PSI 90 Fact Sheet

Agency for Healthcare Research and Quality (AHRQ) Quality Indicators (QIs) Fact Sheet:

Patient Safety and Adverse Events Composite (modified version PSI 90) for ICD-9 CM/PCS, v6.0 (FY2016)

1. What is the modified version of PSI 90 composite (NQF 0531)?

The Patient Safety and Adverse Events Composite, known as PSI 90, for the *International Classification of Diseases, 9th Revision, Clinical Modification* (ICD-9-CM Diagnosis and Procedure Codes) (fiscal year [FY] 2016, v6.0), is an updated and modified version of the Patient Safety Indicator for Selected Indicators Quality Indicator (QI) Composite (v5.0 and prior). Both versions of PSI 90 combine the smoothed (empirical Bayes shrinkage) indirectly standardized morbidity ratios (observed/expected ratios) from selected AHRQ Patient Safety Indicators (PSIs) to provide a composite using clinical judgment. The composite provides an overview of hospital-level quality as it relates to a set of potentially preventable hospital-related events associated with harmful outcomes for patients.

2. Is the new version National Quality Forum (NQF) endorsed?

Yes, the modified version of PSI 90 for ICD-9-CM Diagnosis and Procedure Codes (v6.0) underwent final endorsement at the NQF on December 10, 2015. It retains the NQF endorsed measure number 0531.

3. What changed in v6.0 (FY2016)?

There were a number of changes to PSI 90 for ICD-9-CM Diagnosis and Procedure Codes in v6.0, FY2016.

A. There was a name change.

The name was changed from “Patient Safety of Selected Indicators Composite” to “Patient Safety and Adverse Events Composite” to capture the concept of patient harm resulting from a patient safety event.

B. The number of component indicators increased from 8 to 10.

PSIs 09, 10, and 11 were added to better capture the range of PSI events. PSI 07 (Central Line Related Bloodstream Infection Rate) was removed as the alternative National Healthcare Safety Network measure titled "Central Line-Associated Bloodstream Infection" is used in several federal programs. This "modified version" of PSI 90 component indicator includes the following:

- PSI 03 Pressure Ulcer Rate
- PSI 06 Iatrogenic Pneumothorax Rate
- PSI 08 In-Hospital Fall With Hip Fracture Rate[1]
- PSI 09 Perioperative Hemorrhage or Hematoma Rate
- PSI 10 Postoperative Acute Kidney Injury Rate[2]
- PSI 11 Postoperative Respiratory Failure Rate
- PSI 12 Perioperative Pulmonary Embolism (PE) or Deep Vein Thrombosis (DVT) Rate
- PSI 13 Postoperative Sepsis Rate
- PSI 14 Postoperative Wound Dehiscence Rate
- PSI 15 Unrecognized Abdominopelvic Accidental Puncture/Laceration Rate[3]

C. Changes were made to PSI 08, PSI 12, and PSI 15.

- PSI 08 (In-Hospital Fall with Hip Fracture Rate) now targets all hip fractures from inpatient falls, not just those that occur postoperatively. Based on the updated specification, the name of the indicator was changed from "Postoperative Hip Fracture Rate" to "In-Hospital Fall with Hip Fracture."
- Two changes were made to PSI 12 (Perioperative Pulmonary Embolism [PE]) or Deep Vein Thrombosis [DVT] Rate). Isolated calf vein DVT was removed from the numerator specification and is no longer considered a PSI 12 event. Isolated calf vein DVT events are more likely to be detected during screening and are often clinically insignificant events. In addition, patients with any diagnosis of acute brain and/or spinal injury were removed from the denominator specification (target population) as PSI 12 events in this population may be less preventable due to safety concerns with pharmacological prophylaxis in the hyper-acute period.
- The specifications for PSI 15 (Unrecognized Abdominopelvic Accidental Puncture/Laceration Rate) were refined so that the indicator focuses on the most serious intraoperative injuries due to an accidental puncture or laceration. The denominator is now limited to abdominal and pelvic surgery. The numerator is limited to accidental punctures or lacerations that require a return to the operating room at least one day after the index procedure. Based on these new specifications, the indicator name has been changed

[1] Previously entitled "Postoperative Hip Fracture" prior to v6.0.
[2] Previously entitled "Postoperative Physiologic and Metabolic Derangement" prior to v5.0.
[3] Previously entitled "Accidental Puncture or Laceration Rate" prior to v6.0.

from "Accidental Puncture or Laceration Rate" to "Unrecognized Abdominopelvic Accidental Puncture/Laceration Rate."

D. The reference population was updated and only includes data with complete present on admission (POA) data.

The previous version of the software used 2010 data from the Healthcare Cost and Utilization Project (HCUP) from 42 states as the reference population. All data were used regardless of POA reporting. Missing POA information was imputed using the prediction module.

The modified version of PSI 90 (v6.0) uses 2013 HCUP data from 36 states and only includes states that provide POA information. This change reflects the extended period for POA to be operationalized across all community-based hospitals, given mandated POA reporting on Medicare inpatient claims from October 1, 2008 onward.

E. Component weighing now incorporates harm.

In previous versions of PSI 90 (v5.0 and prior), weighting of the individual component indicators was based on only *volume weights* (numerator weights), calculated on the number of safety-related events for the component indicators in the all-payer reference population.

In the modified version of PSI 90 (v6.0), weighting of the individual component indicators is based on two concepts: the volume of the adverse event and the harm associated with the adverse event.

- The volume weights were calculated based on the number of safety-related events for the component indicators in the all-payer reference population.
- The harm weights were calculated by multiplying empirical estimates of the probability of excess harms associated with each patient safety event by the corresponding utility weights (1–disutility). Disutility is the measure of the severity of the adverse events associated with each of the harms (i.e., outcome severity, or least preferred states from the patient perspective). These excess harm probabilities were estimated by comparing patients with a safety-related event to very similar, otherwise eligible patients without that safety-related event over up to one year after the discharge during which the index event happened. Linked claims data for two years of Medicare Fee for Service beneficiaries (2012–2013) were used for this analysis. To account for confounders in estimating the marginal impact of each PSI on the risk of excess harms, inverse probability propensity weighting with indicator- and harm-specific propensity models were calculated that included age, sex, racial/ethnic categories, Medicaid eligibility, point of origin, modified Medicare Severity–Diagnosis-Related Group categories,[4] Elixhauser comorbidities,[5] and co-occurring PSIs.

[4] See the *AHRQ Quality Indicator Empirical Methods* document at http://www.qualityindicators.ahrq.gov/Modules/Default.aspx

[5] http://www.hcup-us.ahrq.gov/toolssoftware/comorbidity/comorbidity.jsp

F. What are the harms weights and how were they developed?

Harms weights were developed specifically for the AHRQ QIs. Based on literature review and expert opinion from 13 clinical specialists in surgery, internal medicine, nephrology, trauma and emergency care, critical care, nursing, and home healthcare, 30 downstream harms associated with 10 PSIs were defined (see Appendix A). For some PSIs, harms were included for up to one year after the PSI event (such as mortality, skilled nursing facility days, and outpatient dialysis). An expert panel then ranked the harms. These rankings, along with information from relevant studies in the literature, were then used to assign disutilities, or a measure of the severity of the adverse effects, associated with each of the harms.

G. Components weights have changed and are more equally distributed among the component indicators.

The new weighting scheme, along with addition of indicators and the removal of PSI 07, more equally distributes the component weights compared to earlier versions (see Table 1). For example, PSI 12 and PSI 15 accounted for 77.7% of the total weight in v5.0 compared with 21.6% (combined weight in Table 1 of PSI 12 [0.208953] and PSI 15 [0.007011] = 0.215964 or 21.6%) in v6.0. Similarly, the weight of PSI 13 increased from 5.7% (v5.0) to 21.6% (v6.0) when the harm to the patient associated with postoperative sepsis is taken into account.

In summary, the new weighting approach improves the validity and reliability of the composite by accounting for both the frequency of harms associated with each patient safety event as well as the disutility (or severity) of those harms. The revised weighting approach offers a better measure of iatrogenic harms experienced by patients in U.S. hospitals, supporting performance comparisons based on hospitals' success at keeping patients safe from these harms.

Table 1. Summary of Component Weights in PSI 90, v5.0 and v6.0

PSI	Indicator	Component Weight PSI 90 (v5.0)	Component Weight Modified PSI 90 (v6.0)	Percentage Difference in Weights
PSI 03	Pressure Ulcer Rate	0.033006	0.059841	81.3%
PSI 06	Iatrogenic Pneumothorax Rate	0.075069	0.053497	-28.7%
PSI 07	Central Venous Catheter-Related Blood Stream Infection Rate	0.037684	--	N/A
PSI 08	In-Hospital Fall with Hip Fracture Rate	0.001796	0.010097	462.2%
PSI 09	Perioperative Hemorrhage and Hematoma Rate	--	0.085335	N/A
PSI 10	Postoperative Acute Kidney Injury Rate	--	0.041015	N/A

PSI	Indicator	Component Weight PSI 90 (v5.0)	Component Weight Modified PSI 90 (v6.0)	Percentage Difference in Weights
PSI 11	Postoperative Respiratory Failure Rate	--	0.304936	N/A
PSI 12	Perioperative Pulmonary Embolism and Deep Vein Thrombosis Rate	0.337900	0.208953	-38.2%
PSI 13	Postoperative Sepsis Rate	0.057308	0.216046	277.0%
PSI 14	Postoperative Wound Dehiscence Rate	0.018205	0.013269	-27.1%
PSI 15	Unrecognized Abdominopelvic Accidental Puncture/Laceration Rate	0.439030	0.007011	-98.4%

Note: Weights presented are based on data from the all-payer Healthcare Cost and Utilization Project (HCUP), 2013.
Ellipses indicate the indicator is not included in the composite; and thus has no weight assigned. N/A, Not Applicable.

4. Are hospital rankings likely to change as a result of the changes to the PSI 90 methodology?

Yes, the rankings of the hospitals may change when using the modified version of PSI 90. As noted above, additional adverse events are captured in the composite, a few of the adverse events are more narrowly defined in the modified version of PSI 90, and the component weights (which now incorporate a measure of volume and harms) have been updated.

5. When will the final weights and the software be available for the modified version of PSI 90?

The final weights and ICD-9-CM Diagnosis and Procedure Codes v6.0 software with modified PSI 90 technical specifications and component indicators will be available in summer 2016. When available, AHRQ will send an announcement via the AHRQ QI electronic mailing list and will post an announcement on the AHRQ QI website (www.qualityindicators.ahrq.gov).

Appendix A: Description of patient harms captured in the AHRQ Patient Safety and Adverse Events Composite (modified version of PSI 90)

Outcome	Description of events captured	Applicable Patient Safety Indicator (PSI)
Pressure ulcer treatment	Debridement of a pressure ulcer and/or surgical skin flap procedure during the hospitalization when the pressure ulcer developed, due to tissue damage.	PSI 03
180-day hospital readmission for a pressure ulcer related complication	Readmission to an acute care hospital within 30 to 180 days of discharge after a PSI 03 event for any of the following conditions that were present on admission (POA): recurrent pressure ulcer, cellulitis, pyoderma, infection, bacteremia, sepsis, acute or chronic osteomyelitis, septic arthritis, necrotizing fasciitis, gangrene, or flap failure.	PSI 03
30-day all-cause mortality	Death due to any cause within 30-days of the discharge after a PSI triggering event.	PSI 06, PSI 08, PSI 09, PSI 15
30-day all-cause readmission	Readmission to an acute care hospital within 30 days of the discharge after a PSI triggering event (excluding any readmissions categorized separately below).	All
180-day all-cause mortality	Death due to any cause within 30 to 180-days of the discharge after the PSI triggering event.	PSI 03, PSI 10, PSI 11, PSI 12, PSI 13, PSI 14
90-day non-surgical hip fracture complication	Hospital readmission within 30 to 90-days of the discharge after a PSI 08 event for a mechanical or infectious hip fracture complication not requiring surgery.	PSI 08
Hip reoperation within 90 days	Hospital readmission for reoperation on the hip within 90-days of the discharge after a PSI 08 event.	PSI 08
Avascular necrosis	Admission to the hospital within 30 to 365 days of the discharge after a PSI 08 event with aseptic or avascular necrosis.	PSI 08
Anoxic brain damage or shock	Development of brain (cerebral) anoxia and or shock associated with a hemorrhage or hematoma event.	PSI 09
Acute renal failure requiring dialysis	Development of acute kidney injury/failure (stage V) requiring dialysis while hospitalized after a PSI triggering event.	PSI 09, PSI 13
Dialysis post-discharge for up to 6-months	Ongoing need for dialysis for up to 6-months after discharge following a PSI event.	PSI 10
One-year all-cause hospital readmission	All cause hospital readmission within 30 to 365-days of the discharge after a PSI 10 triggering event.	PSI 10
Tracheostomy	Received a tracheostomy due to extended need for mechanical ventilation and/or a complication from intubation.	PSI 11
6-month hospital readmission for a	Hospital readmission within 30 to 180 days of the discharge due to a bleeding complication related to anticoagulation.	PSI 12

bleeding complication		
Emergency department visits within 180-days for a thrombotic complication	Emergency department visits related to a thrombotic event such as pulmonary embolus, deep vein thrombosis, or postphlebitic syndrome within 180-days of discharge after a PSI 12 event.	PSI 12
180-day hospital readmission for an enterocutaneous fistula	Readmitted to an acute care hospital for intra-abdominal abscess or enterocutaneous fistula within 30 to 180-days of the discharge after a PSI 14 event.	PSI 14
180-day hospital readmission for an incisional hernia	Readmitted to an acute care hospital (including observational stays) for incisional hernia or reclosure of postoperative disruption of the abdominal wall within 30 to 180-days of the discharge after a PSI 14 event.	PSI 14
180-day hospital readmission for an intra-abdominal abscess or enterocutaneous fistula	Development of an intra-abdominal abscess or enterocutaneous fistula up to 30 to 180 days of discharge after a PSI 15 event.	PSI 15
Excess hospital days	Excess hospital length of stay (in days) associated with a PSI event.	All
Long-term skilled nursing facility stay	Long-term skilled nursing facility stays that are greater than or equal to 26 consecutive days in a skilled nursing facility or long-term care facility.	All
Short-term skilled nursing home days	The cumulative number of short-term skilled nursing facility days within 365-days of a PSI event.	All