NATIONAL QUALITY FORUM

Measure Information

This document contains the information submitted by measure developers/stewards, but is organized according to NQF's measure evaluation criteria and process. The item numbers refer to those in the submission form but may be in a slightly different order here. In general, the item numbers also reference the related criteria (e.g., item 1b.1 relates to sub criterion 1b).

Brief Measure Information

NQF #: 0531
Corresponding Measures:
De.2. **Measure Title:** Patient Safety Indicator (PSI) 90: Patient Safety and Adverse Events Composite
Co.1.1. **Measure Steward:** Centers for Medicare & Medicaid Services
De.3. **Brief Description of Measure:** The PSI 90 composite measure summarizes patient safety across multiple indicators for the CMS Medicare fee-for-service population.
1b.1. **Developer Rationale:** Not applicable (composite measure)

S.4. **Numerator Statement:** PSI 03: Discharges, among cases meeting the inclusion and exclusion rules for the denominator, with any secondary ICD-10-CM diagnosis codes for pressure ulcer stage III or IV (or unstageable).

PSI 06: Discharges, among cases meeting the inclusion and exclusion rules for the denominator, with any secondary ICD-10-CM diagnosis codes for iatrogenic pneumothorax.

PSI 08: Discharges, among cases meeting the inclusion and exclusion rules for the denominator, with any secondary ICD-10-CM diagnosis codes for hip fracture.

PSI 09: Discharges, among cases meeting the inclusion and exclusion rules for the denominator, with: any secondary ICD-10-CM diagnosis codes for perioperative hemorrhage or hematoma and any-listed ICD-10-CM procedure codes for treatment of hemorrhage or hematoma (Note: The ICD-10-CM specification is limited to postoperative hemorrhage or hematoma).

PSI 10: Discharges, among cases meeting the inclusion and exclusion rules for the denominator, with any secondary ICD-10-CM diagnosis codes for acute renal failure and any-listed ICD-10-CM procedure codes for dialysis.

PSI 11: Discharges, among cases meeting the inclusion and exclusion rules for the denominator, with either: any secondary ICD-10-CM diagnosis code for acute respiratory failure; or any-listed ICD-10-CM procedure codes for a mechanical ventilation for 96 consecutive hours or more that occurs zero or more days after the first major operating room procedure code (based on days from admission to procedure); or any-listed ICD-10-CM procedure codes for a mechanical ventilation for less than 96 consecutive hours (or undetermined) that occurs two or more days after the first major operating room procedure code (based on days from admission to procedure); or any-listed ICD-10-CM procedure codes for a reintubation that occurs one or more days after the first major operating room procedure code (based on days from admission to procedure).

PSI 12: Discharges, among cases meeting the inclusion and exclusion rules for the denominator, with a secondary ICD-10-CM diagnosis code for proximal deep vein thrombosis or a secondary ICD-10-CM diagnosis code for pulmonary embolism.

PSI 13: Discharges, among cases meeting the inclusion and exclusion rules for the denominator, with any secondary ICD-10-CM diagnosis codes for sepsis.

PSI 14: Discharges, among cases meeting the inclusion and exclusion rules for the denominator, with any-listed ICD-10-PCS procedure codes for repair of the abdominal wall and any-listed ICD-10-CM diagnosis code for disruption of internal surgical wound

PSI 15: Discharges, among cases meeting the inclusion and exclusion rules for the denominator, with any secondary ICD-10-CM

diagnosis codes for accidental puncture or laceration during a procedure and second abdominopelvic operation >=1 day after an index abdominopelvic operation.

S.6. **Denominator Statement:** PSI 03: Surgical or medical discharges, for patients ages 18 years and older. Surgical and medical discharges are defined by specific MS-DRG codes.

PSI 06: Surgical and medical discharges, for patients ages 18 years and older. Surgical and medical discharges are defined by specific MS-DRG codes.

PSI 08: Discharges, for patients ages 18 years and older, in a medical DRG or in a surgical DRG, with any listed ICD-10-PCS procedure codes for an operating room procedure.

PSI 09: Surgical discharges, for patients ages 18 years and older, with any-listed ICD-10-PCS procedure codes for an operating room procedure. Surgical discharges are defined by specific MS-DRG codes.

PSI 10: Elective surgical discharges, for patients ages 18 years and older, with any-listed ICD-10-PCS procedure codes for an operating room procedure. Elective surgical discharges are defined by specific MS-DRG codes with admission type recorded as elective.

PSI 11: Elective surgical discharges, for patients ages 18 years and older, with any-listed ICD-10-PCS procedure codes for an operating room procedure. Elective surgical discharges are defined by specific MS-DRG codes with admission type recorded as elective.

PSI 12: Surgical discharges, for patients ages 18 years and older, with any-listed ICD-10-PCS procedure codes for an operating room procedure. Surgical discharges are defined by specific MS-DRG codes.

PSI 13: Elective surgical discharges, for patients ages 18 years and older, with any-listed ICD-10-PCS procedure codes for an operating room procedure. Elective surgical discharges are defined by specific MS-DRG codes with admission type recorded as elective.

PSI 14: Discharges, for patients ages 18 years and older, with any-listed ICD-10-CM procedure codes for abdominopelvic surgery, open approach, or with any-listed ICD-10-PCS procedure codes for abdominopelvic surgery, other than open approach.

PSI 15: Surgical and medical discharges, for patients ages 18 years and older, with any ICD-10-PCS procedure code for an abdominopelvic procedure

S.8. **Denominator Exclusions:** PSI 03:
-Length of stay of less than 3 days
-Principal ICD-10-CM diagnosis code for pressure ulcer stage III or IV (or unstageable)
- All secondary ICD-10-CM diagnosis codes for pressure ulcer III or IV (or unstageable) present on admission. If more than one diagnosis of pressure ulcer is present, all diagnoses must be present on admission for the discharge to be excluded
-Any listed ICD-10-CM diagnosis code for severe burns (>20% body surface area)
-Any listed ICD-10-CM diagnosis code for exfoliative disorders of the skin (>20% body surface area)
-MDC 14 (pregnancy, childbirth, and puerperium)
-Missing gender (SEX=missing), age (AGE=missing), quarter (DQTR=missing), year (YEAR=missing), or principal diagnosis (DX1=missing)

PSI 06:
- Principal ICD-10-CM diagnosis code for iatrogenic pneumothorax
-Any secondary ICD-10-CM diagnosis code for iatrogenic pneumothorax present on admission, among patients qualifying for the numerator
-Any listed ICD-10-CM diagnosis codes for specified chest trauma (rib fractures, traumatic pneumothorax and related chest wall injuries)
-Any listed ICD-10-CM diagnosis codes for pleural effusion
-Any listed ICD-10-PCS procedure codes for thoracic surgery
-Any listed ICD-10-CM procedure codes for cardiac procedure;
-MDC 14 (pregnancy, childbirth, and puerperium)

-Missing gender (SEX=missing), age (AGE=missing), quarter (DQTR=missing), year (YEAR=missing), or principal diagnosis (DX1=missing)

PSI 08:
- Principal ICD-10-CM diagnosis code for hip fracture
-Any secondary ICD-10-CM diagnosis code for hip fracture present on admission, among patients otherwise qualifying for the numerator
- Principal ICD-10-CM diagnosis code for seizure
- Principal ICD-10-CM diagnosis code for syncope
- Principal ICD-10-CM diagnosis code for stroke and occlusion of arteries
- Principal ICD-10-CM diagnosis code for coma
- Principal ICD-10-CM diagnosis code for cardiac arrest
- Principal ICD-10-CM diagnosis code for poisoning
- Principal ICD-10-CM diagnosis code for trauma
- Principal ICD-10-CM diagnosis code for delirium and other psychoses
- Principal ICD-10-CM diagnosis code for anoxic brain injury
-Any listed ICD-10-CM diagnosis codes for metastatic cancer
-Any listed ICD-10-CM diagnosis codes for lymphoid malignancy
-Any listed ICD-10-CM diagnosis codes for bone malignancy
-MDC 14 (pregnancy, childbirth, and puerperium)
-Missing gender (SEX=missing), age (AGE=missing), quarter (DQTR=missing), year (YEAR=missing), or principal diagnosis (DX1=missing)

PSI 09:
-Principal ICD-10-CMS diagnosis code for perioperative hemorrhage or postoperative hematoma
-Any secondary ICD-10-CM diagnosis present on admission for perioperative hemorrhage or postoperative hematoma, among discharges that otherwise qualify for the numerator
-The only operating room procedure is for treatment of perioperative hemorrhage, or hematoma and with any secondary ICD-10-CM diagnosis codes for perioperative hemorrhage or hematoma
-Treatment of postoperative hemorrhage or hematoma occurs one day or more before the first operating room procedure, and with any secondary ICD-10-CM diagnosis codes for postoperative hemorrhage or hematoma
-With any listed ICD-10-CM diagnosis codes for coagulation disorders
-MDC 14 (pregnancy, childbirth, and puerperium)
-Missing gender (SEX=missing), age (AGE=missing), quarter (DQTR=missing), year (YEAR=missing), or principal diagnosis (DX1=missing)

PSI 10:
-Principal ICD-10-CM diagnosis code for acute renal failure, cardiac arrest, cardiac dysrhythmia, shock or chronic kidney failure
-Any secondary ICD-10-CM diagnosis code for acute kidney failure, cardiac arrest, cardiac dysrhythmia, shock or chronic kidney failure, present on admission, among patients otherwise qualifying for the numerator
-Any dialysis procedure that occurs before or on the same day as the first operating room procedure
-Any dialysis access procedure occurring before or on the same day as the first operating room procedure
-Principal ICD-10-CM (or secondary diagnosis present on admission) for urinary tract obstruction
-Any ICD-10-CM diagnosis code present on admission for solitary kidney disease and any ICD-10-PCS procedure code for partial nephrectomy
-MDC 14 (pregnancy, childbirth, and puerperium)
-Missing gender (SEX=missing), age (AGE=missing), quarter (DQTR=missing), year (YEAR=missing), or principal diagnosis (DX1=missing)

PSI 11:
-Principal ICD-10-CM diagnosis code for acute respiratory failure
-Any secondary ICD-10-CM diagnosis code for respiratory failure present on admission, among patients otherwise qualifying for the numerator
-Only operating room procedure is tracheostomy
-Procedure for tracheostomy occurs before the first operating room procedure

-Any listed ICD-10-CM diagnosis codes for neuromuscular disorder
-Any listed ICD-10-PCS procedure codes for laryngeal or pharyngeal, nose, mouth pharynx or facial surgery
- Any listed ICD-10-CM procedure codes for esophageal resection
- Any listed ICD-10-CM procedure codes for lung cancer
- Any listed ICD-10-CM diagnosis codes for degenerative neurological disorder
- Any listed ICD-10-CM procedure codes for lung transplant
-MDC 4 (diseases/disorders of respiratory system);
-MDC 5 (diseases/disorders of circulatory system);
-MDC 14 (pregnancy, childbirth, and puerperium)
-Missing gender (SEX=missing), age (AGE=missing), quarter (DQTR=missing), year (YEAR=missing), or principal diagnosis (DX1=missing)

PSI 12:
-Principal ICD-10-CM diagnosis code for proximal deep vein thrombosis (DVT) or pulmonary embolism (PE),
-Any secondary ICD-10-CM diagnosis code for DVT or PE present on admission, among patients otherwise qualifying for the numerator
-Procedure for interruption of vena cava occurs before or on the same day as the first operating room procedure
-Only operating room procedure was interruption of vena cava
-Any listed ICD-10-CM diagnosis code for acute brain or spinal injury present on admission
-Any listed ICD-10-PCS procedure code for extracorporeal membrane oxygenation (ECMO)
-Procedure for pulmonary arterial thrombectomy occurs before or on the same day as the first operating room procedure
-Only operating room procedure was for pulmonary arterial thrombectomy
-MDC 14 (pregnancy, childbirth, and puerperium)
-Missing gender (SEX=missing), age (AGE=missing), quarter (DQTR=missing), year (YEAR=missing), or principal diagnosis (DX1=missing)

PSI 13:
-Principal ICD-10-CM diagnosis code for sepsis or infection
-Any secondary ICD-10-CM diagnosis code for sepsis or infection present on admission, among patients otherwise qualifying for the numerator
-MDC 14 (pregnancy, childbirth, and puerperium)
-Missing gender (SEX=missing), age (AGE=missing), quarter (DQTR=missing), year (YEAR=missing), or principal diagnosis (DX1=missing)

PSI 14:
-Procedure for abdominal wall reclosure occurs on or before the day of the first open abdominopelvic surgery procedure, if any, and the day of the first laparoscopic abdominopelvic surgery procedure, if any
-Any listed ICD-10-CM diagnosis codes or any-listed ICD-10-PCS procedure codes for immunocompromised state
-Principal ICD-10-CM diagnosis code for disruption of internal operation wound
-Any secondary ICD-10-CM diagnosis code for disruption of internal operation wound present on admission
-Length of stay less than two (2) days-MDC 14 (pregnancy, childbirth, and puerperium)
-Missing gender (SEX=missing), age (AGE=missing), quarter (DQTR=missing), year (YEAR=missing), or principal diagnosis (DX1=missing)

PSI 15:
-Principal ICD-10-CM diagnosis code for accidental puncture or lacerations during a procedure
-Any secondary ICD-10-CM diagnosis code for accidental puncture or laceration during a procedure, among patients otherwise qualifying for the numerator
-MDC 14 (pregnancy, childbirth, and puerperium)
-Missing gender (SEX=missing), age (AGE=missing), quarter (DQTR=missing), year (YEAR=missing), or principal diagnosis (DX1=missing)

De.1. **Measure Type:** Composite
S.17. **Data Source:** Claims
S.20. **Level of Analysis:** Facility

IF Endorsement Maintenance – Original Endorsement Date: Jun 19, 2009 **Most Recent Endorsement Date:** Dec 10, 2015

IF this measure is included in a composite, NQF Composite#/title:

IF this measure is paired/grouped, NQF#/title:

De.4. **IF PAIRED/GROUPED, what is the reason this measure must be reported with other measures to appropriately interpret results?** Not applicable.

1. Evidence, Performance Gap, Priority – Importance to Measure and Report

Extent to which the specific measure focus is evidence-based, important to making significant gains in healthcare quality, and improving health outcomes for a specific high-priority (high-impact) aspect of healthcare where there is variation in or overall less-than-optimal performance. ***Measures must be judged to meet all sub criteria to pass this criterion and be evaluated against the remaining criteria.***

1a. Evidence to Support the Measure Focus – See attached Evidence Submission Form
PSI_90_NQF_Evidence_Attachment_Master-637395159640759611.docx
1a.1 For Maintenance of Endorsement: Is there new evidence about the measure since the last update/submission?
Do not remove any existing information. If there have been any changes to evidence, the Committee will consider the new evidence. Please use the most current version of the evidence attachment (v7.1). Please use red font to indicate updated evidence.
Yes

1b. Performance Gap

Demonstration of quality problems and opportunity for improvement, i.e., data demonstrating:

- considerable variation, or overall less-than-optimal performance, in the quality of care across providers; and/or
- Disparities in care across population groups.

1b.1. **Briefly explain the rationale for this measure** *(e.g., how the measure will improve the quality of care, the benefits or improvements in quality envisioned by use of this measure)*
If a COMPOSITE (e.g., combination of component measure scores, all-or-none, any-or-none), SKIP this question and answer the composite questions.
Not applicable (composite measure)

1b.2. **Provide performance scores on the measure as specified (current and over time) at the specified level of analysis**. *(This is required for maintenance of endorsement. Include mean, std dev, min, max, interquartile range, scores by decile. Describe the data source including number of measured entities; number of patients; dates of data; if a sample, characteristics of the entities include.) This information also will be used to address the sub-criterion on improvement (4b1) under Usability and Use.*
Table 1. Medicare Fee-for-Service Reference Population Rate and Distribution of Hospital Performance on PSI 90 (Patient Safety Composite)

Year	N	Mean	SD	min	p10	p25	Med	p75	p90	max
2016-2017	3212	0.995	0.174	0.567	0.842	0.906	0.970	1.036	1.181	5.326
2017-2018	3212	0.994	0.166	0.530	0.845	0.907	0.970	1.029	1.178	3.791
2018-2019	3212	0.996	0.161	0.629	0.849	0.913	0.971	1.032	1.174	2.588

Source: Medicare FFS discharges from IPPS hospitals (7/1/2016-6/30/2019) processed with CMS v10.0 software.
Abbreviations: SD=standard deviation; p=percentile

Table 2. Distribution of Hospital Performance on PSI 90 Specific Indicators

	2017	2017	2018	2018	2019	2019
Component	N	Mean	N	Mean	N	Mean
PSI 03	3207	0.593	3208	0.618	3208	0.580
PSI 06	3211	0.257	3211	0.243	3210	0.221
PSI 08	3209	0.108	3209	0.106	3207	0.100
PSI 09	3086	2.408	3083	2.532	3075	2.481
PSI 10	2970	1.323	2981	1.368	2960	1.337
PSI 11	2961	6.801	2973	5.755	2950	4.876

PSI 12	3086	3.784	3083	3.670	3077	3.572
PSI 13	2964	4.702	2966	4.743	2943	4.491
PSI 14	3036	0.977	3035	0.865	3021	0.879
PSI 15	3112	1.273	3104	1.226	3086	1.180

1b.3. If no or limited performance data on the measure as specified is reported in 1b2, then provide a summary of data from the literature that indicates opportunity for improvement or overall less than optimal performance on the specific focus of measurement.

1b.4. Provide disparities data from the measure as specified (current and over time) by population group, e.g., by race/ethnicity, gender, age, insurance status, socioeconomic status, and/or disability. *(This is required for maintenance of endorsement. Describe the data source including number of measured entities; number of patients; dates of data; if a sample, characteristics of the entities included.) For measures that show high levels of performance, i.e., "topped out", disparities data may demonstrate an opportunity for improvement/gap in care for certain sub-populations. This information also will be used to address the sub-criterion on improvement (4b1) under Usability and Use.*

For PSI 90, multiple denominator populations are aggregated into a composite score at the facility level. Since the composite score is not estimated at the patient level or the population group level, disparities at these levels cannot be calculated.

To satisfy the NQF requirement, we are reporting our analysis of population group disparities for the individual component measures in PSI 90. These analyses were performed by applying the CMS PSI v10.0 software to the most recent full year of Medicare FFS claims data for the reference population for that software version (7/1/2017-6/30/2018). PSI 90 Component Indicator Rate Disparities for 9,619,208 hospital discharges from 3,254 measured entities are presented in Evidence Attachment Tables 3-12. We explore disparities by sex, age group, and race/ethnicity (see Evidence Attachment Tables 3-12). Age group disparities should be interpreted cautiously because Medicare FFS beneficiaries under 65 years of age are more likely to be disabled, and less likely to be healthy, than the general US population of similar age. We also used same-month Medicaid eligibility status, identified in the Medicare Beneficiary Summary File, as a proxy for socioeconomic status, in accord with recommendations from NQF and the Assistant Secretary for Planning and Evaluation (ASPE).

In summary, disparities exist for the PSI 90 component measures, but there is no consistent pattern across these components. This finding is not surprising as the PSI 90 component measures focus on hospital-acquired complications of care. For example, men have at least 20% higher observed rates than women for PSI 03 (Pressure Ulcer), PSI 09 (Postoperative Hemorrhage or Hematoma), PSI 10 (Postoperative Acute Kidney Injury Requiring Dialysis), PSI 11 (Postoperative Respiratory Failure), PSI 13 (Postoperative Sepsis), and PSI 14 (Postoperative Wound Dehiscence). Men have at least 20% lower observed rates than women for PSI 06 (Iatrogenic Pneumothorax), PSI 08 (In-hospital Fall with Hip Fracture), and PSI 15 (Unrecognized Accidental Puncture or Laceration). All of the PSI risk-adjustment models include sex, age groups, and sex-age interactions. Therefore, the observed disparities across age and sex categories greatly diminish or disappear after risk-adjustment, as intended.

Across racial-ethnic categories, the Medicare FFS data show at least 25% higher adjusted rates among Black patients, relative to White patients, for only three PSIs: PSI 03 (Pressure Injury), PSI 12 (Perioperative Deep Vein Thrombosis or Pulmonary Embolism), and PSI 15 (Unrecognized Accidental Puncture or Laceration). Comparing Hispanic patients with White patients, Hispanics had at least 20% higher adjusted PSI rates only for PSI 14 (Postoperative Wound Dehiscence) and PSI 15 (Unrecognized Accidental Puncture or Laceration). For all other PSI 90 component measures, Black and Hispanic patients had lower or similar adjusted rates, when compared with White patients.

1b.5. If no or limited data on disparities from the measure as specified is reported in 1b.4, then provide a summary of data from the literature that addresses disparities in care on the specific focus of measurement. Include citations. Not necessary if performance data provided in 1b.4

Not applicable, see above.

1c. Composite Quality Construct and Rationale

1c.1. A composite performance measure is a combination of two or more component measures, each of which individually reflects quality of care, into a single performance measure with a single score.

For purposes of NQF measure submission, evaluation, and endorsement, the following will be considered composites:

- Measures with two or more individual performance measure scores combined into one score for an accountable entity.
- Measures with two or more individual component measures assessed separately for each patient and then aggregated into one score for an accountable entity:
    - all-or-none measures (e.g., all essential care processes received, or outcomes experienced, by each patient);

1c.1. Please identify the composite measure construction: two or more individual performance measure scores combined into one score

1c.2. **Describe the quality construct, including:**

- the overall area of quality
- included component measures and
- the relationship of the component measures to the overall composite and to each other.

CMS Patient Safety Indicator (PSI) 90, also known as the Patient Safety and Adverse Events Composite, combines information about 10 common patient safety events that may occur in hospitalized patients. It was created to provide a simple and transparent single metric that can be used to better understand, communicate, and track patient safety in U.S. hospitals. The underlying concept, as described by the Institute of Medicine, is that safety is "freedom from accidental injury"(1) and that safe care "involves making evidence-based clinical decisions to maximize the health outcomes of an individual and to minimize the potential for harm"(2). This concept is closely linked to CMS's priority to implement quality initiative assuring quality healthcare for Medicare Beneficiaries using tools to achieve effective, safe, efficient, patient-centered, equitable, and timely care. Section 3008 of the Affordable Care Act established the Hospital-Acquired Condition (HAC) Reduction Program to encourage hospitals to reduce HACs. Beginning with Fiscal Year (FY) 2015 discharges (i.e. October 1, 2014), the HAC Reduction Program requires the Secretary of Health and Human Services (HHS) to adjust payments. As set forth in the Affordable Care Act, CMS may reduce payments for the worst-performing 25 percent of hospitals by up to one percent, and publicly report hospitals' measure scores, domain scores, and HAC Reduction Program data.

CMS PSI 90 combines the smoothed indirectly standardized morbidity ratios (observed/expected ratio) from 10 component indicators: PSI 03 Pressure Ulcer, PSI 06 Iatrogenic Pneumothorax, PSI 08 In-Hospital Fall with Hip Fracture, PSI 09 Postoperative Hemorrhage or Hematoma, PSI 10 Postoperative Acute Kidney Injury Requiring Dialysis, PSI 11 Postoperative Respiratory Failure, PSI 12 Perioperative Pulmonary Embolism or Deep Vein Thrombosis, PSI 13 Postoperative Sepsis Rate, PSI 14 Postoperative Wound Dehiscence, and PSI 15 Unrecognized Abdominopelvic Accidental Puncture or Laceration Rate.

From a conceptual perspective, the CMS PSI 90 composite should reflect the likelihood of harm associated with a wide range of potentially preventable adverse events. Within this conceptualization, each PSI is an individual predictor of an important and relevant aspect of harm. Thus, the likelihood of harm is expressed as the probability of a potentially preventable adverse event (such as postoperative sepsis) times the average net severity of harm associated with that event. In this conceptualization, CMS PSI 90 is modeled as a heterogeneous, formative index, meaning that the composite is "formed from" a set of measured components, each of which reflects different but overlapping aspects of care. The use of administrative data provides an inexpensive and fairly comprehensive approach to measuring a wide range of elements of the construct of harm while each component indicator contributes a unique aspect of harm.
The final weight for each component measure is the product of harm weights and volume weights (numerator weights). Harm weights are calculated by multiplying empirical estimates of probability of excess harms associated with the patient safety event by the corresponding utility weights linked to each of the harms (1-disutility). Disutility is the measure of the severity of the adverse events associated with each of the harms (ie., outcome severity, or at least preferred states from the patient perspective). The harm weights are calculated using linked claims data for two years of Medicare Fee for Service beneficiaries. Volume weights, the second part of the final weight, are calculated based on the number of safety-related events for the component indicators in the fee-for-service reference population.

For more information, see https://www.qualitynet.org/inpatient/measures/psi/resources.

1. Kohn LT, Corrigan JM, Donaldson MS, eds., Institute of Medicine. To err is human: Building a safer health system. Washington, DC: National Academies Press, 1999.
2. Aspden P, Corrigan JM, Wolcott J, Erickson SM, eds., Institute of Medicine. Patient safety: achieving a new standard for care. Washington, DC: National Academies Press; 2004.

1c.3. **Describe the rationale for constructing a composite measure, including how the composite provides a distinctive or additive value over the component measures individually.**

The CMS PSI 90 composite measure was developed to summarize patient safety across multiple indicators to monitor performance over time or across regions and populations using a methodology that can be applied at the national, regional, State and provider level. Practically, a composite was constructed to increase statistical precision due to an increase in the effective sample size and to address the issue of competing priorities where more than one component measure may be important; and to assist consumers in selecting hospitals, providers in allocating resources to reduce patient safety events, and payers in assessing performance.

1c.4. **Describe how the aggregation and weighting of the component measures are consistent with the stated quality construct and rationale.**
The CMS PSI 90 composite is conceptualized as a formative composite, meaning that the indicator is formed from a set of component indicators, and in this case, these indicators assess different harms and aspects of patient safety.

Formative composites require deliberate selection of weights that best support the decision-making purpose of the composite. Composite measures typically provide a more valid signal if more "important" components are weighted more heavily than less "important" components. A variety of weighting methods exist. Previously, the CMS PSI 90 composite weighted each component according to the number of “opportunities” to provide the optimal process of care or experience the optimal outcome (based on the concept that relatively rare events become more important to the extent that more patients are at risk of experiencing them).

The CMS PSI 90 composite reflects the “redesigned” PSI 90 that was submitted to and endorsed by NQF in 2015, in direct response to feedback from the NQF Patient Safety Standing Committee, NQF members, and many other stakeholders. The measure reflects an approach which is based on (1) soliciting patients’ or clinicians’ judgments about the relative importance of each component (based on the concept that some events are more important, from the clinical or public health perspective, than others of equal frequency) and (2) using more complex statistical and empirical methods to estimate the relative importance of each component (based on the concept that relative importance can be estimated from a causal model in which adverse events are a final common pathway leading to death, prolonged hospital stay, or other undesirable outcomes). The CMS PSI 90 composite retains the “formative” construct, with weighting based on empirical estimates of importance (versus a “reflective” construct based on an underlying unobserved construct of patient safety). The formative construct approach was deemed preferable during the redesign because (1) it is historically consistent with how the PSIs were developed and how PSI 90 was conceived; (2) it retains the conceptual advantages of a single composite, whereas applying item response theory might require division into multiple composites; and (3) it is driven by stronger theory; i.e., decision-making by providers, consumers, and other stakeholders should be driven by the objective of reducing net harm and increasing utility.

The goals of this formative composite is to assess and improve safety (freedom from harm) for a population that may be at risk for a variety of different adverse events, each of which may have different causes and potential mechanisms. The composite must balance the competing risks of these different events, based (in the case of PSI 90) on the perspective of patients’ experience of inpatient care. Thus, the composite is designed in a manner that not only enhances reliability, but also reflects competing importance for specific cohorts.

2. Reliability and Validity—Scientific Acceptability of Measure Properties

Extent to which the measure, as specified, produces consistent (reliable) and credible (valid) results about the quality of care when implemented. ***Measures must be judged to meet the sub criteria for both reliability and validity to pass this criterion and be evaluated against the remaining criteria.***

2a.1. Specifications The measure is well defined and precisely specified so it can be implemented consistently within and across organizations and allows for comparability. eMeasures should be specified in the Health Quality Measures Format (HQMF) and the Quality Data Model (QDM).

De.5. **Subject/Topic Area** *(check all the areas that apply):*
Critical Care, Gastrointestinal (GI), Renal, Respiratory, Surgery, Surgery : Cardiac Surgery, Surgery : General Surgery, Surgery : Perioperative and Anesthesia, Surgery : Thoracic Surgery, Surgery : Vascular Surgery

De.6. **Non-Condition Specific***(check all the areas that apply):*
Safety, Safety : Complications, Safety : Healthcare Associated Infections

De.7. **Target Population Category** *(Check all the populations for which the measure is specified and tested if any):*

Populations at Risk

S.1. **Measure-specific Web Page** *(Provide a URL link to a web page specific for this measure that contains current detailed specifications including code lists, risk model details, and supplemental materials. Do not enter a URL linking to a home page or to general information.)*
https://www.qualitynet.org/inpatient/measures/psi/resources

S.2a. **If this is an eMeasure**, HQMF specifications must be attached. Attach the zipped output from the eMeasure authoring tool (MAT) - if the MAT was not used, contact staff. (Use the specification fields in this online form for the plain-language description of the specifications)
This is not an eMeasure **Attachment:**

S.2b. **Data Dictionary, Code Table, or Value Sets** *(and risk model codes and coefficients when applicable) must be attached. (Excel or csv file in the suggested format preferred - if not, contact staff)*
Attachment **Attachment:** PSI_90_v10.xlsx

S.2c. Is this an instrument-based measure (i.e., data collected via instruments, surveys, tools, questionnaires, scales, etc.)? Attach copy of instrument if available.
No, this is not an instrument-based measure **Attachment:**

S.2d. Is this an instrument-based measure (i.e., data collected via instruments, surveys, tools, questionnaires, scales, etc.)? Attach copy of instrument if available.
Not an instrument-based measure

S.3.1. **For maintenance of endorsement:** Are there changes to the specifications since the last updates/submission. If yes, update the specifications for S1-2 and S4-22 and explain reasons for the changes in S3.2.
Yes

S.3.2. **For maintenance of endorsement,** please briefly describe any important changes to the measure specifications since last measure update and explain the reasons.
Since the last NQF measure update in October 2018 (which referenced AHRQ v6.0 [2017]), all CMS v10.0 component measure specifications are now using ICD-10-CM diagnosis codes and/or ICD-10-PCS procedure codes. State-of-the-art conversion processes were used to convert CMS PSI 90 and its component measures from ICD-9-CMS to ICD-10-CMS/PCS (1, 2). Other changes to the component measures are based on user comments and suggestions, as well as periodic literature scans by the CMS and AHRQ. These changes are as follows:

PSI 03 (Pressure Ulcer):
-Restricted denominator exclusion to qualifying discharges with a principal diagnosis code for pressure ulcer stage III or IV (or unstageable) instead of excluding discharges with a principal diagnosis code of pressure ulcer (any stage). A change in ICD-9-CM coding guidance established that "If a patient is admitted to an inpatient hospital with a pressure ulcer at one stage and it progresses to a higher stage, two separate codes should be assigned: one code for the site and stage of the ulcer on admission and a second code for the same ulcer site and the highest stage reported during the stay." This change allows PSI 03 to capture pressure injuries that are documented as stage 1 or 2 at admission (present on admission, or POA) but progress to stage 3 or 4 after admission.
-Removed denominator exclusions for the following procedures and conditions in ICD-10: pedicle graft procedures, hemiplegia or similar plegias, spina bifida or anoxic encephalopathy, and major skin disorders. Before POA reporting was required, these conditions and procedures potentially associated with pressure ulcers were assumed to indicate that the pressure injury was POA. Therefore, exclusions for these conditions and procedures served as a means of removing events that might not be attributable to hospitals. However, now that POA status is required, these exclusions are redundant and lead to undercounting of hospital-acquired pressure ulcers.
-Removed denominator exclusion for patients admitted from acute hospitals or SNFs/ICFs. Before POA reporting was required, these conditions and procedures potentially associated with pressure ulcers were assumed to indicate that the pressure injury was POA. Therefore, exclusions for these conditions and procedures served as a means of removing events that might not be attributable to hospitals. However, now that POA status is required, these exclusions are redundant and lead to undercounting of hospital-acquired pressure ulcers.

-Added denominator exclusions for diagnosis codes for severe burns (>20% body surface area, BSA) and exfoliative disorders of the skin (>20% BSA). Patients with severe burns are at an increased risk for skin breakdown and already receive intensive skin care as a result of their burn-related injury. Despite best efforts, progression to stage III or IV pressure ulcers may be largely unpreventable, which is inconsistent with the intent of PSI 03 to capture preventable hospital-acquired pressure ulcers. The same logic applies to exfoliative disorders involving large areas of skin surface, such as Stevens-Johnson Syndrome.

PSI 06 (Iatrogenic Pneumothorax)
-No material changes

PSI 08 (In Hospital Fall with Hip Fracture)
-Revised denominator statement to include medical DRGs (in addition to surgical DRGs). The complication can occur in both medical and surgical patients. Previously medical patients were excluded due to concerns of capturing fractures present on admission, but present on admission data allows for dropping this criterion.
-Removed denominator exclusion where the first or only operating room procedure is hip fracture repair. With the inclusion of "present on admission" criteria it is no longer necessary to focus on surgical patients to avoid false positives. PSI 08 now includes patients whose only operating room procedure was a hip fracture repair.
-Removed denominator exclusion for with diagnosis codes for self-inflicted injury. Exclusion of self-inflicted injuries was removed because self-inflicted harm could be better addressed with risk-adjustment rather than exclusion. Hospitals should be expected to make efforts to prevent patient self-inflicted harm. Self-inflicted harm is extremely unlikely to result in a hip fracture.
-Removed denominator exclusion for MDC 8 (diseases and disorders of the musculoskeletal system and connective tissue). When the denominator was expanded to medical and surgical patients, this exclusion had the unintended effect of removing patients who were admitted for a medical condition assigned to MDC 08, fell, and sustained a hip fracture. Hospitals may be expected to prevent falls with hip fracture in these patients.

PSI 09 (Perioperative Hemorrhage or Hematoma Rate)
-Removed denominator exclusion for patients in whom the only operating room procedure is a procedure potentially related to treatment of perioperative hemorrhage or hematoma, unless there is any secondary ICD-10-CM diagnosis code for perioperative hemorrhage or hematoma. This change was necessitated by the fact that ICD-10-PCS procedure codes do not incorporate any diagnostic information; therefore, the same procedure may be performed to drain an abscess or a hematoma. The PSI software was rewritten to narrow the exclusion to patients who had (for example) a drainage or extirpation procedure for hemorrhage or hematoma, with no other major operations.
-Added denominator exclusion for diagnosis codes for coagulation disorders. Antineoplastic chemotherapy induced pancytopenia and other disorders impacting coagulation were added to the definition of platelet disorders for the purpose of excluding patients in the ICD-10 version of PSI 09. As an antiplatelet disorder, patients with antineoplastic chemotherapy induced pancytopenia have a higher risk for a PSI 09 event and should consequently be excluded from the measure. Other disorders can decrease coagulation.

PSI 10 (Postoperative Acute Kidney Injury Requiring Dialysis Rate)
-Added denominator exclusion for diagnosis code present on admission for solitary kidney disease and any procedure code for partial nephrectomy. In the setting of a solitary kidney, partial nephrectomy is expected to lead to significant compromise of renal function, potentially requiring temporary or permanent renal replacement therapy.

PSI 11 (Postoperative Respiratory Failure)
-Revised numerator statement to include only secondary procedure codes for reintubation or mechanical ventilation (not principal procedure codes) occurring one or more days after the first major operating room procedure code. The principal procedure is defined as the procedure most closely related to the principal diagnosis; the target population for PSI 11 consists of patients who are not in respiratory failure at admission (and therefore would not have a principal procedure of intubation or mechanical ventilation).
-Revised denominator exclusion to include any procedure codes for facial surgery, not limited to those including a diagnosis code for craniofacial anomalies. These ICD-10 denominator exclusions were restricted to those that involve an inherent risk of airway compromise, with input from a general surgeon and an otolaryngologist. More specific procedure codes in ICD-10-PCS permit a more tailored denominator exclusion based on the procedures that involve airway compromise requiring extended intubation.

PSI 12 (Perioperative Pulmonary Embolism or Deep Vein Thrombosis)
-Revised numerator statement to limit to proximal deep vein thrombosis. This change was based on emerging evidence of “overdiagnosis” of distal vein thrombosis. Users raised concerns about the impact of inter-hospital variation in postoperative

surveillance and diagnostic testing on the rate of PSI 12; this variation was linked to the observation that major teaching hospitals often have higher PSI 12 rates than minor teaching and non-teaching hospitals. Routine use of ultrasound for postoperative surveillance is not an evidence-based practice, and is not endorsed in clinical practice guidelines (e.g., American College of Chest Physicians). It appears that many of the distal thromboses discovered through routine surveillance would never have caused symptoms, although they do require observation due to the risk of embolization.
-Revised denominator exclusion to exclude cases with a principal diagnosis code (or secondary diagnosis code present on admission) for proximal deep vein thrombosis. This change was linked to the preceding change; all PSI specifications exclude patients admitted with the complication in question.
-Revised denominator exclusion for cases where the only operating room procedure was interruption of vena cava. This change modified the previous exclusion so that cases are excluded only if they are the only operating room procedure, instead of the principal procedure. The principal procedure is defined as the procedure most closely related to the principal diagnosis, which is not relevant to the intent of this exclusion.
-Added denominator exclusion for cases where a procedure for pulmonary arterial thrombectomy occurs before or on the same day as the first operating room procedure or as the only operating room procedure. Pulmonary arterial thrombectomy procedures should not qualify a patient as a surgical patient if no other OR procedures were performed prior to the thrombectomy, because the thrombectomy was presumably performed to treat a pulmonary embolism. Therefore, failure to exclude thrombectomy procedures from the denominator may lead to false positives for PSI 12 events. (Such an exclusion could not be implemented in ICD-9 due to lack of specific codes for pulmonary arterial thrombectomy.)

PSI 13 (Sepsis)
No material changes

PSI 14 (Postoperative Wound Dehiscence Rate)
-Revised numerator statement to include cases involving both procedure codes for repair of the abdominal wall and diagnosis codes for disruption of internal surgical wound. This change was necessitated by the conversion from ICD-9-CM to ICD-10-CM/PCS; the latter code set has no specific procedure codes for reclosure of a postoperative disruption of the abdominal wall. This concept can only be captured using a combination of diagnosis codes (for surgical wound disruption) and procedure codes (for repair of the abdominal wall).
-Revised denominator exclusion to exclude cases where the procedure for abdominal wall closure occurs on or before the day of the first open or laparoscopic abdominopelvic surgery procedure. This type of denominator exclusion applies across all surgical PSIs, to ensure that the index procedure actually preceded the PSI-triggering reparative procedure.

PSI 15 (Unrecognized Abdominopelvic Accidental Puncture or Laceration Rate)
No material changes

(1) Agency for Healthcare Research and Quality. AHRQ ICD-10-CM/PCS Conversion Project. November 15, 2013. Available at: https://www.qualityindicators.ahrq.gov/Downloads/Resources/Publications/2013/C.14.10.D001_REVISED.pdf. Accessed June 22, 2020.
(2) Utter GH, Cox GL, Atolagbe OO, et al. Conversion of the Agency for Healthcare Research and Quality's Quality Indicators from ICD-9-CM to ICD-10-CM/PCS: The Processes, Results, and Implications for Users. Health Services Research;53(5). https://doi.org/10.1111/1475-6773.12981

For further details regarding the original conceptual framework underlying CMS Medicare PSI 90, and the methods used for utility assessment and harm weighting, please refer to the supplemental materials submitted by AHRQ as part of the last cycle of NQF review at https://www.qualityforum.org/QPS/0531.

S.4. Numerator Statement *(Brief, narrative description of the measure focus or what is being measured about the target population, i.e., cases from the target population with the target process, condition, event, or outcome) DO NOT include the rationale for the measure.*
IF an OUTCOME MEASURE, state the outcome being measured. Calculation of the risk-adjusted outcome should be described in the calculation algorithm (S.14).
PSI 03: Discharges, among cases meeting the inclusion and exclusion rules for the denominator, with any secondary ICD-10-CM diagnosis codes for pressure ulcer stage III or IV (or unstageable).

PSI 06: Discharges, among cases meeting the inclusion and exclusion rules for the denominator, with any secondary ICD-10-CM

diagnosis codes for iatrogenic pneumothorax.

PSI 08: Discharges, among cases meeting the inclusion and exclusion rules for the denominator, with any secondary ICD-10-CM diagnosis codes for hip fracture.

PSI 09: Discharges, among cases meeting the inclusion and exclusion rules for the denominator, with: any secondary ICD-10-CM diagnosis codes for perioperative hemorrhage or hematoma and any-listed ICD-10-CM procedure codes for treatment of hemorrhage or hematoma (Note: The ICD-10-CM specification is limited to postoperative hemorrhage or hematoma).

PSI 10: Discharges, among cases meeting the inclusion and exclusion rules for the denominator, with any secondary ICD-10-CM diagnosis codes for acute renal failure and any-listed ICD-10-CM procedure codes for dialysis.

PSI 11: Discharges, among cases meeting the inclusion and exclusion rules for the denominator, with either: any secondary ICD-10-CM diagnosis code for acute respiratory failure; or any-listed ICD-10-CM procedure codes for a mechanical ventilation for 96 consecutive hours or more that occurs zero or more days after the first major operating room procedure code (based on days from admission to procedure); or any-listed ICD-10-CM procedure codes for a mechanical ventilation for less than 96 consecutive hours (or undetermined) that occurs two or more days after the first major operating room procedure code (based on days from admission to procedure); or any-listed ICD-10-CM procedure codes for a reintubation that occurs one or more days after the first major operating room procedure code (based on days from admission to procedure).

PSI 12: Discharges, among cases meeting the inclusion and exclusion rules for the denominator, with a secondary ICD-10-CM diagnosis code for proximal deep vein thrombosis or a secondary ICD-10-CM diagnosis code for pulmonary embolism.

PSI 13: Discharges, among cases meeting the inclusion and exclusion rules for the denominator, with any secondary ICD-10-CM diagnosis codes for sepsis.

PSI 14: Discharges, among cases meeting the inclusion and exclusion rules for the denominator, with any-listed ICD-10-PCS procedure codes for repair of the abdominal wall and any-listed ICD-10-CM diagnosis code for disruption of internal surgical wound

PSI 15: Discharges, among cases meeting the inclusion and exclusion rules for the denominator, with any secondary ICD-10-CM diagnosis codes for accidental puncture or laceration during a procedure and second abdominopelvic operation >=1 day after an index abdominopelvic operation.

S.5. **Numerator Details** *(All information required to identify and calculate the cases from the target population with the target process, condition, event, or outcome such as definitions, time period for data collection, specific data collection items/responses, code/value sets – Note: lists of individual codes with descriptors that exceed 1 page should be provided in an Excel or csv file in required format at S.2b)*
IF an OUTCOME MEASURE, describe how the observed outcome is identified/counted. Calculation of the risk-adjusted outcome should be described in the calculation algorithm (S.14).
See attached technical specifications for complete list of numerator details, which are also available at:
https://www.qualitynet.org/inpatient/measures/psi/resources and
https://www.qualitynet.org/files/5ebeeee9641cb00023dd1f96?filename=2019_PSI_TechSpecs_Excel.zip

S.6. **Denominator Statement** *(Brief, narrative description of the target population being measured)*
PSI 03: Surgical or medical discharges, for patients ages 18 years and older. Surgical and medical discharges are defined by specific MS-DRG codes.

PSI 06: Surgical and medical discharges, for patients ages 18 years and older. Surgical and medical discharges are defined by specific MS-DRG codes.

PSI 08: Discharges, for patients ages 18 years and older, in a medical DRG or in a surgical DRG, with any listed ICD-10-PCS procedure codes for an operating room procedure.

PSI 09: Surgical discharges, for patients ages 18 years and older, with any-listed ICD-10-PCS procedure codes for an operating room

procedure. Surgical discharges are defined by specific MS-DRG codes.

PSI 10: Elective surgical discharges, for patients ages 18 years and older, with any-listed ICD-10-PCS procedure codes for an operating room procedure. Elective surgical discharges are defined by specific MS-DRG codes with admission type recorded as elective.

PSI 11: Elective surgical discharges, for patients ages 18 years and older, with any-listed ICD-10-PCS procedure codes for an operating room procedure. Elective surgical discharges are defined by specific MS-DRG codes with admission type recorded as elective.

PSI 12: Surgical discharges, for patients ages 18 years and older, with any-listed ICD-10-PCS procedure codes for an operating room procedure. Surgical discharges are defined by specific MS-DRG codes.

PSI 13: Elective surgical discharges, for patients ages 18 years and older, with any-listed ICD-10-PCS procedure codes for an operating room procedure. Elective surgical discharges are defined by specific MS-DRG codes with admission type recorded as elective.

PSI 14: Discharges, for patients ages 18 years and older, with any-listed ICD-10-CM procedure codes for abdominopelvic surgery, open approach, or with any-listed ICD-10-PCS procedure codes for abdominopelvic surgery, other than open approach.

PSI 15: Surgical and medical discharges, for patients ages 18 years and older, with any ICD-10-PCS procedure code for an abdominopelvic procedure

S.7. **Denominator Details** *(All information required to identify and calculate the target population/denominator such as definitions, time period for data collection, specific data collection items/responses, code/value sets – Note: lists of individual codes with descriptors that exceed 1 page should be provided in an Excel or csv file in required format at S.2b.)*
IF an OUTCOME MEASURE, describe how the target population is identified. Calculation of the risk-adjusted outcome should be described in the calculation algorithm (S.14).
The attached technical specifications and appendices include a complete list of denominator codes and details, which are also available at: https://www.qualitynet.org/files/5ebeeee9641cb00023dd1f96?filename=2019_PSI_TechSpecs_Excel.zip

PSI 03: See PSI Appendix B - Medical Discharge MS-DRGs and Appendix C - Surgical Discharge MS-DRGs for the full list of codes
PSI 06: See PSI Appendix C - Surgical Discharge MS-DRGs for the full list of codes
PSI 08: See PSI Appendix A - Operating Room Procedure Codes, Appendix B - Medical Discharge MS-DRGs and Appendix C - Surgical Discharge MS-DRGs for the full list of codes, and Appendix E - excluded Trauma Diagnosis Codes
PSI 09: See PSI Appendix A - Operating Room Procedure Codes and Appendix C - Surgical Discharge MS-DRGs for the full list of codes
PSI 10: See PSI Appendix A - Operating Room Procedure Codes and Appendix C - Surgical Discharge MS-DRGs for the full list of codes
PSI 11: See PSI Appendix A - Operating Room Procedure Codes and Appendix C - Surgical Discharge MS-DRGs for the full list of codes
PSI 12: See PSI Appendix A - Operating Room Procedure Codes and Appendix C - Surgical Discharge MS-DRGs for the full list of codes
PSI 13: See PSI Appendix A - Operating Room Procedure Codes and Appendix C - Surgical Discharge MS-DRGs for the full list of codes
PSI 14: see attached technical specifications for the full list of codes
PSI 15: see attached technical specifications plus Appendix B - Medical Discharge MS-DRGs and Appendix C - Surgical Discharge MS-DRGs for the full list of codes

S.8. **Denominator Exclusions** *(Brief narrative description of exclusions from the target population)*
PSI 03:
-Length of stay of less than 3 days
-Principal ICD-10-CM diagnosis code for pressure ulcer stage III or IV (or unstageable)
- All secondary ICD-10-CM diagnosis codes for pressure ulcer III or IV (or unstageable) present on admission. If more than one diagnosis of pressure ulcer is present, all diagnoses must be present on admission for the discharge to be excluded
-Any listed ICD-10-CM diagnosis code for severe burns (>20% body surface area)
-Any listed ICD-10-CM diagnosis code for exfoliative disorders of the skin (>20% body surface area)
-MDC 14 (pregnancy, childbirth, and puerperium)
-Missing gender (SEX=missing), age (AGE=missing), quarter (DQTR=missing), year (YEAR=missing), or principal diagnosis (DX1=missing)

PSI 06:
- Principal ICD-10-CM diagnosis code for iatrogenic pneumothorax
-Any secondary ICD-10-CM diagnosis code for iatrogenic pneumothorax present on admission, among patients qualifying for the numerator
-Any listed ICD-10-CM diagnosis codes for specified chest trauma (rib fractures, traumatic pneumothorax and related chest wall injuries)
-Any listed ICD-10-CM diagnosis codes for pleural effusion
-Any listed ICD-10-PCS procedure codes for thoracic surgery
-Any listed ICD-10-CM procedure codes for cardiac procedure;
-MDC 14 (pregnancy, childbirth, and puerperium)
-Missing gender (SEX=missing), age (AGE=missing), quarter (DQTR=missing), year (YEAR=missing), or principal diagnosis (DX1=missing)

PSI 08:
- Principal ICD-10-CM diagnosis code for hip fracture
-Any secondary ICD-10-CM diagnosis code for hip fracture present on admission, among patients otherwise qualifying for the numerator
- Principal ICD-10-CM diagnosis code for seizure
- Principal ICD-10-CM diagnosis code for syncope
- Principal ICD-10-CM diagnosis code for stroke and occlusion of arteries
- Principal ICD-10-CM diagnosis code for coma
- Principal ICD-10-CM diagnosis code for cardiac arrest
- Principal ICD-10-CM diagnosis code for poisoning
- Principal ICD-10-CM diagnosis code for trauma
- Principal ICD-10-CM diagnosis code for delirium and other psychoses
- Principal ICD-10-CM diagnosis code for anoxic brain injury
-Any listed ICD-10-CM diagnosis codes for metastatic cancer
-Any listed ICD-10-CM diagnosis codes for lymphoid malignancy
-Any listed ICD-10-CM diagnosis codes for bone malignancy
-MDC 14 (pregnancy, childbirth, and puerperium)
-Missing gender (SEX=missing), age (AGE=missing), quarter (DQTR=missing), year (YEAR=missing), or principal diagnosis (DX1=missing)

PSI 09:
-Principal ICD-10-CMS diagnosis code for perioperative hemorrhage or postoperative hematoma
-Any secondary ICD-10-CM diagnosis present on admission for perioperative hemorrhage or postoperative hematoma, among discharges that otherwise qualify for the numerator
-The only operating room procedure is for treatment of perioperative hemorrhage, or hematoma and with any secondary ICD-10-CM diagnosis codes for perioperative hemorrhage or hematoma
-Treatment of postoperative hemorrhage or hematoma occurs one day or more before the first operating room procedure, and with any secondary ICD-10-CM diagnosis codes for postoperative hemorrhage or hematoma
-With any listed ICD-10-CM diagnosis codes for coagulation disorders
-MDC 14 (pregnancy, childbirth, and puerperium)
-Missing gender (SEX=missing), age (AGE=missing), quarter (DQTR=missing), year (YEAR=missing), or principal diagnosis (DX1=missing)

PSI 10:
-Principal ICD-10-CM diagnosis code for acute renal failure, cardiac arrest, cardiac dysrhythmia, shock or chronic kidney failure
-Any secondary ICD-10-CM diagnosis code for acute kidney failure, cardiac arrest, cardiac dysrhythmia, shock or chronic kidney failure, present on admission, among patients otherwise qualifying for the numerator
-Any dialysis procedure that occurs before or on the same day as the first operating room procedure
-Any dialysis access procedure occurring before or on the same day as the first operating room procedure
-Principal ICD-10-CM (or secondary diagnosis present on admission) for urinary tract obstruction
-Any ICD-10-CM diagnosis code present on admission for solitary kidney disease and any ICD-10-PCS procedure code for partial

nephrectomy
-MDC 14 (pregnancy, childbirth, and puerperium)
-Missing gender (SEX=missing), age (AGE=missing), quarter (DQTR=missing), year (YEAR=missing), or principal diagnosis (DX1=missing)

PSI 11:
-Principal ICD-10-CM diagnosis code for acute respiratory failure
-Any secondary ICD-10-CM diagnosis code for respiratory failure present on admission, among patients otherwise qualifying for the numerator
-Only operating room procedure is tracheostomy
-Procedure for tracheostomy occurs before the first operating room procedure
-Any listed ICD-10-CM diagnosis codes for neuromuscular disorder
-Any listed ICD-10-PCS procedure codes for laryngeal or pharyngeal, nose, mouth pharynx or facial surgery
- Any listed ICD-10-CM procedure codes for esophageal resection
- Any listed ICD-10-CM procedure codes for lung cancer
- Any listed ICD-10-CM diagnosis codes for degenerative neurological disorder
- Any listed ICD-10-CM procedure codes for lung transplant
-MDC 4 (diseases/disorders of respiratory system);
-MDC 5 (diseases/disorders of circulatory system);
-MDC 14 (pregnancy, childbirth, and puerperium)
-Missing gender (SEX=missing), age (AGE=missing), quarter (DQTR=missing), year (YEAR=missing), or principal diagnosis (DX1=missing)

PSI 12:
-Principal ICD-10-CM diagnosis code for proximal deep vein thrombosis (DVT) or pulmonary embolism (PE),
-Any secondary ICD-10-CM diagnosis code for DVT or PE present on admission, among patients otherwise qualifying for the numerator
-Procedure for interruption of vena cava occurs before or on the same day as the first operating room procedure
-Only operating room procedure was interruption of vena cava
-Any listed ICD-10-CM diagnosis code for acute brain or spinal injury present on admission
-Any listed ICD-10-PCS procedure code for extracorporeal membrane oxygenation (ECMO)
-Procedure for pulmonary arterial thrombectomy occurs before or on the same day as the first operating room procedure
-Only operating room procedure was for pulmonary arterial thrombectomy
-MDC 14 (pregnancy, childbirth, and puerperium)
-Missing gender (SEX=missing), age (AGE=missing), quarter (DQTR=missing), year (YEAR=missing), or principal diagnosis (DX1=missing)

PSI 13:
-Principal ICD-10-CM diagnosis code for sepsis or infection
-Any secondary ICD-10-CM diagnosis code for sepsis or infection present on admission, among patients otherwise qualifying for the numerator
-MDC 14 (pregnancy, childbirth, and puerperium)
-Missing gender (SEX=missing), age (AGE=missing), quarter (DQTR=missing), year (YEAR=missing), or principal diagnosis (DX1=missing)

PSI 14:
-Procedure for abdominal wall reclosure occurs on or before the day of the first open abdominopelvic surgery procedure, if any, and the day of the first laparoscopic abdominopelvic surgery procedure, if any
-Any listed ICD-10-CM diagnosis codes or any-listed ICD-10-PCS procedure codes for immunocompromised state
-Principal ICD-10-CM diagnosis code for disruption of internal operation wound
-Any secondary ICD-10-CM diagnosis code for disruption of internal operation wound present on admission
-Length of stay less than two (2) days-MDC 14 (pregnancy, childbirth, and puerperium)
-Missing gender (SEX=missing), age (AGE=missing), quarter (DQTR=missing), year (YEAR=missing), or principal diagnosis (DX1=missing)

PSI 15:
-Principal ICD-10-CM diagnosis code for accidental puncture or lacerations during a procedure
-Any secondary ICD-10-CM diagnosis code for accidental puncture or laceration during a procedure, among patients otherwise qualifying for the numerator
-MDC 14 (pregnancy, childbirth, and puerperium)
-Missing gender (SEX=missing), age (AGE=missing), quarter (DQTR=missing), year (YEAR=missing), or principal diagnosis (DX1=missing)

S.9. **Denominator Exclusion Details** *(All information required to identify and calculate exclusions from the denominator such as definitions, time period for data collection, specific data collection items/responses, code/value sets – Note: lists of individual codes with descriptors that exceed 1 page should be provided in an Excel or csv file in required format at S.2b.)*
PSI 03: For a complete list of excluded codes, see attached technical specifications
PSI 06: For a complete list of excluded codes, see attached technical specifications
PSI 08: For a complete list of excluded codes, see attached technical specifications
PSI 09: For a complete list of excluded codes, see attached technical specifications
PSI 10: For a complete list of excluded codes, see attached technical specifications
PSI 11: For a complete list of excluded codes, see attached technical specifications
PSI 12: For a complete list of excluded codes, see attached technical specifications
PSI 13: For a complete list of excluded codes, see attached technical specifications and PSI Appendix D – Infection Diagnosis Codes
PSI 14: For a complete list of excluded codes, see attached technical specifications and PSI Appendix F – Immunocompromised State Diagnosis and Procedure Codes
PSI 15: For a complete list of excluded codes, see attached technical specifications

Excluded codes for all components are also available at: https://www.qualitynet.org/inpatient/measures/psi/resources and https://www.qualitynet.org/files/5ebeeee9641cb00023dd1f96?filename=2019_PSI_TechSpecs_Excel.zip

S.10. **Stratification Information** *(Provide all information required to stratify the measure results, if necessary, including the stratification variables, definitions, specific data collection items/responses, code/value sets, and the risk-model covariates and coefficients for the clinically-adjusted version of the measure when appropriate – Note: lists of individual codes with descriptors that exceed 1 page should be provided in an Excel or csv file in required format with at S.2b.)*
Not applicable.

S.11. **Risk Adjustment Type** (Select type. Provide specifications for risk stratification in measure testing attachment)
Statistical risk model
If other:

S.12. **Type of score:**
Other (specify):
If other: Observed to expected ratio (component measures); Weighted average of the smoothed (empirical Bayes shrinkage) risk standardized observed to expected ratios (composite)

S.13. **Interpretation of Score** *(Classifies interpretation of score according to whether better quality is associated with a higher score, a lower score, a score falling within a defined interval, or a passing score)*
Better quality = Lower score

S.14. **Calculation Algorithm/Measure Logic** (*Diagram or describe the calculation of the measure score as an ordered sequence of steps including identifying the target population; exclusions; cases meeting the target process, condition, event, or outcome; time period for data, aggregating data; risk adjustment; etc.)*
For each component: The observed rate is the number of discharge records where the patient experienced the adverse event divided by the number of discharge records at risk for the event. The expected rate is a comparative rate that incorporates information about a reference population that is not part of the user's input dataset – what rate would be observed if the expected level of care observed in the reference population and estimated with risk adjustment regression models, were applied to the mix of patients with demographic and comorbidity distributions observed in the user's dataset? The expected rate is calculated only for risk-adjusted indicators.

The expected rate is estimated for each person using a generalized estimating equations (GEE) approach to account for correlation

at the hospital or provider level.

The risk-adjusted rate is a comparative rate that also incorporates information about a reference population that is not part of the input dataset – what rate would be observed if the level of care observed in the user's dataset were applied to a mix of patients with demographics and comorbidities distributed like the reference population? The risk adjusted rate is calculated using the indirect method as observed rate divided by expected rate multiplied by the reference population rate. The smoothed rate is the weighted average of the risk-adjusted rate from the user's input dataset and the rate observed in the reference population; the smoothed rate is calculated with a shrinkage estimator to result in a rate near that from the user's dataset if the provider's rate is estimated in a stable fashion with minimal noise, or to result in a rate near that of the reference population if the variance of the estimated rate from the input dataset is large compared with the hospital-to-hospital variance estimated from the reference population. Thus, the smoothed rate is a weighted average of the risk-adjusted rate and the reference population rate, where the weight is the signal-to-noise ratio. In practice, the smoothed rate brings rates toward the mean, and tends to do this more so for outliers (such as rural hospitals)

The composite measure is a weighted average of the smoothed (empirical Bayes shrinkage) indirectly standardized morbidity ratios (observed to expected ratios) of the component indicators. The final weight for each component 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 fee-for-service 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 1 year after the discharge during which the index event happened. Linked claims data for 2 years of Medicare Fee for Service beneficiaries (2016 - 2018) 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, Elixhauser comorbidities, and co-occurring PSIs.

CMS PSI 90 results center on 1.0 to improve interpretability. This means that the CMS PSI 90 composite value of the entire population of the input data equals 1.0. Hospital-level CMS PSI 90 results can be compared with 1.0. Adjusting for case mix, a CMS PSI 90 composite value less than 1.0 indicates a value better than the average of the reference population; likewise, a CMS PSI 90 composite value greater than 1.0 indicates a value worse than the average of the reference population.

S.15. **Sampling** *(If measure is based on a sample, provide instructions for obtaining the sample and guidance on minimum sample size.)*
IF an instrument-based performance measure (e.g., PRO-PM), identify whether (and how) proxy responses are allowed.
Not applicable.

S.16. **Survey/Patient-reported data** *(If measure is based on a survey or instrument, provide instructions for data collection and guidance on minimum response rate.)*
Specify calculation of response rates to be reported with performance measure results.
Not applicable.

S.17. **Data Source** *(Check ONLY the sources for which the measure is SPECIFIED AND TESTED).*
If other, please describe in S.18.
Claims

S.18. **Data Source or Collection Instrument** *(Identify the specific data source/data collection instrument (e.g. name of database, clinical registry, collection instrument, etc., and describe how data are collected.)*
IF instrument-based, identify the specific instrument(s) and standard methods, modes, and languages of administration.
While the measure is tested and specified using fee-for-service data from the Centers for Medicare and Medicaid Services (CMS) (see section 1.1 and 1.2 of the measure testing form), the measure specifications and software are specified to be used with any ICD-10-CM-coded administrative billing/claims/discharge dataset with Present on Admission (POA) information.

S.19. Data Source or Collection Instrument *(available at measure-specific Web page URL identified in S.1 OR in attached appendix at A.1)*
No data collection instrument provided

S.20. Level of Analysis *(Check ONLY the levels of analysis for which the measure is SPECIFIED AND TESTED)*
Facility

S.21. Care Setting *(Check ONLY the settings for which the measure is SPECIFIED AND TESTED)*
Inpatient/Hospital
If other:

S.22. COMPOSITE Performance Measure - Additional Specifications *(Use this section as needed for aggregation and weighting rules, or calculation of individual performance measures if not individually endorsed.)*
CMS PSI 90 was developed to provide a simple and transparent single metric that can be used to better understand, communicate and track patient safety in US hospitals. The indicator is comprised of eleven component PSIs which are calculated using readily available, routinely collected administrative data. The composite is conceptualized as a formative composite, meaning that the indicator is formed from a set of component indicators that assess different harms and aspects of patient safety.

CMS PSI 90 is a combination of the reliability-adjusted (smoothed), risk-standardized observed-to-expected ratio for each composite. CMS PSI 90 weights reflect a potential harm-based approach and are based on three components 1) excess harm associated with the PSI, 2) the estimated preferences for health states reflected by these harms and 3) the volume of the PSI complication. Below we describe the methods used to quantify each portion of the harm based weights and the calculation method for the weights.

The excess harms for each component PSI were estimated using the CMS Inpatient and Outpatient Standard Analytic File (SAF) and the Denominator file. Potential harms, such as mortality, readmissions and additional treatments, were identified by a team of physicians and nurses for each PSI using literature review, environmental scan and clinical judgement. These harms were specified using variables available in the CMS dataset.

We estimated the average excess number of harmful outcomes associated with the occurrence of the PSI event using a separate cohort sample for each component indicator based on the patient records of patients qualifying for that PSI denominator. Index events included observations with the PSI, and the comparison group was those without the PSI. To account for potential confounding between the risk factors for developing a PSI and the risk factors for developing the harms independent of the PSI, we utilized propensity weighting using the risk models for each PSI. We used an inverse probability of treatment weighting approach to estimate the average treatment effect on the treated (ATT) or those with the PSI event. We followed patients for up to 1 year. Separate regression models were fit for each harm outcome. Linear probability models were used for binary outcomes (e.g. mortality, readmission) and a linear model was used to model length of stay.

To assign a relative value for decrements to the quality of life for each PSI event and its sequelae, we adopted the utility scale. A health utility refers to an individual's preference for a specific health state on a scale of 0 to 1, where 0 is equivalent to death and 1 denotes perfect health. These utility values weight different health states according to their relative valuation. They are widely used in health economic analysis (e.g., calculation of quality-of life years saved by a treatment) because they represent stable and assessable population values.

Because adequate utility values were not available in the literature for each health state and because our primary goal was to understand the relative disutility of each harm, we utilized a two-pronged approach in which we elicited relative rankings of each harm from clinicians and then fitted these rankings to known literature-based disutilities. The advantage of the utility approach is that it adopts a commonly used scale from 0-1 that can be converted to a harm scale (1-utility) to weight the relative quality-of-life effect on patients of a diverse set of PSI-related harms. Insignificant events to a patient are not given any weight since there is no disutility. Finally, average utility values represent a relative preference for one health state versus another at a group level, the appropriate analytic level for a quality indicator composite. Relative rankings of utilities are robust at the population level, regardless of utility assessment method chosen.

For each component indicator in the CMS PSI 90 composite, two sets of values need to be computed or estimated in order to calculate the final weights. The first is the excess risk of the outcomes (risk difference) that may occur in association with the

indicator patient safety event. The second is the set of numerator weights, which are calculated from the volume (count) of component events in the CMS fee-for-service (FFS)reference population. Please see the testing attachment for additional details on the calculation of final weights including a formula for that calculation.

2. Validity – See attached Measure Testing Submission Form
PSI90-Composite-Testing-Attachment-508-FINAL.docx

2.1 For maintenance of endorsement
Reliability testing: If testing of reliability of the measure score was not presented in prior submission(s), has reliability testing of the measure score been conducted? If yes, please provide results in the Testing attachment. Please use the most current version of the testing attachment (v7.1). Include information on all testing conducted (prior testing as well as any new testing); use red font to indicate updated testing.
Yes

2.2 For maintenance of endorsement
Has additional empirical validity testing of the measure score been conducted? If yes, please provide results in the Testing attachment. Please use the most current version of the testing attachment (v7.1). Include information on all testing conducted (prior testing as well as any new testing); use red font to indicate updated testing.
Yes

2.3 For maintenance of endorsement
Risk adjustment: For outcome, resource use, cost, and some process measures, risk-adjustment that includes social risk factors is not prohibited at present. Please update sections 1.8, 2a2, 2b1,2b4.3 and 2b5 in the Testing attachment and S.140 and S.11 in the online submission form. NOTE: These sections must be updated even if social risk factors are not included in the risk-adjustment strategy. You MUST use the most current version of the Testing Attachment (v7.1) -- older versions of the form will not have all required questions.
Yes - Updated information is included

3. Feasibility

Extent to which the specifications including measure logic, require data that are readily available or could be captured without undue burden and can be implemented for performance measurement.

3a. Byproduct of Care Processes

For clinical measures, the required data elements are routinely generated and used during care delivery (e.g., blood pressure, lab test, diagnosis, medication order).

3a.1. **Data Elements Generated as Byproduct of Care Processes.**
Coded by someone other than person obtaining original information (e.g., DRG, ICD-9 codes on claims)
If other:

3b. Electronic Sources

The required data elements are available in electronic health records or other electronic sources. If the required data are not in electronic health records or existing electronic sources, a credible, near-term path to electronic collection is specified.

3b.1. **To what extent are the specified data elements available electronically in defined fields** (*i.e., data elements that are needed to compute the performance measure score are in defined, computer-readable fields*) Update this field for **maintenance of endorsement**.
ALL data elements are in defined fields in electronic claims

3b.2. **If ALL the data elements needed to compute the performance measure score are not from electronic sources, specify a credible, near-term path to electronic capture, OR provide a rationale for using other than electronic sources.** For **maintenance of endorsement**, if this measure is not an eMeasure (eCQM), please describe any efforts to develop an eMeasure (eCQM).

3b.3. **If this is an eMeasure, provide a summary of the feasibility assessment in an attached file or make available at a measure-**

specific URL. Please also complete and attach the NQF Feasibility Score Card.
Attachment:

3c. Data Collection Strategy

Demonstration that the data collection strategy (e.g., source, timing, frequency, sampling, patient confidentiality, costs associated with fees/licensing of proprietary measures) can be implemented (e.g., already in operational use, or testing demonstrates that it is ready to put into operational use). For eMeasures, a feasibility assessment addresses the data elements and measure logic and demonstrates the eMeasure can be implemented or feasibility concerns can be adequately addressed.

3c.1. **Required for maintenance of endorsement. Describe difficulties (as a result of testing and/or operational use of the measure) regarding data collection, availability of data, missing data, timing and frequency of data collection, sampling, patient confidentiality, time and cost of data collection, other feasibility/implementation issues.**
IF instrument-based, consider implications for both individuals providing data (patients, service recipients, respondents) and those whose performance is being measured.

Because CMS PSI 90 is based on readily available administrative claims data, feasibility is not an issue. This version of the indicator requires present-on-admission (POA) data. Present-on-Admission was added as a data element to the uniform bill form (UB-04) effective October 1, 2007, and hospitals incurred a payment penalty for not including POA on Medicare records beginning October 1, 2008. Each of the several diagnoses in a discharge record can be flagged as "present at the time the order for inpatient admission occurs" or not (see http://www.cdc.gov/nchs/icd/icd9cm_addenda_guidelines.htm). No difficulties have been reported with respect to data collection, availability of data, missing data, timing and frequency of data collection, sampling, patient confidentiality, or time and cost of data collection. Hospitals routinely generate and transmit claims in a timely manner for all Medicare beneficiaries.

3c.2. **Describe any fees, licensing, or other requirements to use any aspect of the measure as specified** *(e.g., value/code set, risk model, programming code, algorithm)*.

No fees. CMS v10.0 is available by request through the CMS Quality Net Help Desk (https://www.qualitynet.org/inpatient/measures/psi/resources).

4. Usability and Use

Extent to which potential audiences (e.g., consumers, purchasers, providers, policy makers) are using or could use performance results for both accountability and performance improvement to achieve the goal of high-quality, efficient healthcare for individuals or populations.

4a. Accountability and Transparency

Performance results are used in at least one accountability application within three years after initial endorsement and are publicly reported within six years after initial endorsement (or the data on performance results are available). If not in use at the time of initial endorsement, then a credible plan for implementation within the specified timeframes is provided.

4.1. **Current and Planned Use**

NQF-endorsed measures are expected to be used in at least one accountability application within 3 years and publicly reported within 6 years of initial endorsement in addition to performance improvement.

Specific Plan for Use	Current Use (for current use provide URL)

4a1.1 **For each CURRENT use, checked above (update for maintenance of endorsement), provide:**

- Name of program and sponsor
- Purpose
- Geographic area and number and percentage of accountable entities and patients included
- Level of measurement and setting

Public Reporting

CMS publicly reports these measures to increase the transparency of hospital care, provide useful information for consumers, and assist hospitals in their quality improvement efforts.

CMS Medicare Hospital Compare Program

Publicly available database containing information about the quality of care at over 4,000 Medicare-certified hospitals across the U.S. PSI data are only calculated for hospitals that are paid through the Inpatient Prospective Payment System (IPPS), which excludes critical access hospitals (CAHs), long-term care hospitals (LTCHs),cancer hospitals, children´s inpatient facilities, rural health clinics, federally qualified health centers, inpatient psychiatric hospitals, inpatient rehabilitation facilities, Veterans Administration/ Department of Defense hospitals, and religious, non-medical health care institutions.
https://www.medicare.gov/HospitalCompare/Data/Serious-Complications.html

We report the number of Medicare FFS patients who fall into the denominator and experience each of the component Patient Safety Indicator events in Table 13 below.

Table 13. Medicare FFS Beneficiaries Reported for Component Indicators for Medicare FFS IPPS Hospitals

Component	Numerator	Denominator
PSI 03	8,126	13,477,287
PSI 06	4,421	17,444,847
PSI 08	1,661	15,370,433
PSI 09	11,657	4,711,559
PSI 10	3,551	2,603,987
PSI 11	12,995	2,106,016
PSI 12	19,064	5,035,140
PSI 13	12,150	2,539,548
PSI 14	1,000	1,092,647
PSI 15	3,910	3,096,764

Source: National CMS PSI Results for the 2016-2018 Medicare Population, Supplementary Information July 2019 Public Reporting
https://www.qualitynet.org/files/5d0d3919764be766b01030f4?filename=July2019_Ntl_CMS_PSI_Results_2.pdf
Numerator = Actual number of outcomes that occurred in the July 2016 – June 2018 Medicare FFS IPPS hospital population. An outcome will not count if its associated discharge is not part of the denominator.
Denominator=Number of discharges in the July 2016 – June 2018 Medicare FFS IPPS hospital population that meet the inclusion criteria for each CMS PSI.

Payment Programs:
CMS Hospital-Acquired Condition Reduction Program (HACRP):
Section 3008 of the Affordable Care Act requires CMS to establish a program for IPPS hospitals to improve patient safety, by imposing financial penalties on hospitals that perform poorly with regard to hospital-acquired conditions.
https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/AcuteInpatientPPS/HAC-Reduction-Program

The HACRP includes Medicare-participating acute care hospitals from all states (except Maryland) and the District of Columbia. The most recently reported analysis from 7/1/2016 through 6/30/2108 included 3,177 hospitals, of which 3,134 had valid PSI 90 Z scores (98.65%).

CMS Hospital Value-Based Purchasing Program (HVBP):
Congress authorized the Inpatient Hospital VBP in Section 3001(a) of the Affordable Care Act. The Hospital VBP Program rewards acute care hospitals with incentive payments for the quality of care provided in the inpatient hospital setting. This program encourages hospitals to improve the quality, efficiency, patient experience and safety of care that Medicare beneficiaries receive during acute care inpatient stays by:

- Eliminating or reducing adverse events (healthcare errors resulting in patient harm).
- Adopting evidence-based care standards and protocols in order to obtain the best outcomes for Medicare patients.
- Incentivizing hospitals to develop processes that improve patient experience.
- Increasing the transparency of care quality for consumers, clinicians, and others.
- Recognizing hospitals that provide high-quality care at a lower cost to Medicare.

CMS removed the CMS PSI 90 measure from the Hospital Inpatient Quality Reporting Program in FY 2020 due to substantive changes in the design of the composite that interfered with measuring improvement over time. The CMS PSI 90 will be added to the Hospital VBP Program beginning with FY2023 payment determination. The HVBP includes Medicare-participating acute care hospitals from all states (except Maryland) and the District of Columbia. The most recently reported performance period included 2,731 hospitals, but PSI 90 was not computed.

https://www.qualitynet.org/inpatient/measures/psi/resources
https://www.qualitynet.org/inpatient/hvbp/measures

Regulatory and Accreditation Programs:
Statewide Quality Advisory Committee (Massachusetts):
The committee annually recommends a standard set of health metrics to use throughout statewide health quality efforts.
http://chiamass.gov/sqms/

4a1.2. **If not currently publicly reported OR used in at least one other accountability application (e.g., payment program, certification, licensing) what are the reasons?** (*e.g., Do policies or actions of the developer/steward or accountable entities restrict access to performance results or impede implementation?*)
Not applicable

4a1.3. **If not currently publicly reported OR used in at least one other accountability application, provide a credible plan for implementation within the expected timeframes -- any accountability application within 3 years and publicly reported within 6 years of initial endorsement.** (*Credible plan includes the specific program, purpose, intended audience, and timeline for implementing the measure within the specified timeframes. A plan for accountability applications addresses mechanisms for data aggregation and reporting.*)
Not applicable

4a2.1.1. **Describe how performance results, data, and assistance with interpretation have been provided to those being measured or other users during development or implementation.**
How many and which types of measured entities and/or others were included? If only a sample of measured entities were included, describe the full population and how the sample was selected.
CMS provides free software, in both SAS and Windows format, to calculate the CMS PSIs. Users may use their own ICD-10-CM/PCS coded hospital administrative data to calculate the PSIs using this software.

In addition, CMS provides technical assistance to users through an online Q&A form (https://cmsqualitysupport.servicenowservices.com/qnet_qa?id=ask_a_question). CMS triages, troubleshoots, and responds to technical inquiries related to methodology and rationale behind the indicators and general questions related to the use of the software. During a calendar year, CMS typically provides technical support to over 1,000 queries.

4a2.1.2. **Describe the process(es) involved, including when/how often results were provided, what data were provided, what educational/explanatory efforts were made, etc.**
The CMS PSI software is updated annually. Technical support is available on an on-going basis. No data updates are necessary; users apply the CMS PSI software to their own hospital administrative data.

4a2.2.1. **Summarize the feedback on measure performance and implementation from the measured entities and others described in 4d.1.**
Describe how feedback was obtained.
Feedback is obtained from users through a variety of channels, particularly through a technical assistance mechanism described above. In addition, CMS incorporates input on PSI implementation from technical expert panels convened to support PSI development and maintenance, stakeholder committees such as the NQF standing committees, and peer-reviewed or other research publications.

4a2.2.2. **Summarize the feedback obtained from those being measured.**
CMS' PSI support team routinely receives user inquires via the technical assistance mechanism described above. These inquiries commonly involve clarification regarding the technical specifications of the component indicators (most commonly, PSI 03, PSI 08, and PSI 12), as well as clarification about the population subject to inclusion in the PSI 90 composite, eligible admission types, the number of diagnosis fields used to calculate the component measures, and the Medicare fee-for-service date ranges used to calculate PSI rates.

Specific suggestions for refining or enhancing the PSI specifications are addressed by CMS in consultation with AHRQ as needed, in its capacity as the original developer of PSI 90.

4a2.2.3. Summarize the feedback obtained from other users
Not separately evaluated.

4a2.3. Describe how the feedback described in 4a2.2.1 has been considered when developing or revising the measure specifications or implementation, including whether the measure was modified and why or why not.
The CMS PSIs are updated annually, including updating indicator technical specifications in accordance with the latest coding guidance; suggestions from users and other stakeholders obtained through Technical Assistance, committees, or workgroups; and the latest clinical and scientific research. CMS regularly reviews these sources, identifies possible indicator updates, and prioritizes updates for each indicator and software update based on expected impact on users.

Improvement
Progress toward achieving the goal of high-quality, efficient healthcare for individuals or populations is demonstrated. If not in use for performance improvement at the time of initial endorsement, then a credible rationale describes how the performance results could be used to further the goal of high-quality, efficient healthcare for individuals or populations.

4b1. Refer to data provided in 1b but do not repeat here. Discuss any progress on improvement (trends in performance results, number and percentage of people receiving high-quality healthcare; Geographic area and number and percentage of accountable entities and patients included.)
If no improvement was demonstrated, what are the reasons? If not in use for performance improvement at the time of initial endorsement, provide a credible rationale that describes how the performance results could be used to further the goal of high-quality, efficient healthcare for individuals or populations.
Over this three-year period from July 2016 through June 2018, based on national Medicare fee-for-service claims data as described in the Testing attachment, PSI 90 has shown minimal change in mean and median values. However, the 75th, 90th, 95th, and 100th percentile values have decreased, suggesting that the hospitals with the highest PSI event rates have been able to reduce their rates. Data from before October 1, 2015 cannot be compared with later data due to the code set conversion from ICD-9-CM to ICD-10-CM/PCS.

However, these results for PSI 90 do not tell the full story, because each component indicator is separately risk-adjusted and reliability-adjusted at the hospital level before it is put into PSI 90. The observed rates of the component indicators are also shown in 1b above and eight of the ten components demonstrate consistent improvement over time between the 7/1/2016-6/30/2017 year and the 7/1/2018-6/30/2019 year. Specifically, overall national observed rates of PSI 03, 06, 08, 09, 10, 11, 12, 13, 14, and 15 have decreased by 2.2%, 14.0%, 7.6%, -3.0%, -1.0%, 28.3%, 5.6%, 4.5%, 10.0%, and 7.3%, respectively. For all components except PSI 14, the overall national observed rate in 2018-19 was lower than the corresponding rate in 2017-18.

4b2. Unintended Consequences
The benefits of the performance measure in facilitating progress toward achieving high-quality, efficient healthcare for individuals or populations outweigh evidence of unintended negative consequences to individuals or populations (if such evidence exists).

4b2.1. Please explain any unexpected findings (positive or negative) during implementation of this measure including unintended impacts on patients.
One consequence of all quality measurement programs that are used for accountability applications is that health care providers focus their attention on the accuracy of the data and try to minimize both inadvertent underreporting of desired processes of care and inadvertent overreporting of undesired outcomes of care. This is not the intended consequence of quality measurement, but it is certainly an expected consequence. In the case of the NQF-endorsed Patient Safety Indicators, there is anecdotal published evidence of efforts to clarify clinical documentation such that clinically inconsequential events and “incidental” injuries “inherent” to a surgical procedure are no longer coded (and thus no longer reported to payers and state health data organizations.(1) Several large hospitals, such as New York University Langone Medical Center and the University of Washington Medical Center have established “prebilling review processes” with “prompt review of documentation and coding to confirm accuracy [of potential PSI diagnoses] and to identify opportunities to improve care quality and safety.”(2)

The AHRQ QI Toolkit offers specific guidance to hospitals and quality improvement leaders about “how to establish an effective coding communication and review process.”(3) The implication of these efforts is that some of the observed decrease in the incidence of this event over the last decade may be due to more accurate clinical documentation and coding, rather than to true improvements in patient outcomes and quality of care. Therefore, users should be cautious about interpreting recently observed changes in the incidence of component events. There is no evidence that more accurate clinical documentation and coding have had

any negative consequences for individuals or populations. Any harm from increasing providers' attention to documentation is likely to be counterbalanced by the benefits of more accurate data and more careful reflection on adverse events. In addition, these efforts appear to lead to "one-time corrections" in PSI rates, as hospitals implement processes to prevent overreporting, but do not affect the prior or subsequent trend lines. For example, both the University of Washington Medical Center and Cedars Sinai Medical Center (CSMC) reported that concurrent review of clinical documentation was only the first step toward improving PSI performance.(4) CSMC noted that "task forces that include staff from many different departments and disciplines are assigned to carry out a "leave-no-stone-unturned" search for opportunities to prevent harm across the board… all ideas are important…"

Finally, some users have raised a specific concern about unintended consequences of PSI 12, Perioperative Pulmonary Embolism or Deep Vein Thrombosis Rate. Specifically, the concern is that higher rates are a result of "increased vigilance in detection" at some hospitals.(5) Following this argument, high rates may be nonpreventable – even desirable – because perioperative PEs and DVTs are being diagnosed early (i.e., before symptoms develop) and treated aggressively at these "high surveillance" hospitals. Proponents of this argument cite Medicare claims data showing that "postoperative VTE imaging rates ranged from 85.26 per 1000 discharges in the lowest quartile of hospitals… to 168.86 in the highest quartile... drivers of high imaging rates at the 90th quantile were high resident-to-bed ratio (coefficient=51.35, p<0.01), Joint Commission accreditation (coefficient=19.05, p<0.01), presence of other hospitals in the same market with high imaging rates (coefficient=15.29, p<0.01), case severity (coefficient=11.97, p<0.01)…" (suggesting that more imaging is associated with higher quality hospitals).(6) Bilimoria et al. examined 2010 data from Hospital Compare and the American Hospital Association and 2009-2010 Medicare claims data; they reported that greater hospital adherence to VTE prophylaxis was very weakly associated with higher risk-adjusted VTE rates (r2=4.2%, p=0.03) but risk-adjusted VTE rates increased concordantly with VTE imaging use rates (p<0.001). Ju et al. similarly used National Surgical Quality Improvement Program data to identify VTE events and Medicare claims data to obtain information about VTE imaging;(7) mean risk-adjusted VTE rates (within 30 days after surgery) were significantly lower in hospitals in the lowest quartile of VTE imaging use (1.13%) than in hospitals in the highest quartile (1.92%, p<0.001). Similarly, Pierce et al. showed in the National Trauma Data Bank, with 147 hospitals from 2001-2005, that "hospitals with an ultrasound rate of 2% or greater had a 1.07% (95% CI: 1.05-1.09%) increase in reported DVT rate for every 1% increase in ultrasound rate."(8) Admission to a "screening trauma center" that performed vascular ultrasound on at least 2% of admitted trauma patients was independently associated with 2.2 (95% CI 1.1-4.3) times higher odds of DVT, after adjusting for age, injury type, injury severity, need for major surgery, and ventilator days.(9)

The critical question, however, is whether more venous imaging, and hence more diagnosis of VTE, is actually better for patients. Over diagnosis of VTE among asymptomatic or minimally symptomatic patients may lead to overtreatment, with the known adverse effects of anticoagulation and/or IVC device placement. Evidence-based guidelines note that "although distal DVT may be present in patients with a normal proximal ultrasound, it is seldom if ever associated with important clinical sequelae."(10) With respect to treatment, the American College of Chest Physicians also states, "in patients with acute isolated distal DVT of the leg and without severe symptoms or risk factors for extension… we suggest serial imaging of the deep veins for 2 weeks over initial anticoagulation (Grade 2C)."(11) To explore this problem, White et al. (personal communication) undertook a local root-cause analysis of all hospital-acquired VTEs at one academic center that had a relatively high PSI 12 rate. They found that some surgical house staff routinely order venous imaging in all febrile patients because they believe that DVT causes postoperative fever. The hospital's vascular laboratory then routinely scans calf veins and reports the presence of DVT in soleal or gastrocnemius muscular branches, despite evidence that sonography limited to proximal veins is equally safe.(12) Indeed, the American College of Radiology's Appropriateness Criteria for Suspected Lower-Extremity Deep Vein Thrombosis specifically advise radiologists (with the maximum rating of 9) that "the use of this procedure [ultrasound with Doppler] is limited to between the inguinal ligament and knee."(13) The American Academy of Orthopedic Surgeons also recommends "against routine post-operative duplex ultrasonography screening of patients who undergo elective hip or knee arthroplasty."

In a similar way, pulmonary embolism is now being over-diagnosed because small sub-segmental filling defects are being read as pulmonary emboli (rather than as "small sub-segmental filling defects of undetermined significance", which is a more appropriate term).(14) This problem of overdiagnosis and overtreatment (labeled as "surveillance bias" by some authors) has received increasing attention in the clinical and epidemiologic literature.(15-17) The three key hallmarks of overdiagnosis are: (1) increasing incidence over time; (2) decreasing case fatality over time; and (3) no change in overall attributable mortality over time. All of these hallmarks have been supported with respect to pulmonary emboli; therefore, it seems more accurate to describe this concern as "overdiagnosis bias" rather "surveillance bias."

To address these concerns, CMS has made two important changes to PSI 12 to make it less sensitive to overdiagnosis bias: (1) PSI 12 now captures only proximal (groin/thigh), not distal (calf) vein thromboses; and (2) PSI 12 no longer captures solitary subsegmental pulmonary emboli. With these changes, CMS is now seeing a decreasing temporal trend in PSI 12 rates (down 10.2% from 7/1/2016-

6/30/2017 to 7/1/2017-6/30/2018) and no change in case fatality over time. These results provide reassurance that the current specification of PSI 12 is not sensitive to overdiagnosis bias, because it focuses on clinically important events that are consistently diagnosed and treated across all hospitals.

1. Utter GH, Vermoch KL, Rogers S. Clinical documentation improvement and the agency for healthcare research and quality accidental puncture or laceration patient safety indicator. JAMA Surg. 2015;150(5):388-389.
2. http://www.hcpro.com/content/280170.ppt
3. https://www.ahrq.gov/patient-safety/settings/hospital/resource/qitool/index.html
4. http://www.ahrq.gov/professionals/systems/hospital/qitoolkit/qicasestudy.html
5. Rajaram R, Barnard C, Bilimoria KY. Concerns about using the patient safety indicator-90 composite in pay-for-performance programs. JAMA. 2015 Mar 3;313(9):897-8.
6. Chung JW, Ju MH, Kinnier CV, Haut ER, Baker DW, Bilimoria KY. Evaluation of hospital factors associated with hospital postoperative venous thromboembolism imaging utilisation practices. BMJ Qual Saf. 2014;23(11):947-56.
7. Ju MH, Chung JW, Kinnier CV, et al. Association between hospital imaging use and venous thromboembolism events rates based on clinical data. Ann Surg 2014;260(3):558-564.
8. Pierce CA, Haut ER, Kardooni S, et al. Surveillance bias and deep vein thrombosis in the national trauma data bank: the more we look, the more we find. J Trauma 2008;64(4): 932-6.
9. Haut ER, Chang DC, Pierce CA, et al. Predictors of posttraumatic deep vein thrombosis (DVT): hospital practice versus patient factors-an analysis of the National Trauma Data Bank (NTDB). J Trauma 2009;66(4):994-9.
10. http://journal.publications.chestnet.org/data/Journals/CHEST/23443/112299.pdf
11. http://journal.publications.chestnet.org/article.aspx?articleID=1159520
12. Bernardi E, Camporese G, Büller HR, et al. Serial 2-point ultrasonography plus D-dimer vs whole-leg color-coded Doppler ultrasonography for diagnosing suspected symptomatic deep vein thrombosis: a randomized controlled trial. JAMA 2008;300(14): 1653-9.
13. https://acsearch.acr.org/docs/69416/Narrative
14. Suh TM, Cronan JJ, Healey TT. Dots are not clots: the over-diagnosis and over-treatment of PE. Emerg Radiol (2010) 17:347–52.
15. Righini M, Le Gal G, Bounameaux H. Venous thromboembolism diagnosis: unresolved issues. Thromb Haemost 2015;113(6):1184-92.
16. Wiener RS, Schwartz LM, Woloshin S. Time trends in pulmonary embolism in the United States: evidence of overdiagnosis. Arch Intern Med 2011;171(9):831-7.
17. D´Apuzzo MR, Keller TC, Novicoff WM, et al. CT pulmonary angiography after total joint arthroplasty: overdiagnosis and iatrogenic harm? Clin Orthop Relat Res 2013;471(9):2737-42.

4b2.2. **Please explain any unexpected benefits from implementation of this measure.**
None.

5. Comparison to Related or Competing Measures

If a measure meets the above criteria and there are endorsed or new related measures (either the same measure focus or the same target population) or competing measures (both the same measure focus and the same target population), the measures are compared to address harmonization and/or selection of the best measure.

5. Relation to Other NQF-endorsed Measures
Are there related measures (conceptually, either same measure focus or target population) or competing measures (conceptually both the same measure focus and same target population)? If yes, list the NQF # and title of all related and/or competing measures.
No

5.1a. **List of related or competing measures (selected from NQF-endorsed measures)**

5.1b. **If related or competing measures are not NQF endorsed please indicate measure title and steward.**

5a. Harmonization of Related Measures

The measure specifications are harmonized with related measures;
OR
The differences in specifications are justified

5a.1. **If this measure conceptually addresses EITHER the same measure focus OR the same target population as NQF-endorsed measure(s):**
Are the measure specifications harmonized to the extent possible?

5a.2. **If the measure specifications are not completely harmonized, identify the differences, rationale, and impact on interpretability and data collection burden.**
Not applicable.

5b. Competing Measures

The measure is superior to competing measures (e.g., is a more valid or efficient way to measure);
OR
Multiple measures are justified.

5b.1. **If this measure conceptually addresses both the same measure focus and the same target population as NQF-endorsed measure(s):**
Describe why this measure is superior to competing measures (e.g., a more valid or efficient way to measure quality); OR provide a rationale for the additive value of endorsing an additional measure. (Provide analyses when possible.)
Not applicable.

Appendix

A.1 Supplemental materials may be provided in an appendix. All supplemental materials (such as data collection instrument or methodology reports) should be organized in one file with a table of contents or bookmarks. If material pertains to a specific submission form number, that should be indicated. Requested information should be provided in the submission form and required attachments. There is no guarantee that supplemental materials will be reviewed.
Attachment **Attachment:** Appendix_H-PSI_90_NQF_0531_Conceptual_Framework.pdf

Contact Information

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Co.3 **Measure Developer if different from Measure Steward:** IMPAQ International
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Additional Information

Ad.1 **Workgroup/Expert Panel involved in measure development**
Provide a list of sponsoring organizations and workgroup/panel members' names and organizations. Describe the members' role in measure development.
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TEP members responded to the posted Call for TEP and provide feedback on clinical acceptability of measure specifications and feasibility of the measure.

Measure Developer/Steward Updates and Ongoing Maintenance

Ad.2 **Year the measure was first released:** 2009
Ad.3 **Month and Year of most recent revision:** 07, 2019
Ad.4 **What is your frequency for review/update of this measure?** Annually
Ad.5 **When is the next scheduled review/update for this measure?** 07, 2020

Ad.6 **Copyright statement:** Limited proprietary coding is contained in the Measure specifications for user convenience. Users of proprietary code sets should obtain all necessary licenses from the owners of the code sets. The ICD-10 is copyrighted by the World Health Organization (WHO) , which owns and publishes the classification. WHO has authorized the development of an adaptation of ICD-10 for use in the United States for U.S. government purposes. As agreed, all modifications to the ICD-10 must conform to WHO conventions for the ICD. All Rights Reserved.

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Ad.8 **Additional Information/Comments:** This measure was originally developed, specified, and tested by the Agency for Healthcare Research and Quality (AHRQ) and the responsibility for stewardship of this measure was assumed by the Centers for Medicare & Medicaid Services (CMS) in 2020. IMPAQ International LLC also wishes to recognize our colleagues at University of California at Davis, led by Patrick S. Romano, MD MPH FAAP FACP, who have developed and maintained PSI 90 via subcontract under our Measure & Instrument Development and Support (MIDS) Patient Safety Measure Development and Maintenance contract with CMS.