HOSPITAL SAFETY SCORE

SCORING METHODOLOGY

MAY 2013

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2013 Scoring Methodology

Contents

What is the Hospital Safety Score?

The nation's healthcare system is undergoing rapid and dramatic change. There is now a cacophony of data and information in the public domain about hospital performance, but few healthcare consumers can interpret its significance.

The Hospital Safety Score grades general acute care hospitals on how safe they are for patients. The score includes data that patient safety experts use to compare hospitals. Publicly available data from the Centers for Medicare and Medicaid Services (CMS), the Leapfrog Hospital Survey, and secondary data sources are weighted and then combined to produce a single, consumer-friendly composite score that is published as an A, B, C, D or F letter grade.

With the Hospital Safety Score, The Leapfrog Group aims to educate and to encourage consumers to consider safety when selecting a hospital for themselves or their families. In addition, we believe the score will foster strong market incentives for hospitals to make safety a priority.

Who is The Leapfrog Group?

The Leapfrog Group (www.leapfroggroup.org) is a national not-for-profit organization that was founded over a decade ago by the nation's leading employers and private healthcare purchasers. The organization strives to make giant "leaps" forward in the safety, quality, and affordability of healthcare in the U.S. by promoting transparency and value-based hospital incentives. To that end, Leapfrog has focused on measuring and publicly reporting on hospital performance through the annual Leapfrog Hospital Survey. The survey is a trusted, transparent, and evidence-based national tool that more than 1100 hospitals voluntarily participate in free of charge. For more information on The Leapfrog Hospital Survey visit http://leapfroghospitalsurvey.org/.

Eligible and Excluded Hospitals

The Leapfrog Group calculated a Hospital Safety Score for over 2600 hospitals for which there was sufficient publicly available data. Because publicly available data is limited for a variety of reasons, Leapfrog is not able to calculate a score for every hospital in the U.S.

The Leapfrog Group did not calculate a safety score for the following types of hospitals:

- Critical access hospitals (CAH)
- Long-term care and rehabilitation facilities
- Mental health facilities

- Federal hospitals (e.g., Veterans Affairs, Indian Health Services, etc.)
- Specialty hospitals, including surgical centers and cancer hospitals
- Free-standing pediatric hospitals
- Hospitals in U.S. territories
- Maryland hospitals, as they do not participate in the Center for Medicare and Medicaid Services' (CMS) Inpatient Prospective Payment System (IPPS)
- Hospitals that are missing data for **more than 9** process/structural measures or **more than 3** outcome measures

Information for Hospitals that Share a Medicare Provider Number with another Hospital

All facilities that share a Medicare Provider Number (MPN) will be assigned the same source data as reported on CMS's Hospital Compare. Affected measures include the SCIP process measures, Hospital Acquired Conditions, PSIs, and CLABSI, when applicable.

Scoring Methodology

The Hospital Safety Score utilizes national performance measures from the Leapfrog Hospital Survey, the Agency for Healthcare Research and Quality (AHRQ), the Centers for Disease Control and Prevention (CDC), and the Centers for Medicare and Medicaid Services (CMS) to produce a single composite score that represents a hospital's overall performance in keeping patients safe from preventable harm and medical errors. In addition, secondary data from the American Hospital Association's Annual Survey[i] was used to give hospitals as much credit as possible towards their safety scores. The Hospital Safety Score includes 26 measures, which are all currently in use by national measurement and reporting programs. The measure set is divided into two domains: (1) Process/Structural Measures and (2) Outcome Measures. Each domain represents 50% of the Hospital Safety Score.

For Process/Structural Measures, a higher score is always better because these are measures of compliance with best practices in patient care (e.g., SCIP-INF-1: Prophylactic antibiotic received within 1-hour prior to surgical incision). For Outcome Measures, a lower score is always better because these are measures of the incidence of adverse events for patients (e.g., Foreign Objects Left after Surgery).

This document describes, in detail and through examples, how a hospital's Safety Score is calculated. Hospitals and others can use this document to verify Hospital Safety Score calculations. If you have additional questions about the scoring methodology or the Hospital Safety Score, please contact scorehelp@leapfroggroup.org.

Measures

The following table lists the 26 measures included in the Hospital Safety Score, and the source of hospitals' performance information for each measure. In some cases where a hospital's information is not available for a certain measure, Leapfrog uses a secondary data source (as indicated in the table). In cases where a hospital's information is not available from any data source, Leapfrog has outlined a methodology for dealing with the missing data. This methodology is described later in the document, in the Dealing with Missing Data section.

Measure Name	Primary Data Source	Secondary Data Source
Process and Structural Measures (15)		
Computerized Physician Order Entry (CPOE)	Leapfrog Hospital Survey	AHA Annual Survey[ii] (2010 IT Supplement to the 2011 AHA Annual Survey)
ICU Physician Staffing (IPS)	Leapfrog Hospital Survey	2011 AHA Annual Survey
Safe Practice 1: Leadership Structures and Systems	Leapfrog Hospital Survey	
Safe Practice 2: Culture Measurement, Feedback and Intervention	Leapfrog Hospital Survey	
Safe Practice 3: Teamwork Training and Skill Building	Leapfrog Hospital Survey	
Safe Practice 4: Identification and Mitigation of Risks and Hazards	Leapfrog Hospital Survey	
Safe Practice 9: Nursing Workforce	Leapfrog Hospital Survey	
Safe Practice 17: Medication Reconciliation	Leapfrog Hospital Survey	
Safe Practice 19: Hand Hygiene	Leapfrog Hospital Survey	
Safe Practice 23: Care of the Ventilated Patient	Leapfrog Hospital Survey	
SCIP INF 1: Antibiotic within 1 Hour	CMS Hospital Compare	
SCIP INF 2: Antibiotic Selection	CMS Hospital Compare	
SCIP INF 3: Antibiotic Discontinued After 24 Hours	CMS Hospital Compare	
SCIP INF 9: Catheter Removal	CMS Hospital Compare	
SCIP VTE 2: VTE Prophylaxis	CMS Hospital Compare	
Outcome Measures (11)		
Foreign Object Retained	CMS Hospital Compare	
Air Embolism	CMS Hospital Compare	
Pressure Ulcer – Stages 3 and 4	CMS Hospital Compare	
Falls and Trauma	CMS Hospital Compare	
CLABSI	Leapfrog Hospital Survey	CMS Hospital Compare

PSI 4: Death Among Surgical Inpatients	CMS Hospital Compare	
PSI 6: Iatrogenic Pneumothorax	CMS Hospital Compare	
PSI 11: Breathing Failure After Surgery	CMS Hospital Compare *(see note on page 12)*	
PSI 12: Postoperative PE/DVT	CMS Hospital Compare	
PSI 14: Postoperative Wound Dehiscence	CMS Hospital Compare	
PSI 15: Accidental Puncture or Laceration	CMS Hospital Compare	

How Measures are Scored

Categorical Measures. A categorical measure is one that measures a hospital's performance by performance categories or by categorical statements. Computerized Physician Order Entry (CPOE) is an example of a categorical measure. A hospital's performance is reported in the following way: "fully meets the standard," "substantial progress," "some progress," "willing to report," or "declined to report." These performance categories correspond to a hospital's ability to meet the CPOE standard. (See examples at www.leapfroggroup.org/cp) For the Hospital Safety Score Methodology, these performance categories (e.g., "fully meets the standard," "substantial progress," etc.) are converted into numerical values so the measure can be scored and included in the overall Hospital Safety Score. The following image depicts a categorical scale, with the diamond representing a hospital's potential score on a categorical measure. You can see that a hospital can only fall into one (1) of the five (5) categories, and cannot fall in between the categories.

| Declined to Report | Willing to Report | Some Progress | Substantial Progress | Fully Meets Standard |

Continuous Measures. A continuous measure is one that measures a hospital's performance by a counting process or by an interval continuum. A score on a continuous measure can assume an infinite number of values. The SCIP measures are examples of continuous measures. A hospital's rates for this measure may fall anywhere along a continuum between 0 and 100 (e.g., 97, 98.4, etc.). The following image depicts a continuous scale, with the diamonds representing two potential scores a hospital could receive on a continuous measure:

| 0 | 37.7 | | 75 | 100 |

"Not Applicable" Results. If a measure is not applicable for a hospital, it is indicated by "N/A." For example, if a hospital does not have an ICU, it will receive a score of "N/A" on the ICU Physician Staffing measure. When hospitals are not applicable for a measure, the score for that measure is not included in either the numerator or denominator of the overall score. As a result, the remainder of a hospital's applicable measures will receive higher weights, because the weights from the non-applicable measures are allocated across the applicable measures.

Not Available/Not Reported Results. If publicly available data is not available for a given measure, it is indicated as "Not Available" (for CPOE and IPS) or "Not Reported" for the NQS Safe Practice measures. For example, if a hospital did not report on its progress in implementing the Safe Practices, it will receive a score of "Not Reported" on the Safe Practice measures. When data is not available for a measure, the score for that measure is not included in either the numerator or denominator of the overall score. As a result, the remainder of a hospital's applicable measures will receive higher weights, because the weights from measures in which data was not available are allocated across the other measures.

Measure Descriptions

Process/Structural Measures
The following measures are classified as Process/Structural Measures in the Hospital Safety Score. For Process/Structural Measures, a higher score is always better because these are measures of compliance with best practices in patient care (e.g., SCIP-INF-1: Prophylactic antibiotic received within 1-hour prior to surgical incision).

Computerized Physician Order Entry (CPOE). The CPOE measure is collected by The Leapfrog Group on the Leapfrog Hospital Survey. It measures a hospital's progress toward implementing a CPOE system and the efficacy of that system in alerting prescribers to common medication errors such as drug-drug interactions and drug-allergy interaction. CPOE systems can reduce medication errors by up to 88%. CPOE is a categorical measure—hospitals receive either "fully meets standard," "substantial progress," "some progress," "willing to report," or "declined to report" based on their reported data. A numerical score is assigned to each performance category in the following way:

- "Fully meets standard" = 100 points
- "Substantial progress" = 50 points
- "Some progress" = 15 points
- "Willing to report" = 5 points

- "Declined to report" or "Response not required" = refer to *Uses of Secondary Data*

This Scoring Methodology translates a hospital's CPOE score (e.g., 100, 50, 15, or 5) into a Z-Score (see Calculating Z-Scores for more information), then multiplies the Z-Score by 6.1% and adds this calculation to the remaining Process/Structural Measures to derive the Process Score. Please note that this standard weight may differ if your hospital is not applicable for other Process/Structural Measures.

Please see the Dealing with Missing Data section for detailed information on assigning a CPOE score to hospitals using the 2011 AHA Annual Survey as a secondary data source.

ICU Physician Staffing (IPS). The IPS measure is collected by The Leapfrog Group on the Leapfrog Hospital Survey. It measures a hospital's intensivist coverage in ICU's, which significantly reduces mortality rates when implemented. IPS is a categorical measure—hospitals receive either "fully meets standards," substantial progress," "some progress," "willing to report," or "declined to report" based on their reported data. A numerical score is assigned to each level of achievement in the following way:

- "Fully meets" = 100 points
- "Substantial progress" = 50 points
- "Some progress" = 15 points
- "Willing to report" = 5 points
- "Declined to report" or "Response not required" = refer to *Uses of Secondary Data*
- "Does not apply" = N/A (this measure will not be included)

This Scoring Methodology translates a hospital's score (from above) into a Z-Score (see Calculating Z-Scores for more information), then multiplies the Z-Score by 7.0% and adds this calculation to the remaining Process/Structural Measures to derive the Process Score. Please note that this standard weight may differ if your hospital is not applicable for other Process/Structural Measures.

Please see the Dealing with Missing Data section for detailed information on assigning an IPS score to hospitals using the 2011 AHA Annual Survey as a secondary data source.

NQF Safe Practices. NQF Safe Practice measures are collected by The Leapfrog Group on the Leapfrog Hospital Survey. They measure a hospital's progress in implementing processes and protocols that promote safe patient care. The Hospital Safety Score contains eight (8) NQF Safe Practice measures that are classified as Process/Structural Measures in the Scoring Methodology. This Scoring Methodology translates a hospital's score on each Safe Practice into a Z-Score (see Calculating Z-Scores for more information), then multiplies the Z-Score by the standard safe practice weight, and adds this calculation to the remaining Process/Structural Measures to derive the Process Score. The following Safe

Practices are included in the Hospital Safety Score, along with their assigned weights. Please note that these standard weights may differ if your hospital is not applicable for other Process/Structural Measures.

Safe Practice	Weight
SP 1: Leadership Structures and Systems	2.5%
SP 2: Culture Measurement, Feedback and Intervention	2.7%
SP 3: Teamwork Training and Skill Building	2.7%
SP 4: Identification and Mitigation of Risks and Hazards	2.6%
SP 9: Nursing Workforce	3.4%
SP 17: Medication Reconciliation	2.5%
SP 19: Hand Hygiene	3.3%
SP 23: Care of the Ventilated Patient	2.6%

Please see the Dealing with Missing Data section for detailed information on assigning a Safe Practices score to hospitals that do not report to Leapfrog.

Surgical Care Improvement Project (SCIP) Measures. The Hospital Safety Score includes five (5) SCIP measures that are classified as Process/Structural measures in the Scoring Methodology. Hospitals can report on their progress on these measures through CMS' Hospital Quality Reporting Program. The SCIP measures are all reported as a percentage on a scale from 0% to 100%. This Scoring Methodology translates a hospital's score on each SCIP measure into a Z-Score (see Calculating Z-Scores for more information), then multiplies the Z-Score by a standard weight, and adds this calculation to the remaining Process/Structural Measures to derive the Process Score. The following SCIP process measures are included in the Hospital Safety Score, along with their assigned weights. Please note that these standard weights may differ if your hospital is not applicable for other Process/Structural Measures.

SCIP Measure	Weight
SCIP-INF-1: Prophylactic antibiotic received within 1-hour prior to surgical incision	3.1%
SCIP-INF-2: Prophylactic antibiotic selection for surgical patients	2.3%
SCIP-INF-3: Prophylactic antibiotics discontinued within 24 hours after surgery end time	2.3%
SCIP-INF-9: Urinary catheter removed on postoperative day 1 or 2	3.1%
SCIP-VTE-2: Surgery patients who received appropriate venous thromboembolism (VTE)	3.9%

Outcome Measures

The following measures are classified as Outcome Measures in the Hospital Safety Score. For Outcome Measures, a lower score is always better because these are measures of the incidence of adverse events for patients (e.g., Foreign Object Retained After Surgery).

Central-Line Associated Bloodstream Infection (CLABSI) Standardized Infection Ratios. The CLABSI measure is collected by The Leapfrog Group on the Leapfrog Hospital Survey. The measure assesses a hospital's incidence rate of hospital-acquired infections (HAI) in ICUs. The score for this measure is based on the hospital's Standardized Infection Ratio (SIR) for CLABSI. A SIR is identical in concept to a standardized mortality ratio, and can be used as an indirect standardization method for summarizing HAI experience across any number of stratified groups of data.

This Scoring Methodology translates a hospital's CLABSI SIR into a Z-Score (see Calculating Z-Scores for more information), then multiplies the Z-Score by 6.8%, and adds this calculation to the remaining Outcome Measures to derive the Outcome Score. Please note that this standard weight may differ if your hospital is not applicable for other Outcome Measures.

Please see the Dealing with Missing Data section for detailed information on assigning a CLABSI score to hospitals using the CMS Hospital Compare database as a secondary data source.

Hospital Acquired Conditions (HACs). The Hospital Safety Score contains four (4) measures of Hospital Acquired Conditions that are classified as Outcome measures in the Scoring Methodology. Hospitals can report on their progress on these measures through CMS' Hospital Quality Reporting Program. **The HAC measures are reported as a rate per 1,000 discharges**. This Scoring Methodology translates a hospital's score on each of the HAC measures into a Z-Score (see Calculating Z-Scores for more information), then multiplies the Z-Score by the standard weight, and adds this calculation to the remaining Outcome Measures to derive the Outcome Score. The following HAC measures are included in the Hospital Safety Score, along with their assigned weights. Please note that these standard weights may differ if your hospital is not applicable for other Outcome measures.

HAC Measure	Weight
Foreign Object Retained After Surgery	6.0%
Air Embolism	6.0%
Stage III and IV Pressure Ulcers	7.7%
Falls and Trauma	6.2%

AHRQ Patient Safety Indicators (PSIs). The Hospital Safety Score contains six (6) Agency for Healthcare Research and Quality (AHRQ) Patient Safety Indicators that are classified as Outcome measures in the Scoring Methodology. Hospitals can report on their progress on these measures through CMS' Hospital Quality Reporting Program. **The PSIs are reported as a rate per 1,000 patient discharges**. This Scoring Methodology translates a hospital's score on each AHRQ PSI into a Z-Score (see Calculating Z-Scores for more information), then multiplies the Z-Score by the standard weight, and adds this calculation to the remaining Outcome Measures to derive the Outcome Score. The following PSIs are included in the Hospital Safety Score, along with their assigned weights. Please note that these standard weights may differ if your hospital is not applicable for other Outcome measures.

Note for PSI 11 Postoperative Respiratory Failure: AHRQ identified a difference between the SAS® and WinQI® implementation of the numerator inclusion and denominator exclusion logic that has an impact on cases flagged for PSI-11 Postoperative Respiratory Failure in version 4.3 of the Quality Indicator software. The issue affects the number of discharges, the rates, and the interval estimates for PSI-11. These data will be suppressed (reported as N/A - 'Not Available') for all hospitals during July 2012 public reporting in the downloadable database on Hospital Compare. As a result, PSI 11 will show as "Not Available" for this round of scores and the measure is not included in calculating the Hospital Safety Score.

AHRQ PSIs	Weight
PSI 4: Death among Surgical Inpatients with Serious Treatable Complications	2.9%
PSI 6: Iatrogenic Pneumothorax	3.2%
PSI 12: Postoperative Pulmonary Embolism (PE) or Deep Vein Thrombosis (DVT)	3.3%
PSI 14: Postoperative Wound Dehiscence	3.5%
PSI 15: Accidental Puncture or Laceration	4.4%

Using Secondary Data Sources and Dealing with Missing Data

Eleven (11) of the 26 measures that make up the Hospital Safety Score are derived from hospitals' responses to the 2012 Leapfrog Hospital Survey. As the Leapfrog Hospital Survey is a voluntary survey, many hospitals choose not to submit a survey. To address this gap, a methodology was developed to allow scoring of all hospitals in the country, including those that did not report to Leapfrog's annual survey. This section describes the methods developed for using secondary data sources and dealing with missing data. For information on how to complete a free Leapfrog Hospital Survey, visit www.leapfroghosptialsurvey.org.

Computerized Physician Order Entry (CPOE)

The Leapfrog Hospital Survey data is the **primary data source** for CPOE. Hospitals that report their progress in meeting the CPOE Standard in the 2012 Leapfrog Hospital Survey by February 28, 2013, will receive points based on their Leapfrog score for the CPOE measure (refer to table 1.1).

The 2010 IT Supplement to the 2011 AHA Annual Survey is a **secondary data source** for CPOE (this applies to hospitals that did not report to the 2012 Leapfrog Hospital Survey by February 28, 2013). A hospital's response to the 2010 IT Supplement to the 2011 AHA Annual Survey question "Does your hospital have a CPOE system that allows for medication orders?" is used to assign the following score (refer to table 1.2).

TABLE 1.2 Points Earned for CPOE for Hospitals That Did Not Submit a Leapfrog Hospital Survey by February 28, 2013

2011 AHA Annual Survey Response	Points Earned	Notes
1 – fully implemented across all units	65	Score was imputed based on an analysis comparing hospital performance on Leapfrog and AHA surveys
2 – fully implemented in at least one unit	20	Score was imputed based on an analysis comparing hospital performance on Leapfrog and AHA surveys
3 – beginning to implement in at least one impatient unit	20	Score was imputed based on an analysis comparing hospital performance on Leapfrog and AHA surveys
4, 5, or 6	5	

If a hospital did not report to the Leapfrog or AHA survey on their CPOE implementation, the hospital receives a score of, and is publicly reported as, "Not Available." This measure is then **not included** in calculating the Hospital Safety Score.

ICU Physician Staffing (IPS)

The Leapfrog Hospital Survey data is the **primary data source** for IPS. Hospitals that report their progress in meeting the IPS Standard in the 2012 Leapfrog Hospital Survey by February 28, 2013, will receive points based on their Leapfrog score for the IPS measure (refer to table 2.1).

The 2011 AHA Annual Survey is a **secondary data source** for IPS (this applies to hospitals that did not report to the 2012 Leapfrog Hospital Survey by February 28, 2013). A hospital's responses to the 2011 AHA Annual Survey questions on the number of Med/Surg and/or Pediatric ICU beds, the closed/open status of the Med/Surg ICU and/or Pediatric ICUs, and number of FTEs of intensivists in Med/Surg and/or Pediatric ICUs are used to assign the following score (refer to Table 2.2).

Note 1: If a hospital reported zero (0) Med/Surg **and** zero (0) Pediatric ICU beds, the hospital will receive a score of "Not Applicable" and this measure will not be included in calculating the Hospital Safety Score.

Note 2: If a hospital reported with greater than zero (0) Med/Surg ICU Beds **AND/OR** greater than zero (0) Pediatric ICU beds, the hospital's Med/Surg ICU and Pediatric ICU scores will be calculated based on the table below, and then averaged together (see table 2.2).

Table 2.2 Points Earned for IPS for Hospitals That Did Not Submit a Leapfrog Hospital Survey by February 28, 2013

2011 AHA Annual Survey Response	Points Earned	Notes
If Med/Surg ICU is "Closed" and the number of intensivist FTEs is >6	85	Score was imputed based on an analysis comparing hospital performance on Leapfrog and AHA surveys
If Med/Surg ICU is "Closed" and the number of intensivist FTEs is <=6 and >0	65	Score was imputed based on an analysis comparing hospital performance on Leapfrog and AHA surveys
If Med/Surg ICU is "Closed" and the number of intensivist FTEs is zero (0) or if the Med/Surg ICU is "Open"	5	
If Pediatric ICU is "Closed" and the number of intensivist FTEs is >6	85	Score was imputed based on an analysis comparing hospital performance on Leapfrog and AHA surveys

If Pediatric ICU is "Closed" and the number of intensivist FTEs is <=6 and >0	65	Score was imputed based on an analysis comparing hospital performance on Leapfrog and AHA surveys
If Pediatric ICU is "Closed" and the number of intensivist FTEs is zero (0) or if the Med/Surg ICU is "Open"	5	

EXAMPLE 1:
Med/Surg ICU is closed and staffed with 10 FTEs = 85
Pediatric ICU is open and staffed with 6 FTEs= 5
Overall IPS Score calculation: 85 + 5 = 90 / 2 = **45**
Overall IPS Score used to calculate Hospital Safety Score = 45

EXAMPLE 2:
Med/Surg ICU is closed and staffed with 20 FTEs = 85
Pediatric ICU is closed and staffed with 5 FTEs = 65
Overall IPS Score calculation: 85 + 65 = 150 / 2 = **75**
Overall IPS Score used to calculate Hospital Safety Score = 75

EXAMPLE 3:
Med/Surg ICU is closed and staffed with 20 FTEs = 85
No Pediatric ICU beds
Overall IPS Score used to calculate Hospital Safety Score = 85

If a hospital did not report to Leapfrog or AHA on ICU Physician Staffing, the hospital receives a score of, and is publicly reported as, "Not Available." This measure is **not included** in calculating the Hospital Safety Score.

Central-Line Associated Bloodstream Infection (CLABSI) Standardized Infection Ratios

The Leapfrog Hospital Survey data is the **primary data source** for CLABSI. Hospitals that report their progress in meeting the CLABSI Standard in the 2012 Leapfrog Hospital Survey by February 28, 2013, will be assigned the standardized infection ratio calculated by Leapfrog. If a hospital does not meet Leapfrog's minimum reporting requirements for this measure, CMS Hospital Compare data will be used as a secondary data source.

When using data from CMS Hospital Compare as a **secondary data source** for CLABSI (this applies to hospitals did not report to the 2012 Leapfrog Hospital Survey by February 28, 2013 AND to hospitals that did not meet Leapfrog's minimum reporting requirements for this measure), refer to table 3.1:

TABLE 3.1 Hospitals That Did Not Submit a 2012 Leapfrog Hospital Survey by February 28, 2013 or Did Not Meet Leapfrog's Minimum Reporting Requirements

As Reported by CMS on Hospital Compare	Score Used to Calculate Hospital Safety Score and for Public Reporting	Notes
N/A (no ICU locations or small case size)	N/A	Measure is **not included** in calculating the Hospital Safety Score.
Standard Infection Ratio (SIR)	SIR	Measure is **included** in calculating the Hospital Safety Score.

NQF Safe Practices

When using data from the 2012 Leapfrog Hospital Survey as the **primary data source**, (this applies to hospitals that submitted a survey by February 28, 2013), refer to the individual Safe Practice Points for each of the 8 practices. If a hospital is scored as N/A for any of the practices, that measure will not be included in calculating the Hospital Safety Score.

There is no secondary data source for the NQF Safe Practices. Therefore, if a hospital did not submit a Leapfrog Hospital Survey by February 28, 2013, the following will apply:

1. Hospitals will be publicly reported as "Not Reported" for each of the 8 practices and these measures will not be included in calculating the Hospital Safety Score.

A note about extreme values

For hospitals that reported an extreme value for a particulate measure, a value that exceeded the 99th percentile, Leapfrog replaced the reported value with that of the 99th percentile. This is indicated in the source data with an asterisk (*).

A note about minimum sample size

The Hospital Safety Score uses different types of measures (process, structural, and outcome) from different sources (Leapfrog Hospital Survey, CMS Hospital Compare, and American Hospital Association). In an effort to align the minimum reporting requirements for different types of measures from different sources, when a measure's denominator is publicly available, Leapfrog applies the following minimum reporting requirement for using the measure in the safety score: the number of cases in the denominator must be >= 30.

This minimum reporting requirement was identified from the literature, which suggests that thirty cases is generally the point when a non-normal distribution begins to approximate a *normal distribution*, which is important given the Safety Score's use of z-scores for standardizing data across disparate data sets. [1,2] The minimum sample size of 30 has also been used by other organizations that are engaged in evidence-based public reporting of health care performance data (e.g., reporting surgeon performance on CABG surgeries by Pennsylvania Healthcare Cost Containment).

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[1] Gingrich P. Introductory Statistics for the Social Sciences. Chapter 7: Sampling Distributions.
http://uregina.ca/~gingrich/ch7.pdf

[2] Khamis HJ. Statistics Refresher II: Choice of Sample Size. Journal of Diagnostic Medical Sonography. 1988;4:176.

Weighting Individual Measures

Each individual measure included in the Hospital Safety Score is assigned a weight. The methodology to assign weights includes three criteria that reflect the quality of the measure. These criteria are: (1) Impact, (2) Evidence, and (3) Opportunity. These three (3) criteria are then combined using the following equation to compute a relative importance score for each measure: **[Evidence + (Opportunity x Impact)].** The score computed from this calculation is then used to calculate an overall weight for each measure.

Evidence
The Evidence Score for each individual measure is assigned a value of one (1) or two (2) using the following criteria:

- 1 = Supported by either suggestive clinical or epidemiological studies or theoretical rationale
- 2 = Supported by experimental, clinical, or epidemiological studies and strong theoretical rationale

Opportunity
The Opportunity Score for each individual measure is based on the Coefficient of Variation (Standard Deviation/Mean) of that measure, using the following formula: **[1 + (Standard Deviation/Mean)]**. The Opportunity Score is on a continuous scale that is capped at three (3). Any measure with an Opportunity Score above three (3) is assigned a three (3).

Impact
The Impact Score for each individual measure is comprised of two (2) parts, each of which is assigned a value from one (1) to three (3):

1. Number of patients affected
2. Severity of harm

The *number of patients affected* score is determined by the following:

- 1 = Rare event (e.g., Foreign Object Retained After Surgery)
- 2 = Some patients in hospital affected (e.g., ICU Physician Staffing)
- 3 = All patients in hospital affected (e.g., Hand Hygiene Safe Practice)

The *severity of harm* score is determined by the following:

- 1 = No direct evidence of harm or harm reduction (e.g., Hand Hygiene Safe Practice)

- 2 = Clear documentation of harm or harm reduction; adverse events (e.g., Foreign Object Retained After Surgery)
- 3 = Significant mortality reduction (more than 1,000 deaths or a 10% reduction in hospital wide mortality) (e.g., ICU Physician Staffing)

The values from each part are then added together to arrive at the overall Impact Score using the following criteria:

- 1 = Score of 2 (Low Impact)
- 2 = Score of 3-4 (Medium Impact) (e.g., Foreign Object Retained After Surgery; Hand Hygiene Safe Practice)
- 3 = Score of 5-6 (High Impact) (e.g., ICU Physician Staffing)

Scoring Methodology

Once all data elements have been collected for a given hospital and all missing data have been scored appropriately, the Hospital Safety Score can be calculated using the methodology described below.

Calculating Z-Scores

Z-Scores are used to standardize data from individual measures with different scales. This allows for the comparison of individual scores from different types of data. For example, a raw score of 97% on SCIP-INF-1 cannot be compared to a CLABSI SIR rate of 0.87, as they are reported on different scales. Z-Scores can tell a hospital whether their score on a particular measure is above, below, or equal to the mean.

In the Scoring Methodology, a Z-Score is calculated for each measure that is applicable to a hospital. A z-Score is calculated using a hospital's actual (raw) measure score, the national mean, and the standard deviation for that measure. The z-Score for each measure is calculated using the following formulas:

- **For Process/Structural Measures: [Hospital Score – Mean) / Standard Deviation]**
- **For Outcome Measures: [(Mean – Hospital Score) / Standard Deviation]**

The following table includes the national mean and standard deviation for each measure. These values are used to calculate your hospital's Z-Score using the formula's above.

Measure Name	Mean	Standard Deviation
Process and Structural Measures		
Computerized Physician Order Entry (CPOE)	34.36	34.83
ICU Physician Staffing (IPS)	24.68	35.58

Safe Practice 1: Leadership Structures and Systems	109.78	14.35
Safe Practice 2: Culture Measurement, Feedback and Intervention	17.54	5.05
Safe Practice 3: Teamwork Training and Skill Building	33.57	9.36
Safe Practice 4: Identification and Mitigation of Risks and Hazards	106.75	20.36
Safe Practice 9: Nursing Workforce	89.50	16.28
Safe Practice 17: Medication Reconciliation	31.47	5.61
Safe Practice 19: Hand Hygiene	27.13	5.25
Safe Practice 23: Care of the Ventilated Patient	18.02	3.41
SCIP INF 1: Antibiotic within 1 Hour	98.24	2.17
SCIP INF 2: Antibiotic Selection	98.23	2.19
SCIP INF 3: Antibiotic Discontinued After 24 Hours	96.98	2.95
SCIP INF 9: Catheter Removal	93.83	6.27
SCIP VTE 2: VTE Prophylaxis	96.97	3.31
Outcomes Measures		
Foreign Object Retained	0.024	0.06
Air Embolism	0.002	0.01
Pressure Ulcer – Stages 3 and 4	0.119	0.20
Falls and Trauma	0.540	0.39
CLABSI	0.543	0.51
PSI 4: Death Among Surgical Inpatients	113.65	18.69
PSI 6: Iatrogenic Pneumothorax	0.344	0.12
PSI 12: Postoperative PE/DVT	4.538	1.91
PSI 14: Postoperative Wound Dehiscence	0.970	0.54
PSI 15: Accidental Puncture or Laceration	1.997	0.75

A note about negative z-scores

To ensure that a single measure does not dominate a hospital's overall score in an unintended way, Leapfrog truncated negative z-scores at -5.00. Hospitals that have a calculated z-score below -5.00 on a measure will receive a modified z-score of -5.00 on that measure.

Calculating Weighted Measure Scores

Weighted Process Score. To find the weighted process score, first multiply the z-Score of each process measure by the weight assigned for that measure to get the weighted process measure score. (Remember, if your hospital was not applicable on other process measures, your

hospital's weight on any given process or structural measure may differ from the standard weight.) Then, find the total process score by adding the weighted process measure scores of each process measure together. This is your hospital's overall weighted process score.

Weighted Outcome Score. To find the weighted outcome score, first multiply the z-Score of each outcome measure by the weight assigned to that measure to get the weighted outcome measure score. (Remember, if your hospital was not applicable on other outcome measures, your hospital's weight on any given measure may differ from the standard weight.) Then, find the total outcome score by adding the weighted outcome measure scores of each outcome measure together. This is your hospital's overall weighted outcome score.

Calculating Overall Patient Safety Score

To calculate the overall Hospital Safety Score for your hospital, add the overall weighted process score and the overall weighted outcome score calculated in the previous step. Add 3.0 to your score; this is done to normalize scores to a positive distribution. This is your final Hospital Safety Score.

Appendix A. Scoring Worksheet

Measure Category	Overall Category Weight	Measure	Your Hospital's Score	Mean	Standard Deviation	Your Hospital's Z-Score	Standard Weight	Your Weight	Weighted Measure Score
Process/Structural	50%	CPOE		34.36	34.83		6.1%		
		IPS		24.68	35.58		7.0%		
		SP 1		109.78	14.35		2.5%		
		SP 2		17.54	5.05		2.7%		
		SP 3		33.57	9.36		2.7%		
		SP 4		106.75	20.36		2.6%		
		SP 9		89.50	16.28		3.4%		
		SP 17		31.47	5.61		2.5%		
		SP 19		27.13	5.25		3.3%		
		SP 23		18.02	3.41		2.6%		
		SCIP-INF-1		98.24	2.17		3.1%		
		SCIP-INF-2		98.23	2.19		2.3%		
		SCIP-INF-3		96.98	2.95		2.3%		
		SCIP-INF-9		93.83	6.27		3.1%		
		SCIP-VTE-2		96.97	3.31		3.9%		
Outcome	50%	HAC: Foreign Object Retained		0.024	0.06		6.0%		
		HAC: Air Embolism		0.002	0.01		6.0%		
		HAC: Pressure Ulcers		0.119	0.20		7.7%		
		HAC: Falls and Trauma		0.540	0.39		6.2%		
		CLABSI		0.543	0.51		6.8%		
		PSI 4		113.65	18.69		2.9%		
		PSI 6		0.344	0.12		3.2%		
		PSI 12		4.538	1.91		3.3%		
		PSI 14		0.970	0.54		3.5%		
		PSI 15		1.997	0.75		4.4%		
Process Measure Score (Sum of all Process/Structural Measures):									
Outcome Measure Score (Sum of all Outcome Measures):									
Numerical Safety Score (add 3.0 to normalize score)									

Appendix B. Hospital Safety Score Measures and Weights

Measure Category	Overall Category Weight	Measure	Evidence Score	Opportunity Score	Impact Score	Measure Weight
Process/Structural	50%	CPOE	2	2.01	3	6.1%
		IPS	2	2.44	3	7.0%
		SP 1	1	1.13	2	2.5%
		SP 2	1	1.29	2	2.7%
		SP 3	1	1.28	2	2.7%
		SP 4	1	1.19	2	2.6%
		SP 9	1	1.18	3	3.4%
		SP 17	1	1.18	2	2.5%
		SP 19	2	1.19	2	3.3%
		SP 23	1	1.19	2	2.6%
		SCIP-INF-1	2	1.02	2	3.1%
		SCIP-INF-2	1	1.02	2	2.3%
		SCIP-INF-3	1	1.03	2	2.3%
		SCIP-INF-9	2	1.07	2	3.1%
		SCIP-VTE-2	2	1.03	3	3.9%
Outcome	50%	HAC: Foreign Object Retained	1	3.00	2	6.0%
		HAC: Air Embolism	1	3.00	2	6.0%
		HAC: Pressure Ulcers	1	2.65	3	7.7%
		HAC: Falls and Trauma	2	1.72	3	6.2%
		CLABSI	2	1.95	3	6.8%
		PSI 4	1	1.16	2	2.9%
		PSI 6	1	1.35	2	3.2%
		PSI 12	1	1.42	2	3.3%
		PSI 14	1	1.56	2	3.5%
		PSI 15	1	1.38	3	4.4%

Safety Score Help Desk

If you have any questions regarding the scoring methodology, please contact the Help Desk at ScoreHelp@leapfroggroup.org.

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[i] Source AHA Annual Survey, Health Forum, LLC, a subsidiary of the American Hospital Association
[ii] AHA Annual Survey © 2011 Health Forum, LLC