exclude cases: – with ICD-9-CM codes for sepsis in the principal diagnosis field – with a principal diagnosis of infection, or any code for immunocompromised state, or cancer – MDC 14 (pregnancy, childbirth, and puerperium) – with a length of stay of less than 4 days
Data Source	Administrative data.

Identifying the institutional context	This PSI is relevant to both quality improvement and cost containment.
Care Setting	The PSI applies for high quality nursing care.
Professionals Responsible for Health Care	Surgeons and nurses.
Lowest Level of Health Care Delivery Addressed	Individual clinical units or departments.
Allowance for Patient Factors	Risk adjustment for age, sex, DRG, comorbidity categories.
Stratification by Vulnerable Populations	No stratification.
Standard of Comparison	No specific standards given.

Postoperative Haemorrhage or Haematoma

PSI 19: Postoperative Haemorrhage or Haematoma	
Origin: Review of an AHRQ PSI (3)	
Dimension	**Description**
Description of Specific Aspects of Patient Safety	Postoperative Haemorrhage or Haematoma is a harmful and potentially life-threatening complication in surgical care. Thus it is a suitable measure of patient safety.
Aim of the PSI	This PSI aims at surveillance of cases of hemorrhage or hematoma following a surgical procedure.
Level of Determination of Patient Safety	Safety is assessed at the aggregated patient level.
Source(s)	This indicator was originally proposed by Iezzoni et al. as part of the Complications Screening Program (CSP 24, "post-procedural hemorrhage or hematoma"), although their definition allowed either procedure or diagnosis codes. The indicator was also included as one component of a broader indicator in AHRQs original HCUP Quality Indicators (3). This AHRQ indicator is defined on both a provider level by including cases of Postoperative Haemorrhage or Haematoma occurring as a secondary diagnosis during hospitalisation and on an area level by including all cases of Postoperative Haemorrhage or Haematoma in the area.
Extent of Clinically Testing	The project team developing the AHRQ PSI conducted extensive empirical analyses on this PSI. The team concluded that this PSI generally performs well on several different dimensions, including reliability, bias, relatedness of indicators, and persistence over time. Also they team concluded, that the overall usefulness of this PSI is favourable. AHRQ panellists noted in their review of the PSI that some patients may be at higher risk for developing a postoperative hemorrhage or hematoma than others, especially patients with coagulopathies and those on anticoagulants. The panellist also noted that patients admitted for trauma may be at a higher risk for developing postoperative hemorrhage or may have a hemorrhage diagnosed that occurred during the trauma. AHRQ panellists suggested this PSI to be stratified for patients with underlying clotting differences and for trauma and non-trauma patients – if possible (3). The AHRQ PSI software was applied to Veteran Affairs (VA) administrative data to identify potential instances of compromised patient safety; determine occurrence rates of PSI events in the VA; and examine the construct validity of the PSIs. The study population was 97% male, with a mean age of 65 years, 54% were age 65 and older. All together 11411 PSI events were identified, 46% of PSI events occurred in surgical hospitalisation and 54% in medical hospitalisation. The observed PSI rate per 1000 discharges was 3.23

	for Postoperative Haemorrhage or Haematoma. This PSI was significantly associated with the AHRQ PSIs for failure to rescue, iatrogenic pneumothorax, postoperative wound dehiscence, technical difficulties with procedure and infections due to medical care. Significant differences were found for hospitalisations with PSI and those without PSI events for longer lengths of stay, higher mortality, and higher costs (4). The performance of the AHRQ PSIs was analysed to: 1) provide a descriptive analysis of the incidence of PSI events from 2001 to 2004 in the VA; 2) examine trends in national PSI rates at the hospital discharge level over time; and 3) assess whether hospital characteristics (teaching status, number of beds, and degree of quality improvement implementation) and baseline safety-related hospital performance predict future hospital safety-related performance. Risk-adjusted rates of the PSI for iatrogenic pneumothorax and failure to rescue demonstrated no trend in the rate over time. After accounting for patient and hospital characteristics, hospitals' baseline risk-adjusted PSI rates were the most important predictors of the 2004 risk-adjusted rates for Postoperative Hemorrhage or Hematoma among seven other PSIs. It was concluded, that this PSI is a useful tools for tracking and monitoring patient safety events. Future research should investigate whether trends reflect better or worse care or increased attention to documenting patient safety events (5). The Agency for Healthcare Research and Quality PSI algorithms were applied to administrative data across four years of 1.92 million discharges from children's hospitals. The mean risk-adjusted rates of PSI events ranged from 0.1 events per 1000 discharges for a foreign body left in during a procedure to 140 events per 1000 discharges for failure to rescue. The researchers concluded: “PSIs derived from administrative data are indicators of patient safety concerns and can be relevant as screening tools for children's hospitals; however, cases identified by these indicators do not always represent preventable events. Some, such as a foreign body left in during a procedure, iatrogenic pneumothorax, infection attributable to medical care, decubitus ulcer, and venous thrombosis, seem to be appropriate for paediatric care and may be directly amenable to system changes”(6). Administrative data from community hospitals in 16 US states with reliable race/ethnicity measures using the AHRQ PSIs was analysed to determine whether racial and ethnic differences in patient safety events disappear when income (a proxy for socioeconomic status) is taken into account. Postoperative Haemorrhage or Haematoma occur significantly more often among Asian and Pacific Islander and African American, Non Hispanics than among white. It was concluded that: ”The AHRQ PSIs are a broad screen for potential safety events that point to needed improvement in the quality of care for specific populations” (7). AHRQ is determining the feasibility and practicality in a project concerning validation of selected AHRQ Quality Indicators (8).

	The results suggest that this PSI may be useful as a measure of patient safety (3-7).
Evidence of Clinically use of Standards	No evidence of clinically use of standards was found.
PSI category	Theme Related PSI**:** "Surgical Complication".
Data definitions	Cases of hematoma or hemorrhage requirering a procedure per 1000 surgical discharges with an operating room procedure.
Numerator Description	Discharges with ICD-9-CM code for postoperative hematoma or hemorrhage require ring a procedure in any secondary diagnosis field and code for postoperative control of hemorrhage or drainage of hematoma (respectively) in any procedure field.
Denominator Description	All medical and surgical discharges 18 years and older defined by specific DRGs and an ICD-10-CM code for an operating room procedure. Exclude cases with: – With an ICD-9-CM codes postoperative hematoma or hemorrhage diagnosis in any principal diagnosis field – Where the only operating room procedure is postoperative control of hemorrhage or drainage of hematoma – Where a procedure for postoperative control of hemorrhage or drainage of hematoma occurs before the first operating procedure. *Note: If day of procedure is not available in the input data file, the rate may be slightly lower than if the information was available.* – MDC 14 (pregnancy, childbirth, and puerperium)
Data Source	Administrative data.
Identifying the institutional context	The impact of postoperative haemorrhage or haematoma makes this PSI important for both financial and quality improvement policies.
Care Setting	The PSI applies for quality surgical care.
Professionals Responsible for Health Care	Surgeons.
Lowest Level of Health Care Delivery Addressed	Individual clinical department.
Allowance for Patient Factors	Risk adjustment for age, sex and comorbidity categories.
Stratification by Vulnerable Populations	No stratification.
Standard of Comparison	No specific standards given.
Scoring	AHRQ has PSI software for scoring.

Postoperative Physiologic Metabolic Derangements

PSI 20: Postoperative Physiologic Metabolic Derangements	
Origin: Review of an AHRQ PSI (3)	
Dimension	**Description**
Description of Specific Aspects of Patient Safety	Postoperative Physiologic Metabolic Derangements is a potentially life-threatening complication in surgical care. Thus it is a suitable measure of patient safety.
Aim of the PSI	This PSI is intended to flag cases of postoperative metabolic or physiologic complications.
Level of Determination of Patient Safety	Safety is assessed at the aggregated patient level.
Source(s)	This indicator was originally proposed by Iezzoni et al. as part of the Complication Screening Programme (CSP 20, "postoperative physiologic and metabolic derangements"). The University Health System Consortium adopted the CSP indicator for major surgery patients (3).
Extent of Clinically Testing	The project team developing the AHRQ PSI conducted extensive empirical analyses on this PSI. The team concluded that this PSI generally performs well on several different dimensions, including reliability, bias, relatedness of indicators, and persistence over time. AHRQ panellists had concern about the definition of acute renal failure: what one doctor may call acute renal failure, another may not. To ensure that the only renal failure cases that are accounted for are those that are clinically severe, the panel suggested that acute renal failure be included only when it is paired with a procedure code for dialysis. Panellists also noted that coding of relatively transient metabolic and physiologic complications may be lacking, e.g. cases of diabetic ketoacidosis. Conversely, some physicians may capture non-clinically significant events in this indicator. (3). The AHRQ PSI software was applied to Veteran Affairs (VA) administrative data to identify potential instances of compromised patient safety; determine occurrence rates of PSI events in the VA; and examine the construct validity of the PSIs. The study population was 97% male, with a mean age of 65 years, 54% were age 65 and older. All together 11411 PSI events were identified, 46% of PSI events occurred in surgical hospitalisation and 54% in medical hospitalisation. The observed PSI rate per 1000 discharges was 1.89 for Postoperative Physiologic Metabolic Derangements. Significant differences were found for hospitalisations with PSI and those without PSI events for longer lengths of stay, higher mortality, and higher costs (4). The performance of the AHRQ PSIs was analysed to: 1) provide a descriptive analysis of the incidence of PSI events from 2001 to 2004 in the VA; 2) examine trends in national PSI rates at the hospital

	discharge level over time; and 3) assess whether hospital characteristics (teaching status, number of beds, and degree of quality improvement implementation) and baseline safety-related hospital performance predict future hospital safety-related performance. Risk-adjusted rates of the PSI for iatrogenic pneumothorax and failure to rescue demonstrated no trend in the rate over time. It was concluded, that this PSI is a useful tools for tracking and monitoring patient safety events. Future research should investigate whether trends reflect better or worse care or increased attention to documenting patient safety events (5). Administrative data from community hospitals in 16 US states with reliable race/ethnicity measures using the AHRQ PSIs was analysed to determine whether racial and ethnic differences in patient safety events disappear when income (a proxy for socioeconomic status) is taken into account. Postoperative Physiologic Metabolic Derangements occur significantly more often among Asian and Pacific Islander and African American, Non Hispanics than among white. It was concluded that: ”The AHRQ PSIs are a broad screen for potential safety events that point to needed improvement in the quality of care for specific populations” (7). AHRQ is determining the feasibility and practicality in a project concerning validation of selected AHRQ Quality Indicators (8). The results suggest that this PSI may be useful as a measure of patient safety (3-5;7)
Evidence of Clinically use of Standards	No evidence of clinically use of standards was found.
PSI category	Theme Related PSI**:** “Surgical Complication”.
Data definitions	Cases of specified physiological or metabolic derangement per 1000 elective surgical discharges with an operating room procedure.
Numerator Description	Discharges with ICD-9-CM codes for physiologic and metabolic derangements in any secondary diagnosis field. Discharges with acute renal failure (subgroup of physiologic and metabolic derangements) must be accompanied by a procedure code for dialysis (3995, 5498).
Denominator Description	All elective* surgical discharges age 18 and older defined by specific DRGs and an ICD-9-CM code for an operating room procedure. *Defined by admit type. Exclude cases: – with ICD-9-CM codes for physiologic and metabolic derangements in the principal diagnosis field – with a principal ICD-9-CM code for chronic renal failure – with acute renal failure where a procedure for dialysis occurs before or on the same day as the first operating room procedure *Note: If day of procedure is not available in the input data file, the rate may be slightly lower than if the information was available*

	– with both a diagnosis code of ketoacidosis, hyperosmolarity, or other coma (subgroups of physiologic and metabolic derangements coding) and a principal diagnosis of diabetes – with both a secondary diagnosis code for acute renal failure (subgroup of physiologic and metabolic derangements coding) and a principal diagnosis of acute myocardial infarction, cardiac arrhythmia, cardiac arrest, shock, hemorrhage, or gastrointestinal hemorrhage – MDC 14 (pregnancy, childbirth and the puerperium)
Data Source	Administrative data.
Identifying the institutional context	The impact of postoperative physiologic metabolic derangements makes this PSI important for both financial and quality improvement policies.
Care Setting	The PSI applies for quality medical care.
Professionals Responsible for Health Care	Surgeons, anaesthesiologists and nurses.
Lowest Level of Health Care Delivery Addressed	Individual clinical department.
Allowance for Patient Factors	Risk adjustment for age, sex and comorbidity categories.
Stratification by Vulnerable Populations	No stratification.
Standard of Comparison	No specific standards given.
Scoring	AHRQ has PSI software for scoring.

Postoperative Respiratory Failure

PSI 21: Postoperative Respiratory Failure	
Origin: Review of an AHRQ PSI (3)	
Dimension	**Description**
Description of Specific Aspects of Patient Safety	Postoperative Respiratory Failure is an important and potentially life-threatening complication in surgical care. Thus it is a suitable measure of patient safety.
Aim of the PSI	This PSI aims at surveillance of cases of postoperative respiratory failure.
Level of Determination of Patient Safety	Safety is assessed at the aggregated patient level.
Source(s)	This indicator was originally proposed by Iezzoni et al. as part of the Complication screening program; CSP 3, "postoperative pulmonary compromise". The CSP definition also includes pulmonary congestion, other (or postoperative) pulmonary insufficiency, and acute pulmonary edema. The University Health System Consortium (#2927) and AHRQs original HCUP Quality Indicators adopted the CSP indicator for major surgery patients. Needleman and Buerhaus identified postoperative pulmonary Failure as an "Outcome Potentially Sensitive to Nursing," using the original CSP definition (3).
Extent of Clinically Testing	The project team developing the AHRQ PSI conducted extensive empirical analyses on this PSI. The team concluded that this PSI generally performs well on several different dimensions, including reliability, bias, relatedness of indicators, and persistence over time (3). The AHRQ PSI software was applied to Veteran Affairs (VA) administrative data to identify potential instances of compromised patient safety; determine occurrence rates of PSI events in the VA; and examine the construct validity of the PSIs. The study population was 97% male, with a mean age of 65 years, 54% were age 65 and older. All together 11411 PSI events were identified, 46% of PSI events occurred in surgical hospitalisation and 54% in medical hospitalisation. The observed PSI rate per 1000 discharges was 3.43 for Postoperative Respiratory Failure. Significant differences were found for hospitalisations with PSI and those without PSI events for longer lengths of stay, higher mortality, and higher costs (4). The performance of the AHRQ PSIs was analysed to: 1) provide a descriptive analysis of the incidence of PSI events from 2001 to 2004 in the VA; 2) examine trends in national PSI rates at the hospital discharge level over time; and 3) assess whether hospital characteristics (teaching status, number of beds, and degree of quality improvement implementation) and baseline safety-related hospital

	performance predict future hospital safety-related performance. Risk-adjusted rates of the PSI for iatrogenic pneumothorax and failure to rescue demonstrated significant trends over time. After accounting for patient and hospital characteristics, hospitals' baseline risk-adjusted PSI rates were the most important predictors of the 2004 risk-adjusted rates for Postoperative Respiratory Failure among seven other PSIs. It was concluded, that this PSI is a useful tools for tracking and monitoring patient safety events. Future research should investigate whether trends reflect better or worse care or increased attention to documenting patient safety events (5). The Agency for Healthcare Research and Quality PSI algorithms were applied to administrative data across four years of 1.92 million discharges from children's hospitals. The mean risk-adjusted rates of PSI events ranged from 0.1 events per 1000 discharges for a foreign body left in during a procedure to 140 events per 1000 discharges for failure to rescue. The researchers concluded: "PSIs derived from administrative data are indicators of patient safety concerns and can be relevant as screening tools for children's hospitals; however, cases identified by these indicators do not always represent preventable events. Some, such as a foreign body left in during a procedure, iatrogenic pneumothorax, infection attributable to medical care, decubitus ulcer, and venous thrombosis, seem to be appropriate for paediatric care and may be directly amenable to system changes"(6). Administrative data from community hospitals in 16 US states with reliable race/ethnicity measures using the AHRQ PSIs was analysed to determine whether racial and ethnic differences in patient safety events disappear when income (a proxy for socioeconomic status) is taken into account. Postoperative Respiratory Failure occurs significantly more often among Asian and Pacific Islander, African American, Non Hispanics and Hispanic than among white. It was concluded that: "The AHRQ PSIs are a broad screen for potential safety events that point to needed improvement in the quality of care for specific populations" (7). AHRQ is determining the feasibility and practicality in a project concerning validation of selected AHRQ Quality Indicators (8). The results suggest that this PSI may be useful as a measure of patient safety (3-7).
Evidence of Clinically use of Standards	No evidence of clinically use of standards was found.
PSI category	Theme Related PSI**:** "Surgical Complication".
Data definitions	Cases of acute respiratory failure per 1000 elective surgical discharges with an operating room procedure.
Numerator Description	Either 1) Discharges with ICD-9-CM codes for acute respiratory Failure (518.81) in any secondary diagnosis field (After 1999, include 518.84) OR 2) ICD-9-CM procedure codes for postoperative reintubation procedure based on number of days after the major operating procedure code: 96.04 ≥1 days, 96.70 or 96.71 ≥2 days, or

	96.72 ≥0 days.
Denominator Description	All elective (Defined by admit type) surgical discharges age 18 and over defined by specific DRGs and an ICD-9-CM code for an operating room procedure. Exclude cases: – with ICD-9-CM codes for acute respiratory Failure in the principal diagnosis field – with an ICD-9-CM diagnosis code of neuromuscular disorder – where a procedure for tracheostomy is the only operating room procedure or tracheostomy occurs before the first operating room procedure – MDC 14 (pregnancy, childbirth, and puerperium) – MDC 4 (diseases/disorders of respiratory system) – MDC 5 (diseases/disorders of circulatory system) *Note: If day of procedure is not available in the input data file, the rate may be slightly lower than if the information was available.*
Data Source	Administrative data.
Identifying the institutional context	The impact of postoperative respiratory failure makes this PSI important for both financial and quality improvement policies.
Care Setting	The PSI applies for quality medical care.
Professionals Responsible for Health Care	Surgeons, anaesthesiologists and nurses
Lowest Level of Health Care Delivery Addressed	Individual clinical department.
Allowance for Patient Factors	Risk adjustment for age, sex and comorbidity categories.
Stratification by Vulnerable Populations	No stratification.
Standard of Comparison	No specific standards given.
Scoring	AHRQ has PSI software for scoring.

Accidental Puncture or Laceration

PSI 22: Accidental Puncture Or Laceration	
Origin: Review of an AHRQ PSI (3)	
Dimension	**Description**
Description of Specific Aspects of Patient Safety	Accidental puncture or laceration is an important and potentially life-threatening complication in surgical care. Thus it is a suitable measure of patient safety.
Aim of the PSI	This PSI aims at surveillance of cases of accidental puncture or laceration - arising due to technical difficulties in medical care.
Level of Determination of Patient Safety	Safety is assessed at the aggregated patient level.
Source(s)	This indicator was originally proposed by Iezzoni et al. as part of the Complications Screening Program. This PSI was present – in a slightly different form in AHRQs original HCUP Quality Indicators. The University Health System Consortium adopted the CSP as an indicator for medical (#2806) and major surgery (#2956) patients (3). This AHRQ indicator is defined on both a provider level by including cases of Accidental Puncture or Laceration occurring as a secondary diagnosis during hospitalisation and on an area level by including all cases of Accidental Puncture or Laceration.
Extent of Clinically Testing	The project team developing the AHRQ PSI conducted extensive empirical analyses on this PSI. The team concluded that this PSI generally performs well on several different dimensions, including reliability, bias, relatedness of indicators, and persistence over time. AHRQ-panellists were unsure about how the culture of quality improvement in a hospital would affect coding of this complication. Out of fear of punishment , some physicians may be reluctant to record the occurrence of accidental puncture or laceration (3). The performance of the AHRQ PSIs was analysed to: 1) provide a descriptive analysis of the incidence of PSI events from 2001 to 2004 in the VA; 2) examine trends in national PSI rates at the hospital discharge level over time; and 3) assess whether hospital characteristics (teaching status, number of beds, and degree of quality improvement implementation) and baseline safety-related hospital performance predict future hospital safety-related performance. Risk-adjusted rates of the PSI for iatrogenic pneumothorax and failure to rescue demonstrated significant trends over time. For this PSI a non significant increase in the rate was found over time. After accounting for patient and hospital characteristics, hospitals' baseline risk-adjusted PSI rates were the most important predictors of the 2004 risk-adjusted rates for Accidental Puncture or Laceration among seven other PSIs. It was concluded, that this PSI is a useful tools for tracking and monitoring patient safety events. Future research should investigate whether trends reflect better or worse care or increased attention to documenting patient safety events (5).

	The Agency for Healthcare Research and Quality PSI algorithms were applied to administrative data across four years of 1.92 million discharges from children's hospitals. The mean risk-adjusted rates of PSI events ranged from 0.1 events per 1000 discharges for a foreign body left in during a procedure to 140 events per 1000 discharges for failure to rescue. The researchers concluded: "PSIs derived from administrative data are indicators of patient safety concerns and can be relevant as screening tools for children's hospitals; however, cases identified by these indicators do not always represent preventable events. Some, such as a foreign body left in during a procedure, iatrogenic pneumothorax, infection attributable to medical care, decubitus ulcer, and venous thrombosis, seem to be appropriate for paediatric care and may be directly amenable to system changes"(6). Administrative data from community hospitals in 16 US states with reliable race/ethnicity measures using the AHRQ PSIs was analysed to determine whether racial and ethnic differences in patient safety events disappear when income (a proxy for socioeconomic status) is taken into account. Accidental Puncture or Laceration occurs significantly more often among Hispanic than among white. It was concluded that: "The AHRQ PSIs are a broad screen for potential safety events that point to needed improvement in the quality of care for specific populations" (7). AHRQ is determining the feasibility and practicality in a project concerning validation of selected AHRQ Quality Indicators (8). The results suggest that this PSI may be useful as a measure of patient safety (3;5-7).
Evidence of Clinically use of Standards	No evidence of clinically use of standards was found.
PSI category	Theme Related PSI**:** "Surgical Complication".
Data definitions	Cases of technical difficulty (e.g., accidental cut or laceration during procedure) per 1000 discharges.
Numerator Description	Discharges with ICD-9-CM code denoting technical difficulty (e.g., accidental cut, puncture, perforation, or laceration) in any secondary diagnosis field.
Denominator Description	All medical and surgical discharges age 18 years and older defined by specific DRGs. Exclude cases: – with ICD-9-CM code denoting technical difficulty (e.g., accidental cut, puncture, perforation, or laceration) in the principal diagnosis field – MDC 14 (pregnancy, childbirth, and puerperium)
Data Source	Administrative data.
Identifying the institutional context	The impact of accidental puncture or laceration makes this PSI important for both financial and quality improvement policies.

Care Setting	The PSI applies for quality surgical care.
Professionals Responsible for Health Care	Surgeons.
Lowest Level of Health Care Delivery Addressed	Individual clinical department.
Allowance for Patient Factors	Risk adjustment for age, sex and comorbidity categories.
Stratification by Vulnerable Populations	No stratification.
Standard of Comparison	No specific standards given.
Scoring	AHRQ has PSI software for scoring.

Wrong Site-Surgery

PSI 23: Wrong Site-surgery	
Origin: Review of an OECD PSI (33)	
Dimension	**Description**
Description of Specific Aspects of Patient Safety	The consequences of wrong-site surgery can be severe. It is estimated that one in four orthopaedic surgeons may make such an error once in 25 years of practice. Thus wrong-site surgery has potential as a patient safety measure.
Aim of the PSI	This PSI is intended to flag cases of wrong-site surgery.
Level of Determination of Patient Safety	Safety is assessed at the aggregated patient level.
Source(s)	Originally a JCAHO sentinel events indicator.
Extent of Clinically Testing	The OECD Health Care Quality Indicators (HCQI) Project was initiated to implement quality measures for international benchmarking of medical care at the health system level. Five priority areas including patient safety were selected. International expert panels were formed to identify clinically important, scientifically sound, and feasible measures based on a structured consensus process. The consensus process was successfully completed in all five priority areas leading to a recommendation of 86 indicators of which 21 cover patient safety. The results suggest that this PSI may be useful as a measure of patient safety (33).
Evidence of Clinically use of Standards	No evidence of clinically use of standards was found.
PSI category	Theme Related PSI**:** “Surgical Complication”.
Data definitions	Not specified by OECD.
Numerator Description	Number of procedures on the wrong patient, wrong side of the body, or wrong organ.
Denominator Description	All surgical procedures.
Data Source	Not specified by OECD.
Identifying the institutional context	In addition to being a good measure of safety, the impact of wrong-site surgery makes this indicator important for both financial and quality improvement policies.
Care Setting	The PSI applies for high quality surgery care.
Professionals Responsible for Health Care	Surgeons.
Lowest Level of Health Care Delivery Addressed	Individual clinical department.

Allowance for Patient Factors	No risk adjustment described.
Stratification by Vulnerable Populations	No stratification.
Standard of Comparison	No specific standards given.
Scoring	No scoring advice given.

Medical Equipment-Related Adverse Events

PSI 24: Medical Equipment-Related Adverse Events	
Origin: Review of an OECD PSI (33)	
Dimension	**Description**
Description of Specific Aspects of Patient Safety	Equipment related adverse events may occur due to a variety of causes, such as equipment defect, improper set-up or maintenance, environmental factors or improper use. Events related to medical equipment can trigger an accident, harm the patient in various ways, or it may complicate the recognition and treatment of other problems. Thus it is a suitable measure of patient safety.
Aim of the PSI	This PSI is intended to flag cases of in-hospital medical equipment-related adverse events.
Level of Determination of Patient Safety	Safety is assessed at the aggregated patient level.
Source(s)	Originally a JCAHO sentinel event indicator.
Extent of Clinically Testing	The OECD Health Care Quality Indicators (HCQI) Project was initiated to implement quality measures for international benchmarking of medical care at the health system level. Five priority areas including patient safety were selected. International expert panels were formed to identify clinically important, scientifically sound, and feasible measures based on a structured consensus process. The consensus process was successfully completed in all five priority areas leading to a recommendation of 86 indicators of which 21 cover patient safety (33). The OECD HCQI project group found: "No studies to date have developed a widely used standardised protocol for equipment maintenance for clinical engineering departments, largely because the lack of standardisation of endpoints renders assessing the relative value of any particular maintenance protocol impossible. Nonetheless, equipment failure does result in a small fraction of clinical events and thus is an important safety intervention" (33).
Evidence of Clinically use of Standards	No evidence of clinically use of standards was found.
PSI category	Theme Related PSI**:** "Surgical Complication".
Data definitions	Not specified.
Numerator Description	Number of patient deaths or major permanent losses of function associated with a problem with medical equipment.
Denominator Description	All hospital admissions.
Data Source	Not specified.
Identifying the	In addition to being a good measure of safety, the economic impact of medical related equipment related adverse events makes this PSI

institutional context	important for both financial and quality improvement policies.
Care Setting	The PSI applies for high quality surgery care.
Professionals Responsible for Health Care	Surgeons.
Lowest Level of Health Care Delivery Addressed	Individual clinical department.
Allowance for Patient Factors	No risk adjustment described.
Stratification by Vulnerable Populations	No stratification.
Standard of Comparison	No specific standards given.
Scoring	No scoring advice given.

Patients experience of Adverse Events – Surgical Interventions

PSI 25: Patients Experience of Adverse Events – Surgical Interventions	
Origin: PSI by SimPatIE	
Dimension	**Description**
Description of Specific Aspects of Patient Safety	The frequency of harmful surgical adverse events is cause for serious concern. Patients are an important source of observations and information about adverse events. The ultimate goal is to achieve the best care and outcomes for patients each time they are in touch with the health care system. Thus patient's experiences of harm due to an operation are an important measure of patient safety.
Aim of the PSI	This PSI aims at surveillance of patient harm due to an operation experienced by the patients.
Level of Determination of Patient Safety	Safety is assessed at the aggregated patient level.
Source(s)	This PSI is derived from the section on patient safety of the Danish national patient survey: Patient's experiences in hospital, question 18b (9;11).
Extent of Clinically Testing	Attitudes and responses to adverse events have been investigated from Danish patient's and the staff's point of view, using a questionnaire survey. Patients were asked about their experiences with errors and staffs handling of errors. Comparison of responses to the same questions was made between the two groups. Twenty percent of patient had experiences minor errors and eight percent large errors during hospitalisation (11). Another Danish study using mailed questionnaires estimated the incidence of medical errors; also the extent of agreement between patients and staff of the type of error was investigated. Errors were described in free text by informants and rated in categories by a risk manager. 44% of staff had experienced an error within the last three months in ambulatory or in-patient care, whereas 13% of the patients had experienced an error. By the description the risk manager found that 44% of the patient reported errors could be classified as dissatisfaction. One percent of staff had experienced an erroneous surgical procedure. Three percent of in-patients and 0.3% of staff has experienced an error related to anaesthesia. The researchers concluded that patients typically find it difficult to distinguish between an error and their dissatisfaction, highlighting a need for firm criteria if patients are to report errors as a basis for improvements. Comparison of error rates between patients and staff – and indeed between hospitals - will be misleading until these criteria are reliable and validated (10). This PSI has not been clinically applied.
Evidence of Clinically use of Standards	No evidence of clinically use of standards was found.

PSI category	Theme Related PSI**:** "Surgical Complication".
Data definitions	Number of patients experiencing a harmful adverse event due to an operation per 1000 operation procedures.
Numerator Description	Number of patients experiencing a harmful adverse event due to an operation.
Denominator Description	Number of operation procedures.
Data Source	Administrative data and/or Patient's Experiences (Satisfaction) Survey.
Identifying the institutional context	The qualitative and quantitative impact harmful surgical procedures make this PSI important in quality and economic improvement policies.
Care Setting	The PSI applies for quality surgical care.
Professionals Responsible for Health Care	Surgeons, anaesthesiologists and nurses.
Lowest Level of Health Care Delivery Addressed	Individual clinical department.
Allowance for Patient Factors	No risk adjustment described.
Stratification by Vulnerable Populations	No stratification.
Standard of Comparison	No specific time standards given, but comparison every second year has shown to be good.
Scoring	Scoring according to the manual of the Patient's Experiences (Satisfaction) Survey.

Theme Related PSIs: "Medication Error"

Transfusion Reaction

PSI 26: Transfusion Reaction	
Origin: Review of OECD/AHRQ/CIHI PSI (3;33)	
Dimension	**Description**
Description of Specific Aspects of Patient Safety	The chance of a patient suffering a fatal transfusion reaction due to ABO-incompatibility is roughly equivalent to the risk of acquiring HIV infection from a blood transfusion. Thus transfusion reaction is an important measure of patient safety.
Aim of the PSI	This indicator is intended to flag cases of major reactions due to transfusions.
Level of Determination of Patient Safety	Safety is assessed at the aggregated patient level.
Source(s)	This indicator was originally proposed by Iezzoni et al. as part of the Complications Screening Program (CSP "sentinel events"). It was also included as one component of a broader PSI for "adverse events and iatrogenic complications" in AHRQs original HCUP Quality Indicators. It was proposed by Miller et al. in the original "AHRQ PSI Algorithms and Groupings (33).
Extent of Clinically Testing	The OECD Health Care Quality Indicators (HCQI) Project was initiated to implement quality measures for international benchmarking of medical care at the health system level. Five priority areas including patient safety were selected. International expert panels were formed to identify clinically important, scientifically sound, and feasible measures based on a structured consensus process. The consensus process was successfully completed in all five priority areas leading to a recommendation of 86 indicators of which 21 covered patient safety (33). The AHRQ project team developing the PSI conducted empirical analyses on this PSI. Given the low rates or occurrences for Transfusion Reaction, the team did not measure reliability or minimum bias. The indicator could not be risk-adjusted due to the small number of numerator cases. The Literature review conducted by the ARHQ team did not reveal evidence on validity from prior studies, it was explained due to the rarity of this complication (3). The AHRQ PSI software was applied to Veteran Affairs (VA) administrative data to identify potential instances of compromised patient safety; determine occurrence rates of PSI events in the VA; and examine the construct validity of the PSIs. The study population was 97% male, with a mean age of 65 years, 54% were age 65 and older. Mean length of stay was 7.1.days. All together 11411 PSI events were identified, 46% of PSI events occurred in surgical hospitalisation and 54% in medical hospitalisation. The observed PSI

	rate per 1000 discharges was 0.007 the lowest of all studied for transfusion reaction. No statistically significant differences were found for hospitalisations with this PSI events and those without PSI events for longer lengths of stay, higher mortality and higher costs (4). The performance of the AHRQ PSIs was analysed to: 1) provide a descriptive analysis of the incidence of PSI events from 2001 to 2004 in the VA; 2) examine trends in national PSI rates at the hospital discharge level over time; and 3) assess whether hospital characteristics (teaching status, number of beds, and degree of quality improvement implementation) and baseline safety-related hospital performance predict future hospital safety-related performance. Risk-adjusted rates of the PSI for iatrogenic pneumothorax and failure to rescue demonstrated a consistent rate over time. It was concluded, that the PSIs are useful tools for tracking and monitoring patient safety events. Future research should investigate whether trends reflect better or worse care or increased attention to documenting patient safety events (5). AHRQ is determining the feasibility and practicality in a project concerning validation of selected AHRQ Quality Indicators (8). The results suggest that this PSI may be useful as a measure of patient safety (3-5;33).
Evidence of Clinically use of Standards	No evidence of clinically use of standards was found.
PSI category	Theme Related PSI: ”Medication Error”.
Data definitions	Cases of transfusion reaction per 1000 discharges.
Numerator Description	Discharges with ICD-9-CM codes for transfusion reaction in any secondary diagnosis field per 100 discharges.
Denominator Description	All medical and surgical discharges. The OECD expert panel recommended changing the original AHRQ-denominator to: “all transfusions”.
Data Source	Administrative data.
Identifying the institutional context	The impact of transfusion reactions makes this PSI important for both financial and quality improvement policies.
Care Setting	The PSI applies for high quality transfusion care.
Professionals Responsible for Health Care	Doctors.
Lowest Level of Health Care Delivery Addressed	Individual clinical department.
Allowance for Patient Factors	No risk adjustment described.
Stratification by Vulnerable Populations	No stratification.

Standard of Comparison	No specific standards given.
Scoring	AHRQ has PSI software for scoring. Users of the PSI software should note the output will only contain observed rates of transfusion reaction (3).

Wrong Blood Type

PSI 27: Wrong blood type	
Origin: Review of an OECD PSI (33)	
Dimension	**Description**
Description of Specific Aspects of Patient Safety	The chance of a patient suffering a fatal transfusion reaction due to ABO-incompatibility is roughly equivalent to the risk of acquiring HIV infection from a blood transfusion. Half of the reported deaths due to major complications of transfusion in United Kingdom were shown a consequence of transfusing the wrong blood to a patient. Reports from a period of two years from October 1996 of death or major complications of transfusions revealed that he most common (52%) adverse event was giving the wrong blood type to the patient. Thus wrong blood type is a suitable measure of patient safety.
Aim of the PSI	This PSI is intended to flag cases of patients given the wrong blood type.
Level of Determination of Patient Safety	Safety can be assessed at the individual and the aggregated patient level. Though du to the rarity of the wrong blood type and the severity of the event, safety is recommended assessed at the individual patient level.
Source(s)	This indicator was originally proposed by the Australian Council for Safety and Quality.
Extent of Clinically Testing	The OECD Health Care Quality Indicators (HCQI) Project was initiated to implement quality measures for international benchmarking of medical care at the health system level. Five priority areas including patient safety were selected. International expert panels were formed to identify clinically important, scientifically sound, and feasible measures based on a structured consensus process. The consensus process was successfully completed in all five priority areas leading to a recommendation of 86 indicators of which 21 cover patient safety. The results suggest that this PSI may be useful as a measure of patient safety (33).
Evidence of Clinically use of Standards	No evidence of clinically use of standards was found.
PSI category	Theme Related PSI: “Medication Error”
Data definitions	Not specified.
Numerator Description	Number of haemolytic blood transfusion reaction resulting from ABO incompatibility.
Denominator Description	All transfusions.
Data Source	Not specified.
Identifying the institutional context	The impact of this PSI theme is important for both financial and quality improvement policies.

Care Setting	The PSI applies for quality transfusion care.
Professionals Responsible for Health Care	Doctors.
Lowest Level of Health Care Delivery Addressed	Individual clinical department.
Allowance for Patient Factors	No risk adjustment described.
Stratification by Vulnerable Populations	No stratification.
Standard of Comparison	No specific standards given.
Scoring	No scoring advice given.

Medication Error

PSI 28: Medication Error	
Origin: Review of an OECD PSI (33)	
Dimension	**Description**
Description of Specific Aspects of Patient Safety	Medication errors are known to be fairly common but preventable events. Medication errors refer to errors in processes of ordering, transcribing, dispensing, administering, or monitoring medications. Many medication errors are thought to have no or few consequences for the patient's health by health care workers also many medication errors are thought undetected. Though medication errors may result in serious patient morbidity or mortality. Patient compliance has an impact on preventing medication errors. Medication errors are a suitable theme for measuring patient safety.
Aim of the PSI	This PSI is intended to flag cases of in-hospital medication errors.
Level of Determination of Patient Safety	Safety is assessed at the aggregated patient level.
Source(s)	Originally a JCAHO sentinel event indicator
Extent of Clinically Testing	The OECD Health Care Quality Indicators (HCQI) Project was initiated to implement quality measures for international benchmarking of medical care at the health system level. Five priority areas including patient safety were selected. International expert panels were formed to identify clinically important, scientifically sound, and feasible measures based on a structured consensus process. The consensus process was successfully completed in all five priority areas leading to a recommendation of 86 indicators of which 21 cover patient safety (33).
Evidence of Clinically use of Standards	No evidence of clinically use of standards was found.
PSI category	Theme Related PSI: "Medication Errors".
Data definitions	Not specified by OECD.
Numerator Description	Number of patient deaths, paralysis, coma, or other major permanent loss of function associated with a medical error.
Denominator Description	*According to the SimPatIE Stepwise Assessment Indicator Framework Approach, this PSI is not described further as the denominator is not defined by OECD or by JACHO.*

Electronic Trigger Tool - Surveillance of Adverse Drug Events

PSI 29: Electronic Trigger Tool - Surveillance of Adverse Drug Events	
Origin: PSI by SimPatIE	
Dimension	**Description**
Description of Specific Aspects of Patient Safety	Adverse drug events (ADEs) are continually placing patients at risk of harm. ADEs are the single most frequent adverse event type. Tracking the occurrences of ADEs over time is a useful way to tell about the development of safety related to medication. Thus use of specified "triggers" or clues – signalising that an ADE might have occurred – is a suitable patient safety measure.
Aim of the PSI	This PSI is intended to flag rates of ADEs.
Level of Determination of Patient Safety	Safety is assessed at the aggregated patient level.
Source(s)	Manual chart review has been considered the "gold-standard" for identifying adverse events in many patient safety studies. The methodology is expensive and has shown imperfect (46). Automated surveillance for adverse drug events has been demonstrated firstly by Classen et al. in the early 1990s (47). Since then more groups have developed electronic methods suitable for detecting adverse events based on the use of "triggers", coded data, free-text clinical narratives, or a combination of techniques (47-53). Advances in such electronic systems will facilitate our ability to monitor adverse events (46). Thus this PSI is based upon a computerised screening tool that searches free-text discharge summaries for trigger words representing possible adverse drug events.
Extent of Clinically Testing	To assess the accuracy and define the epidemiology of computer based medication error reports a retrospective cohort study of 581 error reports containing 1010 medication errors was conducted. Of medication errors reviewed, 298 (30%) were prescribing errors, 245 (24%) were dispensing errors, 410 (41%) were administration errors, and 57 (6%) involved medication administration records (MAR). Following expert review the overall distribution of error type categories did not change significantly, although only MAR errors were underreported by the reporters. The researchers concluded “despite clear imperfections in the data captured, medication error reporting tools are effective as a means of collecting reliable information on errors rapidly and in real time. Our data suggest that administration errors are at least as common as prescribing errors in children” (49). A recent study by Murff et al. of the development of an electronic trigger tool was based on a cohort study including 424 randomly selected admissions. All discharge summaries with a trigger word

	present underwent chart review by two independent physician reviewers. The presence of adverse events was assessed using structured implicit judgment. A random sample of discharge summaries without trigger words was reviewed too. It was found that 59% of the discharge summaries contained trigger words. Based on discharge summary review, 44.8% (327 of 730) of the alerted trigger words indicated a possible adverse event. After medical record review, the tool detected 131 adverse events. The sensitivity and specificity of the screening tool were 69% and 48%, respectively. The positive predictive value of the tool was 52%. The study showed that the computerised screening method offers researchers and quality managers a means to routinely detect adverse events (50). The use of Trigger Tools appears to increase the rate of ADE detection approximately 50-fold over traditional reporting methodologies. This result is based upon a retrospective review of patient records (52). This result is supported by another study using the Trigger Tool in a neonate ICU. The researchers found that the rate of adverse event was substantially higher than previously described. Many adverse events resulted in permanent harm and the majority of events were classified as preventable. Only 8% of the ADEs were identified using traditional voluntary reporting methods (54). It has been found, that the use of the trigger tool decreased patient harm significantly (55)
Evidence of Clinically use of Standards	The following standard has been used by IHI: "Decrease the number of ADEs per 1000 doses by 75 percent within 1 year"
Indicator category	Theme Related PSI: "Medication Errors".
Data definitions	The total number of ADEs per 1000 doses.
Numerator Description	The total number of ADEs identified in a (defined) sample of patient records.
Denominator Description	Total number of medication doses administered to the patient records reviewed.
Data Source	Applying Trigger Tool for measuring the frequency of adverse drugs events to patient's records.
Identifying the institutional context	The assessment of and development of safety related to medication is important in general clinical and organisational improvement policies.
Care Setting	The indicator applies for medication safety.
Professionals Responsible for heath care	Doctors and cares.
Lowest Level of Health Care Delivery Addressed	Individual clinical units or departments.

Allowance for Patient Factors	Not applicable.
Stratification by Vulnerable Populations	Not applicable.
Standard of Comparison	Comparison over time can be made. No set time frame for comparison has been identified.
Scoring	Scoring is made according to the Electronic Trigger Tool chosen e.g. (50)

Theme Related PSIs: "Obstetrics"

Obstetric Trauma – Vaginal Delivery without Instrument

PSI 30: Obstetric Trauma – Vaginal Delivery without Instrument	
Origin: Review of an AHRQ PSI (3)	
Dimension	**Description**
Description of Specific Aspects of Patient Safety	Obstetric trauma during delivery is often preventable. The percentage of deliveries involving third and fourth degree lacerations is a useful quality indicator of obstetrical care and can assist in reducing the morbidity from extensive perineal tears.
Aim of the PSI	This PSI is intended to flag cases of potentially preventable trauma during vaginal delivery without instrument.
Level of Determination of Patient Safety	Safety is assessed at the aggregated patient level.
Source(s)	An overlapping subset of this indicator (third- or fourth-degree perineal laceration) has been adopted by the Joint Commission for the Accreditation of Healthcare Organisations (JCAHO) as a core performance measure for "pregnancy and related conditions" (PR-25). Based on expert consensus panels, McKesson Health Solutions included the JCAHO indicator in its Care Enhance Resource Management Systems, Quality Profiler Complications Measures Module. Fourth-Degree Laceration, one of the codes mapped to this PSI, was included as one component of a broader indicator ("obstetrical complications") in AHRQs original HCUP Quality Indicator (3). Modified this PSI is included in the Danish National Board of Health's Obstetric Indicators.
Extent of Clinically Testing	The project team developing the AHRQ PSI conducted extensive empirical analyses on this PSI. The team concluded that this PSI generally performs well on several different dimensions, including reliability, bias, relatedness of indicators, and persistence over time (3). Administrative data from community hospitals in 16 US states with reliable race/ethnicity measures using the AHRQ PSIs was analysed to determine whether racial and ethnic differences in patient safety events disappear when income (a proxy for socioeconomic status) is taken into account. Obstetric trauma – Vaginal delivery without instrument occurs significantly less often among African American, Non Hispanic and Hispanic than among white. Where as Vaginal delivery without instrument occurs a little more often among Asian and Pacific Islander than among White. This was explained due to the fact that race is a risk factor for severe perineal laceration after vaginal delivery, and black woman are at lower risk than whites and Asian women are at the highest risk. It was concluded that: "The AHRQ PSIs are a broad screen for potential safety events that point to needed

	improvement in the quality of care for specific populations" (7). AHRQ is determining the feasibility and practicality in a project concerning validation of selected AHRQ Quality Indicators (8). The results suggest that this PSI may be useful as a measure of patient safety (3;7)
Evidence of Clinically use of Standards	No evidence of clinically use of standards was found.
PSI category	Theme Related PSI: "Obstetrics".
	Cases of obstetric trauma (third or fourth degree lacerations) per 1000 vaginal deliveries without instrument. Obstetric trauma includes uterine rupture, fracture of pelvis, including coccyx, laceration or haematoma of cervix, vagina, vulva, perineum and anus
Numerator Description	Discharges with ICD-9-CM code for third and fourth degree obstetric trauma in any diagnosis or procedure field.
Denominator Description	All vaginal delivery discharges. Exclude instrument-assisted delivery.
Data Source	Administrative data: hospital morbidity data collection.
Identifying the institutional context	Complications to delivery can have an ongoing burden on the hospital system in increased length of stays and readmissions making this PSI theme important in clinical, quality and economic policies.
Care Setting	The PSI applies for high quality maternity care.
Professionals Responsible for Health Care	Midwifes and doctors.
Lowest Level of Health Care Delivery Addressed	Individual clinical department.
Allowance for Patient Factors	Risk adjustment for age and comorbidity categories.
Stratification by Vulnerable Populations	No stratification given.
Standard of Comparison	No specific standards given.
Scoring	AHRQ has PSI software for scoring.

Obstetric Trauma – Vaginal Delivery with Instrument

PSI 31: Obstetric Trauma – Vaginal Delivery with Instrument	
Review of OECD/AHRQ/CIHI PSI (3;33)	
Dimension	**Description**
Description of Specific Aspects of Patient Safety	Obstetric trauma during delivery is often preventable. The percentage of deliveries involving third and fourth degree lacerations is a useful quality indicator of obstetrical care and can assist in reducing the morbidity from extensive perineal tears
Aim of the PSI	This PSI is intended to flag cases of potentially preventable trauma during vaginal delivery with instrument.
Level of Determination of Patient Safety	Safety is assessed at the aggregated patient level.
Source(s)	An overlapping subset of this indicator (third- or fourth-degree perineal laceration) has been adopted by the Joint Commission for the Accreditation of Healthcare Organisations (JCAHO) as a core performance measure for "pregnancy and related conditions" (PR-25). Based on expert consensus panels, McKesson Health Solutions included the JCAHO indicator in its Care Enhance Resource Management Systems, Quality Profiler Complications Measures Module. Fourth degree laceration, one of the codes mapped to this indicator, was included as one component of a broader indicator: "obstetrical complications" in AHRQs original HCUP Quality Indicators (3;33). Modified this PSI is included in the Danish National Board of Health's Obstetric Indicators.
Extent of Clinically Testing	The OECD Health Care Quality Indicators (HCQI) Project was initiated to implement quality measures for international benchmarking of medical care at the health system level. Five priority areas including patient safety were selected. International expert panels were formed to identify clinically important, scientifically sound, and feasible measures based on a structured consensus process. The consensus process was successfully completed in all five priority areas leading to a recommendation of 86 indicators of which 21 cover patient safety Although AHRQ/CIHI Safety Indicators collects data for obstetric trauma separately for instrument assisted and non-instrument assisted vaginal deliveries (SY021) the OECD panel decided to combine these two measures. The OECD PSI panel assessed the indicator to be well operationalised. Though concluding: "However, it may be necessary to exclude or adjust for additional high-risk conditions to ensure comparability of this indicator across countries" (33). The AHRQ project team developing the PSI conducted empirical analyses on this PSI. This PSI generally performs well on several different dimensions, including reliability, relatedness indicators, and persistence over time (3).

	AHRQ is determining the feasibility and practicality in a project concerning validation of selected AHRQ Quality Indicators (8). The results suggest that this PSI may be useful as a measure of patient safety (3;33).
Evidence of Clinically use of Standards	No evidence of clinically use of standards was found.
PSI category	Theme Related PSI: "Obstetrics".
Data definitions	Cases of obstetric trauma (third or fourth degree lacerations) per 1000 instrument-assisted vaginal deliveries. Obstetric trauma includes uterine rupture, fracture of pelvis, including coccyx, laceration or haematoma of cervix, vagina, vulva, perineum and anus
Numerator Description	Discharges with ICD-9-CM code for third and fourth degree obstetric trauma in any diagnosis or procedure field.
Denominator Description	All vaginal delivery discharges with any procedure code for instrument-assisted delivery.
Data Source	Administrative data: hospital morbidity data collection.
Identifying the institutional context	Complications to delivery can have an ongoing burden on the hospital system in increased length of stays and readmissions making this PSI theme important in clinical, quality and economic policies.
Care Setting	The PSI applies for high quality maternity care.
Professionals Responsible for Health Care	Midwifes and nurses.
Lowest Level of Health Care Delivery Addressed	Individual clinical department.
Allowance for Patient Factors	Risk adjustment for age.
Stratification by Vulnerable Populations	No stratification given.
Standard of Comparison	No specific standards given.
Scoring	AHRQ has PSI software for scoring.

Obstetric Trauma – Cesarian Delivery

PSI 32: Obstetric Trauma – Cesarian Delivery	
Review of OECD/AHRQ PSI (3;33)	
Dimension	**Description**
Description of Specific Aspects of Patient Safety	Obstetric trauma during delivery: vaginal or cesarian is often preventable. Thus trauma during cesarian delivery is a suitable measure of patient safety.
Aim of the PSI	This PSI is intended to flag cases of potentially preventable trauma during cesarian delivery.
Level of Determination of Patient Safety	Safety is assessed at the aggregated patient level.
Source(s)	An overlapping subset of this indicator (third- or fourth-degree perineal laceration) has been adopted by the Joint Commission for the Accreditation of Healthcare Organisations (JCAHO) as a core performance measure for "pregnancy and related conditions" (PR-25). Based on expert consensus panels, McKesson Health Solutions included the JCAHO indicator in its Care Enhance Resource Management Systems, Quality Profiler Complications Measures Module. Fourth degree laceration, one of the codes mapped to this indicator, was included as one component of a broader indicator: "obstetrical complications" in AHRQs original HCUP Quality Indicators (3;33).
Extent of Clinically Testing	The OECD Health Care Quality Indicators (HCQI) Project was initiated to implement quality measures for international benchmarking of medical care at the health system level. Five priority areas including patient safety were selected. International expert panels were formed to identify clinically important, scientifically sound, and feasible measures based on a structured consensus process. The consensus process was successfully completed in all five priority areas leading to a recommendation of 86 indicators of which 21 cover patient safety (3;33). The OECD PSI panel assessed the indicator to be well operationalised. Though concluding: "However, it may be necessary to exclude or adjust for additional high-risk conditions to ensure comparability of this indicator across countries" (33). The AHRQ project team developing the PSI conducted empirical analyses on this PSI. This PSI generally performs well on several different dimensions, including reliability, relatedness indicators, and persistence over time (3). The results suggest that this PSI may be useful as a measure of patient safety (3;33). AHRQ is determining the feasibility and practicality in a project concerning validation of selected AHRQ Quality Indicators (8).

Evidence of Clinically use of Standards	No evidence of clinically use of standards was found.
PSI category	Theme Related PSI: "Obstetrics".
Data definitions	Cases of obstetric trauma (third or fourth degree lacerations) per 1000 Cesarian deliveries.
Numerator Description	Discharges with ICD-9-CM codes for obstetric trauma in any diagnosis or procedure field.
Denominator Description	All cesarian delivery discharges.
Data Source	Administrative data.
Identifying the institutional context	Complications to delivery can have an ongoing burden on the hospital system in increased length of stays and readmissions making this PSI theme important in clinical, quality and economic policies.
Care Setting	The PSI applies for high quality maternity care.
Professionals Responsible for Health Care	Midwifes and doctors.
Lowest Level of Health Care Delivery Addressed	Individual clinical department.
Allowance for Patient Factors	No risk adjustment.
Stratification by Vulnerable Populations	No stratification given.
Standard of Comparison	No specific standards given.
Scoring	AHRQ has PSI software for scoring.

Problems with Child Birth

PSI 33: Problems with Child Birth	
Review of an OECD PSI (33).	
Dimension	**Description**
Description of Specific Aspects of Patient Safety	Serious complications or even death from delivery are catastrophic events. Proper pre- and perinatal care and monitoring should be able to avoid such events, making this theme suitable as a measure of patient safety.
Aim of the PSI	This PSI is intended to flag cases of maternal death or serious morbidity associated with labour or delivery.
Level of Determination of Patient Safety	Safety is assessed at the aggregated patient level.
Source(s)	Originally a PSI from the Australian Council for Safety and Quality. Maternal death is part of the JCAHO sentinel events indicator set and is defined as the number of intrapartum (related to the birth process) maternal deaths. Also WHO has developed a maternal death indicator (33).
Extent of Clinically Testing	The OECD Health Care Quality Indicators (HCQI) Project was initiated to implement quality measures for international benchmarking of medical care at the health system level. Five priority areas including patient safety were selected. International expert panels were formed to identify clinically important, scientifically sound, and feasible measures based on a structured consensus process. The consensus process was successfully completed in all five priority areas leading to a recommendation of 86 indicators of which 21 covered patient safety (33). The OECD panel considered an alternative measure to this one; the alternative PSI serves as a fallback indicator should data collection for this indicator prove difficult. The alternative measure captures maternal complications and Maternal Death. Maternal death is part of the JCAHO sentinel events indicator set and is defined as the number of intrapartum (related to the birth process) maternal deaths. Also WHO has developed a maternal death indicator (33).
Evidence of Clinically use of Standards	No evidence of clinically use of standards was found.
PSI category	Theme Related PSI: “Obstetrics”.
Data definitions	Not specified.
Numerator Description	Maternal death or serious morbidity associated with labour or delivery.
Denominator Description	Total number of labour and deliveries.
Data Source	Hospital morbidity data collection.

Identifying the institutional context	Problems with child birth can have an ongoing burden on the hospital system in increased length of stays and readmissions making this PSI theme important in clinical, quality and economic policies.
Care Setting	The PSI applies for high quality maternal care.
Professionals Responsible for Health Care	Doctors and midwifes.
Lowest Level of Health Care Delivery Addressed	Individual clinical department.
Allowance for Patient Factors	No risk adjustment described.
Stratification by Vulnerable Populations	No stratification.
Standard of Comparison	No specific standards given.
Scoring	Not specified.

Birth Trauma – Injury to Neonate

PSI 34: Birth Trauma – Injury to Neonate	
Review of OECD/AHRQ/CIHI PSI (3;33)	
Dimension	**Description**
Description of Specific Aspects of Patient Safety	A US study regarding newborns with a discharge diagnosis of birth trauma found that 25% had sustained a significant injury to the head, neck, or shoulder. Birth trauma injury is preventable, making birth trauma a suitable measure of patient safety.
Aim of the PSI	This indicator is intended to flag cases of birth trauma for live born infants born in hospital.
Level of Determination of Patient Safety	Safety is assessed at the aggregated patient level.
Source(s)	This indicator was proposed by Miller et al. (2001) in the original "AHRQ INDICATOR Algorithms and Groupings," although their definition also includes injury to the brachial plexus (767.6), which was excluded from this PSI. Based on expert consensus panels, McKesson Health Solutions included a broader version of this indicator (767.xx) in its Care Enhance Resource Management Systems, Quality Profiler Complications Measures Module (3). Modified this PSI is included in the Danish National Board of Health's Obstetric Indicators.
Extent of Clinically Testing	This indicator has been widely used in the obstetric community, although it is most commonly based on chart review rather than administrative data (3). The OECD Health Care Quality Indicators (HCQI) Project was initiated to implement quality measures for international benchmarking of medical care at the health system level. Five priority areas including patient safety were selected. International expert panels were formed to identify clinically important, scientifically sound, and feasible measures based on a structured consensus process. The consensus process was successfully completed in all five priority areas leading to a recommendation of 86 indicators of which 21 cover patient safety (33). The AHRQ project team developing the PSI conducted empirical analyses on this PSI. The overall usefulness of this indicator was rated as favourable. Birth Trauma generally performs well on several different dimensions, including reliability, relatedness of indicators, and persistence over time (3). AHRQ is determining the feasibility and practicality in a project concerning validation of selected AHRQ Quality Indicators (8). This indicator may require further discussion as the WHO has data concerning the deaths of neonates in all settings (33). The results suggest that this PSI may be useful as a measure of patient

	safety (3;33).
Evidence of Clinically use of Standards	No evidence of clinically use of standards was found.
PSI category	Theme Related PSI: "Obstetrics".
Data definitions	Cases of birth trauma, injury to neonate, per 1000 live born births.
Numerator Description	Discharges with ICD-9-CM code for birth trauma in any diagnosis field. Exclude infants with – A subdural or cerebral hemorrhage (subgroup of birth trauma coding) and any diagnosis code of pre-term infant (denoting birth weight of less than 2,500 grams and less than 37 weeks gestation or 34 weeks gestation or less). – Injury to skeleton (767.3, 767.4) and any diagnosis code of osteogenesis imperfecta (756.51). The OECD-panel decided to use Perinatal death/loss of function (SY058) as fallback for SY019 if data are not widely available for the later. SY058 comes from JCAHO sentinel events. It measures the number of perinatal deaths unrelated to a congenital condition in an infant having a birth weight greater than 2500 grams (33).
Denominator Description	Discharges with ICD-9-CM codes for birth trauma in any diagnosis field per 100 live born births.
Data Source	Administrative data – hospital morbidity data collection.
Identifying the institutional context	Birth trauma can lead to prolonged disability of the infant requiring substantial resources for rehabilitation and care making this PSI theme important in clinical, quality and economic policies.
Care Setting	This PSI applies for high quality maternity care.
Professionals Responsible for Health Care	Midwifes and doctors.
Lowest Level of Health Care Delivery Addressed	Individual clinical department.
Allowance for Patient Factors	Risk adjustment: Sex.
Stratification by Vulnerable Populations	No stratification.
Standard of Comparison	No specific standards given.
Scoring	AHRQ has PSI software for scoring.

Theme Related PSIs: "In-Hospital Fall"

Postoperative Hip Fracture

PSI 35: Postoperative Hip Fracture	
Origin: Review of a common OECD/AHRQ/CIHI PSI (3;33)	
Dimension	**Description**
Description of Specific Aspects of Patient Safety	Hip fracture can have devastating consequences including pain, loss of function and, sometimes, death. When hip fracture occurs in the post-operative period it can reflect inappropriate prescribing by medical staff (*e.g.*, use of long-acting sedatives) or inadequate nursing procedures (*e.g.*, lack of patient monitoring and bedrail use). Thus postoperative hip fracture is an adequate measure of patient safety.
Aim of the PSI	This PSI is intended to survey the incidence of postoperative hip fractures (as distinct from hip fractures occurring in non-surgical settings).
Level of Determination of Patient Safety	Safety is assessed at the aggregated patient level.
Source(s)	This indicator was originally proposed by Iezzoni et al. as part of the Complications Screening Program: CSP 25, "in-hospital hip fracture or fall". The CSP definition also includes any documented fall, based on external cause of injury codes. The American Nurses Association, its State associations, and the California Nursing Outcomes Coalition have identified the number of patient falls leading to injury per 1000 patient days based on clinical data collection as a "nursing-sensitive quality indicator for acute care settings"(33).
Extent of Clinically Testing	The OECD Health Care Quality Indicators (HCQI) Project was initiated to implement quality measures for international benchmarking of medical care at the health system level. Five priority areas including patient safety were selected. International expert panels were formed to identify clinically important, scientifically sound, and feasible measures based on a structured consensus process. The consensus process lead to a recommendation of 86 indicators of which 21 covers aspects of patient safety (34). The project team developing the AHRQ PSI conducted extensive empirical analyses on this PSI. The team concluded that this PSI generally performs well on several different dimensions, including reliability, bias, relatedness of indicators, and persistence over time (3). The AHRQ PSI software was applied to Veteran Affairs (VA) administrative data to identify potential instances of compromised patient safety; determine occurrence rates of PSI events in the VA; and examine the construct validity of the PSIs. The study population was 97% male, with a mean age of 65 years, 54% were age 65 and

	older. All together 11411 PSI events were identified, 46% of PSI events occurred in surgical hospitalisation and 54% in medical hospitalisation. The observed PSI rate per 1000 discharges was 1.14 for postoperative hip fracture. This PSI was not significantly associated with any other of the studied PSIs. Statistical significantly differences were found for hospitalisations with PSI events and those without PSI events for longer lengths of stay, mortality and higher costs (4). The performance of the AHRQ PSIs was analysed to: 1) provide a descriptive analysis of the incidence of PSI events from 2001 to 2004 in the VA; 2) examine trends in national PSI rates at the hospital discharge level over time; and 3) assess whether hospital characteristics (teaching status, number of beds, and degree of quality improvement implementation) and baseline safety-related hospital performance predict future hospital safety-related performance. Risk-adjusted rates of the PSI for iatrogenic pneumothorax and failure to rescue demonstrated a consistent rate over time. It was concluded, that the PSIs are useful tools for tracking and monitoring patient safety events. Future research should investigate whether trends reflect better or worse care or increased attention to documenting patient safety events (5). Administrative data from community hospitals in 16 US states with reliable race/ethnicity measures using the AHRQ PSIs was analysed to determine whether racial and ethnic differences in patient safety events disappear when income (a proxy for socioeconomic status) is taken into account. Postoperative hip fracture occurs significantly less often among other races than among white, possibility due to genetic differences. It was concluded that: ”The AHRQ PSIs are a broad screen for potential safety events that point to needed improvement in the quality of care for specific populations” (7). The results suggest that this PSI may be useful as a measure of patient safety (3-5;7;8;33;34).
Evidence of Clinically use of Standards	No evidence of clinically use of standards was found.
PSI category	Theme Related PSI**:** “In-Hospital Fall”
Data definitions	Cases of in-hospital hip fracture per 100 surgical discharges with an operating room procedure.
Numerator Description	Discharges with ICD-9-CM code for hip fracture in any secondary diagnosis field.
Denominator Description	All surgical discharges. Exclude cases: – Who have musculoskeletal and connective tissue diseases (MDC 8) – With principal diagnosis codes for seizure, syncope, stroke, coma, cardiac arrest, poisoning, trauma, delirium and other

	psychoses, or anoxic brain injury – With any diagnosis of metastatic cancer, lymphoid malignancy or bone malignancy, and self inflicted injury – 17 years of age and younger
Data Source	Administrative data.
Identifying the institutional context	As postoperative hip fractures can cause pain, suffering, prolonged hospital stays and additional surgical interventions, monitoring this PSI is important for pursuing quality improvement, economic, legal and ethical policies.
Care Setting	The PSI applies for high quality surgical care.
Professionals Responsible for Health Care	Surgeons.
Lowest Level of Health Care Delivery Addressed	Individual clinical units or departments.
Allowance for Patient Factors	Risk adjustment for age, sex, DRG, comorbidity categories.
Stratification by Vulnerable Populations	No stratification.
Standard of Comparison	No specific standards given.
Scoring	AHRQ has PSI software for scoring.

In-Hospital Hip Fracture or Fall

PSI 36: In Hospital Hip Fracture or Fall	
Review of an OECD PSI (33).	
Dimension	**Description**
Description of Specific Aspects of Patient Safety	Falls are a common cause of morbidity and mortality especially among elderly in-patients over 65 years of age. Falls are associated with functional disability and injury, increased length of stay, and risk of nursing home placement from hospital. Often falls are the result of the interaction of many factors. Falls may be caused by the persons' health status, response to medical interventions, external factors such as the type of floor or other factors. Thus in-hospital hip fracture or fall is an adequate measure of patient safety.
Aim of the PSI	This PSI is intended to flag cases of in-hospital hip fractures or falls.
Level of Determination of Patient Safety	Safety is assessed at the aggregated patient level.
Source(s)	The complication screening programme (33).
Extent of Clinically Testing	The OECD Health Care Quality Indicators (HCQI) Project was initiated to implement quality measures for international benchmarking of medical care at the health system level. Five priority areas including patient safety were selected. International expert panels were formed to identify clinically important, scientifically sound, and feasible measures based on a structured consensus process. The consensus process was successfully completed in all five priority areas leading to a recommendation of 86 indicators of which 21 cover patient safety (33). The Complications Screening Program (CSP) aims to identify 28 potentially preventable complications of hospital care using computerised discharge abstracts, including demographic information, diagnosis and procedure codes. A study was set up to validate the CSP as a quality indicator. Explicit process of care criteria were used to determine whether hospital discharges flagged by the CSP experienced more process problems than unflagged discharges. The CSP was applied to computerised hospital discharge abstracts from Medicare beneficiaries > 65 years old admitted in 1994 to hospitals in California and Connecticut for major surgery or medical treatment. The final sample included 740 surgical and 416 medical discharges. Rates of process problems were high, ranging from 24.4 to 82.5% across CSP screens for surgical cases. Problems were lower for medical cases, ranging from 2.0 to 69.1% across CSP screens. Problem rates were 45.7% for surgical and 5.0% for medical controls. Rates of problems did not differ significantly across flagged and unflagged discharges. The researchers concluded: "The CSP did not flag discharges with significantly higher rates of explicit process problems than unflagged discharges" (37).

	Another study of the CSP was undertaken to study the accuracy of computer algorithms on administrative data to identify hospital complications. The assessment was based on a medical records indicator differentiating hospital-acquired conditions from pre-existing comorbidities. Indicators for identifying potential hospital complications were applied to all secondary diagnoses for all 1997-1998 discharges. The researchers concluded: "Current complication algorithms identify many cases where the condition was actually present on hospital admission. This fact, coupled with the known variability in coding between institutions, makes comparisons between hospitals on many of the complications problematic. Collection of the present-on-admission flag significantly reduces the noise in monitoring complication rates (38). The results suggest that this PSI may be useful as a measure of patient safety (33;37).
Evidence of Clinically use of Standards	No evidence of clinically use of standards was found.
PSI category	Theme Related PSI**:** "In-Hospital Fall".
Data definitions	Cases of in-hospital hip fracture or fall per 100 surgical discharges with an operating room procedure.
Numerator Description	Patients experiencing an in-hospital hip fracture or fall; defined as secondary diagnosis only. A fall is defined as unintentionally coming to rest on the ground, floor, or other lower level, but not as a result of syncope or overwhelming external force. Exclude cases: – With trauma or metastatic cancer as any diagnosis – With principal diagnosis of seizure, syncope, stroke, coma, cardiac arrest, or poisoning – In MDC 8.
Denominator Description	Inpatients undergoing major surgery OR minor or miscellaneous surgery OR invasive cardiac procedures OR invasive radiologic procedures OR endoscopy OR medical patients OR all patients as defined by the CSP.
Data Source	Administrative data.
Identifying the institutional context	The impact of falls makes this PSI important for both financial and quality improvement policies.
Care Setting	The PSI applies for high quality care.
Professionals Responsible for Health Care	All health care workers.
Lowest Level of Health Care Delivery Addressed	Individual clinical department.

Allowance for Patient Factors	No risk adjustment described.
Stratification by Vulnerable Populations	No stratification.
Standard of Comparison	No specific standards given.
Scoring	Not specified

Patient Falls

PSI 37: Patient Falls	
Review of an OECD PSI (33).	
Dimension	**Description**
Description of Specific Aspects of Patient Safety	Falls are a common cause of morbidity and mortality especially among elderly in-patients over 65 years of age. Falls are associated with functional disability and injury, increased length of stay, and risk of nursing home placement from hospital. Often falls are the result of the interaction of many factors. Falls may be caused by the persons' health status, response to medical interventions, external factors such as the type of floor or other factors. Thus in-hospital fall is an adequate measure of patient safety.
Aim of the PSI	This PSI is intended to flag cases of in-hospital patient falls resulting in death or major permanent loss of function.
Level of Determination of Patient Safety	Safety is assessed at the aggregated patient level.
Source(s)	JCAHO sentinel events (33).
Extent of Clinically Testing	The OECD Health Care Quality Indicators (HCQI) Project was initiated to implement quality measures for international benchmarking of medical care at the health system level. Five priority areas including patient safety were selected. International expert panels were formed to identify clinically important, scientifically sound, and feasible measures based on a structured consensus process. The consensus process was successfully completed in all five priority areas leading to a recommendation of 86 indicators of which 21 cover patient safety (33). The OECD panel reviewed the literature and found that studies show that intervention can decrease the risk of falls but also evidence that interventions to reduce specific risk factors resulted in a 30% reduction in falls over one year in a prospective community cohort (33).
Evidence of Clinically use of Standards	No evidence of clinically use of standards was found.
PSI category	Theme Related PSI**:** "In-Hospital Fall".
Data definitions	Cases of in-hospital fall with serous consequences per 1000 admissions.
Numerator Description	Number of patient falls that result in death or major permanent loss of function as a result of the injuries sustained in the fall direct. A fall is defined as unintentionally coming to rest on the ground, floor, or other lower level, but not as a result of syncope or overwhelming external force.
Denominator Description	All hospital admissions.

Data Source	Administrative data.
Identifying the institutional context	The impact of falls makes this PSI important for both financial and quality improvement policies.
Care Setting	The PSI applies for high quality care.
Professionals Responsible for Health Care	All health care workers.
Lowest Level of Health Care Delivery Addressed	Individual clinical department.
Allowance for Patient Factors	No risk adjustment described.
Stratification by Vulnerable Populations	No stratification.
Standard of Comparison	No specific standards given.
Scoring	Not specified

Disease Specific as well as other Specific PSIs

Failure to Rescue

PSI 39: Failure to Rescue	
Origin: Review of an AHRQ PSI (3)	
Dimension	**Description**
Description of Specific Aspects of Patient Safety	Complications might occur in any care process – though good hospitals identify such complications quickly and treat them aggressively to avoid further complications and deaths.
Aim of the PSI	The PSI aims at surveillance of patients who die following the development of a complication.
Level of Determination of Patient Safety	Safety can be assessed at the individual and the aggregated patient level.
Source(s)	This indicator was originally proposed by Silber et al. as a more powerful tool than the risk-adjusted mortality rate. The Indicator is intended to detect true differences in patient outcomes across hospitals. The underlying premise was that better hospitals are distinguished not by having fewer adverse occurrences but by more successfully treatment of patients who experience complications.
Extent of Clinically Testing	The project team developing the AHRQ PSI conducted extensive empirical analyses on this PSI. The team concluded that this PSI generally performs well on several different dimensions, including reliability, bias, relatedness of indicators, and persistence over time. AHRQ-Panellists noted that 1) this PSI is fundamentally different than other AHRQ PSIs, as it reflects effectiveness in rescuing a patient from a complication versus preventing a complication and 2) several adverse incentives may be introduced by implementing this indicator. In particular, since some type of adjustment may be desirable, this indicator may encourage the up coding of complications and co-morbidities to inflate the denominator or manipulate risk adjustment. Others noted that this indicator could encourage irresponsible resource use and allocation, although this is likely to be a controversial idea. Finally, panellists emphasised that this indicator should be used internally by hospitals, as it is not validated for public reporting. (3). The AHRQ PSI software was applied to Veteran Affairs (VA) administrative data to identify potential instances of compromised patient safety; determine occurrence rates of PSI events in the VA; and examine the construct validity of the PSIs. The study population was 97% male, with a mean age of 65 years, 54% were age 65 and older. All together 11411 PSI events were identified, 46% of PSI events occurred in surgical hospitalisation and 54% in medical hospitalisation. The observed PSI rate per 1000 discharges was 155.55 for failure to rescue, the highest rate observed among all AHRQ PSIs. This PSI was significantly associated with the AHRQ PSIs for Death

	in low-mortality DRGs, postoperative pulmonary embolism or deep vein thrombosis, technical difficulties with procedure and decubitus ulcer. Significant differences were found for hospitalisations with PSI and those without PSI events for longer lengths of stay and higher costs (4). The performance of the AHRQ PSIs was analysed to: 1) provide a descriptive analysis of the incidence of PSI events from 2001 to 2004 in the VA; 2) examine trends in national PSI rates at the hospital discharge level over time; and 3) assess whether hospital characteristics (teaching status, number of beds, and degree of quality improvement implementation) and baseline safety-related hospital performance predict future hospital safety-related performance. Risk-adjusted rates of the PSI for iatrogenic pneumothorax and failure to rescue demonstrated a significant trend for a decreasing rate over time. After accounting for patient and hospital characteristics, hospitals' baseline risk-adjusted PSI rates were the most important predictors of the 2004 risk-adjusted rates for failure to rescue among seven other PSIs. It was concluded, that this PSI is a useful tools for tracking and monitoring patient safety events. Future research should investigate whether trends reflect better or worse care or increased attention to documenting patient safety events (5). The Agency for Healthcare Research and Quality PSI algorithms were applied to administrative data across four years of 1.92 million discharges from children's hospitals. The mean risk-adjusted rates of PSI events ranged from 0.1 events per 1000 discharges for a foreign body left in during a procedure to 140 events per 1000 discharges for failure to rescue. The researchers concluded: “PSIs derived from administrative data are indicators of patient safety concerns and can be relevant as screening tools for children's hospitals; however, cases identified by these indicators do not always represent preventable events. Some, such as a foreign body left in during a procedure, iatrogenic pneumothorax, infection attributable to medical care, decubitus ulcer, and venous thrombosis, seem to be appropriate for paediatric care and may be directly amenable to system changes. In their present form, two of the indicators, namely, failure to rescue and death in low-mortality DRGs, are inaccurate for the paediatric population, do not represent preventable errors in the majority of paediatric cases, and should not be used to estimate quality of care or preventable deaths in children's hospitals”(6). AHRQ is determining the feasibility and practicality in a project concerning validation of selected AHRQ Quality Indicators (8). The results suggest that this PSI may be useful as a measure of patient safety – Though special thoughts should be given to application of this PSI to the paediatric population. (3-6).
Evidence of Clinically use of Standards	No evidence of clinically use of standards was found.
PSI category	Diagnose Specific as well as other Specific PSIs.

Data definitions	Number of deaths per 1000 patients having developed specified complications of care during hospitalisation.
Numerator Description	Number of in-hospital deaths. (Discharges with a disposition of "deceased").
Denominator Description	Number of in-hospital deaths (Discharges with a disposition of "deceased") plus discharges 18 years and older with potential complications of care listed in failure to rescue definition (i.e., pneumonia, DVT/PE, sepsis, acute renal failure, shock/cardiac arrest, or GI hemorrhage/acute ulcer). Exclude cases: – age 75 years and older – neonatal patients in MDC 15 – transferred to an acute care facility (Discharge Disposition = 2) – transferred from an acute care facility (Admission Source = 2) – admitted from a long-term care facility (Admission Source=3) Additional exclusion criteria specific to each diagnosis.
Data Source	Administrative data.
Identifying the institutional context	This PSI is relevant to quality improvement.
Care Setting	The PSI applies for high quality health care.
Professionals Responsible for Health Care	Health care workers.
Lowest Level of Health Care Delivery Addressed	Individual clinical units or departments.
Allowance for Patient Factors	Risk adjustment for age, sex, DRG, comorbidity categories.
Stratification by Vulnerable Populations	No stratification.
Standard of Comparison	No specific standards given.
Scoring	AHRQ has PSI software for scoring.

Iatrogenic Pneumothorax

PSI 40: Iatrogenic Pneumothorax	
Origin: Review of an AHRQ PSI (3)	
Dimension	**Description**
Description of Specific Aspects of Patient Safety	Pneumothorax is a frequent and preventable complication in medical care. Thus it is a suitable measure of patient safety.
Aim of the PSI	This PSI aims at surveillance of cases of pneumothorax caused by medical care.
Level of Determination of Patient Safety	Safety is assessed at the aggregated patient level.
Source(s)	This diagnosis code was proposed by Miller et al. as one component of a broader indicator for "iatrogenic conditions" in the "Patient Safety Indicator Algorithms and Groupings." It was also included as one component of a broader indicator; "adverse events and iatrogenic events complications" in AHRQ Version 1.3 HCUP (3). This AHRQ indicator is defined on both a provider level by including cases of iatrogenic pneumothorax occurring as a secondary diagnosis during hospitalisation and on an area level by including all cases of iatrogenic pneumothorax (3).
Extent of Clinically Testing	The project team developing the AHRQ PSI conducted extensive empirical analyses on this PSI. The team concluded that this PSI generally performs well on several different dimensions, including reliability, bias, relatedness of indicators, and persistence over time. Also they team concluded, that the overall usefulness of this PSI is favourable. In their literature review the AHRQ project team found no published evidence for this PSI that supports that hospitals; a) providing better processes of care experience fewer adverse events; b) providing better overall care experience fewer adverse events; and c) offering more nursing hours per patient day, better nursing skill mix, better physician skill mix, or more experienced physicians experience fewer adverse events (3). The AHRQ PSI software was applied to Veteran Affairs (VA) administrative data to identify potential instances of compromised patient safety; determine occurrence rates of PSI events in the VA; and examine the construct validity of the PSIs. The study population was 97% male, with a mean age of 65 years, 54% were age 65 and older. All together 11411 PSI events were identified, 46% of PSI events occurred in surgical hospitalisation and 54% in medical hospitalisation. The observed PSI rate per 1000 discharges was 1.17 for iatrogenic pneumothorax. This PSI was significantly associated with the AHRQ PSIs for decubitus ulcer, infections due to medical care, postoperative haemorrhage or haematoma, postoperative wound dehiscence and technical difficulties with procedure. Significant differences were found for hospitalisations with PSI and those without

	PSI events for longer lengths of stay, higher mortality, and higher costs (4). The performance of the AHRQ PSIs was analysed to: 1) provide a descriptive analysis of the incidence of PSI events from 2001 to 2004 in the VA; 2) examine trends in national PSI rates at the hospital discharge level over time; and 3) assess whether hospital characteristics (teaching status, number of beds, and degree of quality improvement implementation) and baseline safety-related hospital performance predict future hospital safety-related performance. Risk-adjusted rates of the PSI for iatrogenic pneumothorax and failure to rescue demonstrated a significant increasing rate over time. After accounting for patient and hospital characteristics, hospitals' baseline risk-adjusted PSI rates were the most important predictors of the 2004 risk-adjusted rates for iatrogenic pneumothorax among seven other PSIs. It was concluded, that this PSI is a useful tools for tracking and monitoring patient safety events. Future research should investigate whether trends reflect better or worse care or increased attention to documenting patient safety events (5). The Agency for Healthcare Research and Quality PSI algorithms were applied to administrative data across four years of 1.92 million discharges from children's hospitals. The mean risk-adjusted rates of PSI events ranged from 0.1 events per 1000 discharges for a foreign body left in during a procedure to 140 events per 1000 discharges for failure to rescue. The researchers concluded: “PSIs derived from administrative data are indicators of patient safety concerns and can be relevant as screening tools for children's hospitals; however, cases identified by these indicators do not always represent preventable events. Some, such as a foreign body left in during a procedure, iatrogenic pneumothorax, infection attributable to medical care, decubitus ulcer, and venous thrombosis, seem to be appropriate for paediatric care and may be directly amenable to system changes”(6). Administrative data from community hospitals in 16 US states with reliable race/ethnicity measures using the AHRQ PSIs was analysed to determine whether racial and ethnic differences in patient safety events disappear when income (a proxy for socioeconomic status) is taken into account. Iatrogenic Pneumothorax occur significantly less often among Hispanic people and African American, Non Hispanics than among white. It was concluded that: ”The AHRQ PSIs are a broad screen for potential safety events that point to needed improvement in the quality of care for specific populations” (7). AHRQ is determining the feasibility and practicality in a project concerning validation of selected AHRQ Quality Indicators (8). The results suggest that this PSI may be useful as a measure of patient safety (3-6).
Evidence of Clinically use of Standards	No evidence of clinically use of standards was found.
PSI category	Diagnose Specific as well as other Specific PSIs.

Data definitions	Cases of iatrogenic pneumothorax per 1000 discharges.
Numerator Description	Discharges with ICD-9-CM code of 512.1 in any secondary diagnosis field.
Denominator Description	All medical and surgical discharges age 18 years and older defined by specific DRGs. Exclude cases: – ICD-9-CM code of 512.1 in the principal diagnosis field – MDC 14 (pregnancy, childbirth, and puerperium) – with an ICD-9-CM diagnosis code of chest trauma or pleural effusion – with an ICD-9-CM procedure code of diaphragmatic surgery repair – with any code indicating thoracic surgery or lung or pleural biopsy or assigned to cardiac surgery DRGs
Data Source	Administrative data.
Identifying the institutional context	The impact of iatrogenic pneumothorax makes this PSI important for both financial and quality improvement policies.
Care Setting	The PSI applies for quality medical care.
Professionals Responsible for Health Care	Doctors and nurses.
Lowest Level of Health Care Delivery Addressed	Individual clinical department.
Allowance for Patient Factors	Risk adjustment for age, sex and comorbidity categories.
Stratification by Vulnerable Populations	No stratification.
Standard of Comparison	No specific standards given.
Scoring	AHRQ has PSI software for scoring.

Assessment of Suicidal Risk in Schizophrenic Patients

PSI 41: Assessment of Suicidal Risk in Schizophrenic Patients	
Review of a PSI from the Danish National Indicator Project (NIP) (56-58)	
Dimension	**Description**
Description of Specific Aspects of Patient Safety	Schizophrenic patients have a known higher risk of suicidal behaviour especially in the time right after discharge from hospital. Thus assessment of suicidal risk at discharge is an adequate measure of patient safety.
Aim of the PSI	This indicator is intended to survey assessment of suicidal risk in schizophrenic patients discharged from the hospital.
Level of Determination of Patient Safety	Safety is assessed at the aggregated patient level.
Source(s)	Originally a PSI of NIP in Denmark. This PSI is part of an indicator set of nine indicators for surveillance of the quality of care provide for all Danish inpatients with schizophrenia (58).
Extent of Clinically Testing	Over mortality in schizophrenic has been found, this over mortality is mainly due to suicide (59;60). Mortality and causes of death was investigated in a total Danish national sample of 9156 schizophrenic patients admitted for the first time. Suicide accounted for 50% of deaths in men and 35% of deaths in women. Suicide risk during the first year of follow-up increased by 56%, with a 50% reduction on psychiatric in-patient facilities (60). This process PSI of NIP is bases on extensive literature studies and described in detail (61) in agreement with the National Danish Guidelines for Schizophrenia (62). The Danish National Indicator Project aims at documenting and improving the quality of care, the project was established in 2000 as a nationwide mandatory multidisciplinary quality improvement project. From 2000 to 2002, disease-specific clinical indicators and standards were developed for six diseases: stroke, hip fracture, schizophrenia, acute gastrointestinal surgery, heart failure, and lung cancer). Indicators and standards have been implemented in all clinical units and departments in Denmark treating patients with the six diseases. Results feedback is monthly, and yearly regional and national audit processes are organised to explain the results and to prepare implementation of improvements. All results are published in order to inform the public, and to give patients and relatives the opportunity to make informed choices (57). The NIP expert panel concluded that this PSI generally performs well.
Evidence of Clinically use of Standards	For at least 90% of all patients discharged from hospital assessment of suicidal risk is documented in the patients record.
PSI category	Diagnose Specific as well as other Specific PSIs.

Data definitions	Patients with a primary or secondary diagnosis of schizophrenia (Any ICD-10 F.20 diagnosis) discharged form hospital.
Numerator Description	Assessed and documented suicidal risk within the last week prior to discharge. Assessment should include an evaluation of depressive symptoms and the risk of suicide.
Denominator Description	Patients discharges from hospital with an ICD-10 diagnosis of any F.20 diagnose (F20.0-F20.99)
Data Source	Patient records.
Identifying the institutional context	The impact of suicides in schizophrenic patients makes this PSI important in quality improvement policies.
Care Setting	The PSI applies for quality health care.
Professionals Responsible for Health Care	Doctors/Nurses.
Lowest Level of Health Care Delivery Addressed	Individual clinical department.
Allowance for Patient Factors	No risk adjustment described.
Stratification by Vulnerable Populations	Stratification according to : – Age: 1) Patients ≥ 18 years and 2) patients < 18 years – Psychopathological status: 1) the patient has been diagnosed within the last 12 month (incident) or 2) the patient was diagnosed more than 12 month ago (prevalent)
Standard of Comparison	No specific time standards given, but yearly comparison has shown to be good.
Scoring	NIP has software for scoring the PSI. Cumulated scores are subjected to auditing. On the basis of the first experience with NIP, a number of requirements has been specified for a forthcoming second generation of clinical database system has been described. The requirements regard: coordination, rational management and experience-based development of IT systems for the clinical databases and integration with present and forthcoming systems including electronic patient record systems (63).

Monitoring Side Effect of Anti-Psychotic Treatment

PSI 42: Monitoring Side effects of Anti-psychotic treatment	
Review of a PSI from the Danish National Indicator Project (NIP) (56-58)	
Dimension	**Description**
Description of Specific Aspects of Patient Safety	Antipsychotic treatment often has side effects with a substantial qualitative and quantitative harmful impact. Thus assessment of weight gaining, sexuality, sedation and neurological symptoms must be assessed in order to give adequate treatment and obtain compliance. Thus is an adequate measure of patient safety.
Aim of the PSI	This PSI is intended to survey the practice screening for side effects in schizophrenic patients receiving anti-psychotic treatment.
Level of Determination of Patient Safety	Safety is assessed at the aggregated patient level.
Source(s)	Originally a PSI of NIP in Denmark. This PSI is part of an indicator set of nine indicators for surveillance of the quality of care provide for all Danish inpatients with schizophrenia (58).
Extent of Clinically Testing	The Danish National Indicator Project aims at documenting and improving the quality of care, the project was established in 2000 as a nationwide mandatory multidisciplinary quality improvement project. From 2000 to 2002, disease-specific clinical indicators and standards were developed for six diseases: stroke, hip fracture, schizophrenia, acute gastrointestinal surgery, heart failure, and lung cancer). Indicators and standards have been implemented in all clinical units and departments in Denmark treating patients with the six diseases. Results feedback is monthly, and yearly regional and national audit processes are organised to explain the results and to prepare implementation of improvements. All results are published in order to inform the public, and to give patients and relatives the opportunity to make informed choices (57). This process PSI of NIP is bases on extensive literature studies and described in detail (61) in agreement with the National Danish Guidelines for Schizophrenia (62). The NIP expert panel concluded that this PSI generally performs well.
Evidence of Clinically use of Standards	Side effects are monitored for 100% of all patients receiving antipsychotic treatment.
PSI category	Diagnose Specific as well as other Specific PSIs.
Data definitions	All patients with a primary or secondary diagnosis of schizophrenia; any ICD-10 F.20 diagnosis receiving antipsychotic treatment.
Numerator Description	Assessed side effects of antipsychotic treatment.
Denominator Description	Patients discharges from hospital with an ICD-10 diagnosis of any F20 – diagnose (F20.0-F20.99)

Data Source	Patient records.
Identifying the institutional context	The consequences of side effects of antipsychotic treatment in schizophrenic patients make this PSI important in quality improvement policies.
Care Setting	The PSI applies for quality health care.
Professionals Responsible for Health Care	Authorised health care workers.
Lowest Level of Health Care Delivery Addressed	Individual clinical department.
Allowance for Patient Factors	No risk adjustment described.
Stratification by Vulnerable Populations	Stratification according to : – Age: 1) Patients ≥ 18 years and 2) patients < 18 years – Psychopathological status: 1) the patient has been diagnosed within the last 12 month (incident) or 2) the patient was diagnosed more than 12 month ago (prevalent) – Treatment status: 1) the patient has been in treatment (ambulatory care or inpatient) for the previous year or 2) the patient is discharged from in-patient/out-patient treatment – Type of side effects: • Neurological side effects • Sedation • Gaining weight • Sexual side effects • Fasting blood sugar
Standard of Comparison	No specific time standards given, but yearly comparison has shown to be good.
Scoring	NIP has software for scoring the PSI. Cumulated scores are subjected to auditing. On the basis of the first experience with NIP, a number of requirements has been specified for a forthcoming second generation of clinical database system has been described. The requirements regard: coordination, rational management and experience-based development of IT systems for the clinical databases and integration with present and forthcoming systems including electronic patient record systems (63).

References

(1) Jarman B, Gault S, Alves B. Explaining differences in English hospital death rates using routinely collected data. British Medical Journal 1999 May 6;318:1515-20.

(2) Jarman B. Using mortality data to drive system level improvement, 10th European Forum on Quality Improvement, London, April 2005. 4-1-2005. Slide show

(3) Agency for Healthcare Research and Quality. Guide to Patient Safety Indicators. http://www.qualityindicators.ahrq.gov/psi_download.htm. 2006.

(4) Rosen AK, Rivard P, Zhao S, Loveland S, Tsilimingras D, Christiansen CL, et al. Evaluating the patient safety indicators: how well do they perform on Veterans Health Administration data? Med Care 2005 Sep;43(9):873-84.

(5) Rosen AK, Zhao S, Rivard P, Loveland S, Montez-Rath ME, Elixhauser A, et al. Tracking rates of Patient Safety Indicators over time: lessons from the Veterans Administration. Med Care 2006 Sep;44(9):850-61.

(6) Sedman A, Harris JM, Schulz K, Schwalenstocker E, Remus D, Scanlon M, et al. Relevance of the Agency for Healthcare Research and Quality Patient Safety Indicators for children's hospitals. Pediatrics 2005 Jan;115(1):135-45.

(7) Coffey RM, Andrews RM, Moy E. Racial, ethnic, and socioeconomic disparities in estimates of AHRQ patient safety indicators. Med Care 2005 Mar;43(3 Suppl):I48-I57.

(8) Agency for Healthcare Research and Quality. AHRQ; Description of patient safety indicators. http://www.ahrq.gov/downloads/pub/advances/vol2/Rivard.doc. 2006.

(9) Enheden for Brugerundersøgelser AiGD. Patienters oplevelser på landets sygehuse - Spørgeskemaundersøgelse. http://www.hosp.dk/direktion.nsf/ResponseDokumenter/E0D62B388C5CC19CC1256FB900395D2A. 2005.

(10) Poulsen KB, Kallestrup R, Schostak J.F. Who is right? The quality of medical error reporting: (Dis-) agreement between hospital staff and patients interpretation. Book of abstract, The International Society for Quality in Health Care Congress, 2006.London: 2006. p. 116-7.

(11) Enheden for Brugerundersøgelser AiGD. Patienters oplevelser på landets sygehuse - Tabelsamling. http://www.patientoplevelser.dk/log/medie/Rapporter/LPU_Tabel_2004.pdf. 2005.

(12) Madsen MD, Østergaard D. Udvikling af metode og værktøj til at måle sikkerhedskultur på sygehusafdelinger. Afrapportering af projekt om sikkerhedskultur og patientsikkerhed i Københavns Amt. http://www.risoe.dk/rispubl/SYS/syspdf/ris-r-1491.pdf. 2004.

(13) Madsen MD. Improving Patient Safety: Safety Culture & Patient Safety Ethics. http://www.risoe.dk/rispubl/SYS/syspdf/ris-phd-25.pdf. Denmark: Roskilde University; 2006.

(14) Coleman EA, Smith JD, Frank JC, Eilertsen TB, Thiare JN, Kramer AM. Development and testing of a measure designed to assess the quality of care transitions. Int J Integr Care 2002;2:e02.

(15) CTM. Care Transitions Measure - Specifications for the CTM-3. http://www.caretransitions.org/documents/CTMspecs.pdf. 2006.

(16) CTM. Care Transitions Measure - Summary of Prior Research in the Development of the Care Transitions Measure (CTM). http://www.caretransitions.org/documents/SUMMARY%20OF%20PRIOR%20RESEARCH.pdf. 2006.

(17) CTM. Care Transitions Measure - Overview of the CTM. http://www.caretransitions.org/documents/New_CTM_Developments.pdf. 2006.

(18) Coleman EA, Parry C, Chalmers S, Min SJ. The care transitions intervention: results of a randomized controlled trial. Arch Intern Med 2006 Sep 25;166(17):1822-8.

(19) Scott T, Mannion R, Marshall M, Davies H. Does organisational culture influence health care performance? A review of the evidence. J Health Serv Res Policy 2003 Apr;8(2):105-17.

(20) Griffin MA, Neal A. Perceptions of safety at work: a framework for linking safety climate to safety performance, knowledge, and motivation. J Occup Health Psychol 2000 Jul;5(3):347-58.

(21) Madsen MD, Andersen HB, Itoh K. Assessing Safety Culture in Healt Care in Haandbook of Human Factors and Ergonomics in Healthcare. In: Carayon P, editor. 2006.

(22) Nieva VF, Sorra J. Safety culture assessment: a tool for improving patient safety in healthcare organizations. Qual Saf Health Care 2003 Dec;12 Suppl 2:ii17-ii23.

(23) Pronovost P, Sexton B. Assessing safety culture: guidelines and recommendations. Qual Saf Health Care 2005 Aug;14(4):231-3.

(24) Walshe K, Boaden R. Patient Safety. Research into Practice. Open University Press, MCgraw Hill Maidenhead, UK; 2006.

(25) Reason J, Wreathall J. Checklist for Assessing Institutional Resilience (CAIR). http://www.rmf.harvard.edu/files/documents/Mod7doclink2.pdf. 2000.

(26) Sexton JB, Helmreich RL, Pronovost P, Thomas EJ. Safety Climate Survey. http://www.ihi.org/IHI/Topics/PatientSafety/SafetyGeneral/Tools/Safety+Climate+Survey.htm. 2004. IHI Institute for Healthcare Improvement (Books).

(27) Sorra JS, Nieva VF. Hospital Survey on Patient Safety Culture. (Prepared by Westat, under Contract No. 290-96-0004). AHRQ Publication No. 04-0041. 1-9-2004. Rockville, MD: Agency for Healthcare Research and Quality.

(28) Kho ME, Carbone JM, Lucas J, Cook DJ. Safety Climate Survey: reliability of results from a multicenter ICU survey. Qual Saf Health Care 2005 Aug;14(4):273-8.

(29) Ashcroft DM, Morecroft C, Parker D, Noyce PR. Safety culture assessment in community pharmacy: development, face validity, and feasibility of the Manchester Patient Safety Assessment Framework. Qual Saf Health Care 2005 Dec;14(6):417-21.

(30) Hofmann DA, Mark B. An investigation of the relationship between safety climate and medication errors as well as other nurse and patient outcomes. Personnel Psychology 2006;59(4):847-69.

(31) Colla JB, Bracken AC, Kinney LM, Weeks WB. Measuring patient safety climate: a review of surveys. Qual Saf Health Care 2005 Oct;14(5):364-6.

(32) Flin R, Burns C, Mearns K, Yule S, Robertson EM. Measuring safety climate in health care. Qual Saf Health Care 2006 Apr;15(2):109-15.

(33) Millar J, Mattke S, et al. Selecting indicators for patient safety at the health systems level in OECD countries. http://www.oecd.org/dataoecd/53/26/33878001.pdf. OECD 18. 2004.

(34) Mattke S, Epstein AM, Leatherman S. The OECD Health Care Quality Indicators Project: history and background. Int J Qual Health Care 2006 Sep;18 Suppl 1:1-4.

(35) Leth RA, Moller JK. Trends in the prevalence of hospital-acquired infections and hospital use of antibiotics in the Aarhus county. Ugeskr Laeger 2006 Mar 13;168(11):1129-32.

(36) Leth RA, Moller JK. Surveillance of hospital-acquired infections based on electronic hospital registries. J Hosp Infect 2006 Jan;62(1):71-9.

(37) Iezzoni LI, Davis RB, Palmer RH, Cahalane M, Hamel MB, Mukamal K, et al. Does the Complications Screening Program flag cases with process of care problems? Using explicit criteria to judge processes. Int J Qual Health Care 1999 Apr;11(2):107-18.

(38) Naessens JM, Scott CG, Huschka TR, Schutt DC. Do complication screening programs detect complications present at admission? Jt Comm J Qual Saf 2004 Mar;30(3):133-42.

(39) McGreevey C, Nadzam D, Corbin L. The Joint Commission on Accreditation of Healthcare Organizations' Indicator Measurement System. Health care outcomes database. Comput Nurs 1997 Mar;15(2 Suppl):S87-S94.

(40) Pittet D, Hugonnet S, Harbarth S, Mourouga P, Sauvan V, Touveneau S, et al. Effectiveness of a hospital-wide programme to improve compliance with hand hygiene. Infection Control Programme. Lancet 2000 Oct 14;356(9238):1307-12.

(41) Boyce JM, Pittet D. Guideline for Hand Hygiene in Health-Care Settings: recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force. Infect Control Hosp Epidemiol 2002 Dec;23(12 Suppl):S3-40.

(42) Lucet JC, Rigaud MP, Mentre F, Kassis N, Deblangy C, Andremont A, et al. Hand contamination before and after different hand hygiene techniques: a randomized clinical trial. J Hosp Infect 2002 Apr;50(4):276-80.

(43) Struelens MJ, Wagner D, Bruce J, MacKenzie FM, Cookson BD, Voss A, et al. Status of infection control policies and organisation in European hospitals, 2001: the ARPAC study. Clin Microbiol Infect 2006 Aug;12(8):729-37.

(44) Trick WE, Vernon MO, Hayes RA, Nathan C, Rice TW, Peterson BJ, et al. Impact of ring wearing on hand contamination and comparison of hand hygiene agents in a hospital. Clin Infect Dis 2003 Jun 1;36(11):1383-90.

(45) Arrowsmith VA, Maunder JA, Sargent RJ, Taylor R. Removal of nail polish and finger rings to prevent surgical infection. Cochrane Database Syst Rev 2001;(4):CD003325.

(46) Murff HJ, Patel VL, Hripcsak G, Bates DW. Detecting adverse events for patient safety research: a review of current methodologies. J Biomed Inform 2003 Feb;36(1-2):131-43.

(47) Classen DC, Pestotnik SL, Evans RS, Burke JP. Computerized surveillance of adverse drug events in hospital patients. 1991. Qual Saf Health Care 2005 Jun;14(3):221-5.

(48) Classen DC, Metzger J. Improving medication safety: the measurement conundrum and where to start. Int J Qual Health Care 2003 Dec;15 Suppl 1:i41-i47.

(49) Miller MR, Clark JS, Lehmann CU. Computer based medication error reporting: insights and implications. Qual Saf Health Care 2006 Jun;15(3):208-13.

(50) Murff HJ, Forster AJ, Peterson JF, Fiskio JM, Heiman HL, Bates DW. Electronically screening discharge summaries for adverse medical events. J Am Med Inform Assoc 2003 Jul;10(4):339-50.

(51) Resar RK, Rozich JD, Classen D. Methodology and rationale for the measurement of harm with trigger tools. Qual Saf Health Care 2003 Dec;12 Suppl 2:ii39-ii45.

(52) Rozich JD, Haraden CR, Resar RK. Adverse drug event trigger tool: a practical methodology for measuring medication related harm. Qual Saf Health Care 2003 Jun;12(3):194-200.

(53) Kilbridge PM, Classen DC. Automated surveillance for adverse events in hospitalized patients: back to the future. Qual Saf Health Care 2006 Jun;15(3):148-9.

(54) Sharek PJ, Horbar JD, Mason W, Bisarya H, Thurm CW, Suresh G, et al. Adverse events in the neonatal intensive care unit: development, testing, and findings of an NICU-focused trigger tool to identify harm in North American NICUs. Pediatrics 2006 Oct;118(4):1332-40.

(55) Cohen MM, Kimmel NL, Benage MK, Cox MJ, Sanders N, Spence D, et al. Medication safety program reduces adverse drug events in a community hospital. Qual Saf Health Care 2005 Jun;14(3):169-74.

(56) Mainz J, Bartels PD, Laustsen S, Jorgensen T, Thulstrup AM, Linneberg AR, et al. The National Indicator Project for monitoring and improvement of professional performance within health care. Ugeskr Laeger 2001 Nov 12;163(46):6401-6.

(57) Mainz J, Krog BR, Bjornshave B, Bartels P. Nationwide continuous quality improvement using clinical indicators: the Danish National Indicator Project. Int J Qual Health Care 2004 Apr;16 Suppl 1:i45-i50.

(58) NIP. The Danish National Indicator Project. www.nip.dk. 2007.

(59) Bralet MC, Yon V, Loas G, Noisette C. [Cause of mortality in schizophrenic patients: prospective study of years of a cohort of 150 chronic schizophrenic patients]. Encephale 2000 Nov;26(6):32-41.

(60) Mortensen PB, Juel K. Mortality and causes of death in first admitted schizophrenic patients. Br J Psychiatry 1993 Aug;163:183-9.

(61) NIP. The Danish National Indicator Project, Dokumentalistrapport. www.nip.dk. 2005.

(62) National Board of Health D. National Danish Guidelines for Schizophrenia. http://www.sst.dk/publ/Publ2004/RefprogSkizo.pdf. 2004.

(63) Vingtoft S, Jensen LP, Madsen I, Nielsen PH, Kverneland A, Kjaergaard J. IT systems for clinical databases - status and perspectives. Ugeskr Laeger 2002 Sep 16;164(38):4398-405.