



## 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 #:** 2362e

**Corresponding Measures:**

**De.2. Measure Title:** Glycemic Control - Hyperglycemia

**Co.1.1. Measure Steward:** Centers for Medicare and Medicaid Services

**De.3. Brief Description of Measure:** Average percentage of hyperglycemic hospital days for individuals with a diagnosis of diabetes mellitus, anti-diabetic drugs (except metformin) administered, or at least one elevated glucose level during the hospital stay

**1b.1. Developer Rationale:** This safety measure relates to glycemic control and hyperglycemia management in the hospital inpatient setting and is proposed with its companion balancing measure related to hypoglycemia (Glycemic Control - Hypoglycemia). Hyperglycemia is an intermediate outcome that occurs frequently in the inpatient setting, despite serious consequences, including longer lengths of stay and increased risk of infection and mortality. Several important benefits related to quality improvement are envisioned with the implementation of this measure. Specifically, the measure will draw providers' attention to individuals in the hospital setting who are at risk of developing hyperglycemia and will encourage providers to monitor and manage blood glucose levels more carefully in the inpatient setting. Lower rates of hyperglycemia are expected to result in lower rates of in-hospital mortality and infection and shorter lengths of stay. Adoption of this performance measure has the potential to improve the quality of care for individuals with hyperglycemia and, therefore, advance the quality of care in the area of patient safety, a priority area identified in the National Quality Strategy.

**S.4. Numerator Statement:** Sum of the percentage of hospital days in hyperglycemia for each admission in the denominator

**S.6. Denominator Statement:** Total number of admissions with a diagnosis of diabetes mellitus, at least one administration of insulin or any anti-diabetic medication except metformin, or at least one elevated blood glucose value (>200 mg/dL [11.1 mmol/L]) at any time during the entire hospital stay

**S.8. Denominator Exclusions:** The following admissions are excluded from the denominator:

- Admissions with diagnosis of diabetic ketoacidosis (DKA) or hyperglycemic hyperosmolar syndrome (HHS)
- Admissions without any hospital days included in analysis
- Admissions with lengths of stay greater than 120 days

**De.1. Measure Type:** Outcome

**S.17. Data Source:** Electronic Health Records, Electronic Health Records : Electronic Health Record, Laboratory, Pharmacy

**S.20. Level of Analysis:** Facility

**IF Endorsement Maintenance – Original Endorsement Date:** Sep 02, 2014 **Most Recent Endorsement Date:** Sep 02, 2014

**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?** This measure is paired with the measure Glycemic Control – Hypoglycemia. The purpose of the pairing is to serve as a balancing measure and avoid unintended consequences.

### 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**

[Glycemic\\_Control\\_Hyperglycemia\\_Evidence\\_Form.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.

**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.*

This safety measure relates to glycemic control and hyperglycemia management in the hospital inpatient setting and is proposed with its companion balancing measure related to hypoglycemia (Glycemic Control - Hypoglycemia). Hyperglycemia is an intermediate outcome that occurs frequently in the inpatient setting, despite serious consequences, including longer lengths of stay and increased risk of infection and mortality. Several important benefits related to quality improvement are envisioned with the implementation of this measure. Specifically, the measure will draw providers' attention to individuals in the hospital setting who are at risk of developing hyperglycemia and will encourage providers to monitor and manage blood glucose levels more carefully in the inpatient setting. Lower rates of hyperglycemia are expected to result in lower rates of in-hospital mortality and infection and shorter lengths of stay. Adoption of this performance measure has the potential to improve the quality of care for individuals with hyperglycemia and, therefore, advance the quality of care in the area of patient safety, a priority area identified in the National Quality Strategy.

**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.**

The measure was tested in eight hospitals in four states (AZ, FL, MO, and TX). The hospitals varied in size (25-695 beds), types (critical access hospital, acute care community hospital, and level I trauma center), teaching status (teaching vs. non-teaching hospital), and EHR systems (Cerner, Epic, and McKesson). The test sample from each institution included at least 5,000 inpatient admissions or one year of admissions. A detailed breakdown of the characteristics of the measured facilities and the patient population can be found in sections 1.5 and 1.6 of the attached Measure Testing Submission Form.

The measure performance, including the denominator, numerator, and the measure rate by hospital, is presented below.

Hospital ID / Dates of Data / Denominator / Numerator / Measure Rate / 95% Confidence Interval

1 / Jul 1, 2011 - Oct 1, 2011 / 2,033 / 453.69 / 22.32% / 20.54 - 24.19  
 2 / Apr 1, 2012 - Aug 31, 2012 / 853 / 238.35 / 27.94% / 25.01 - 31.09  
 3 / Jan 3, 2011 - Jan 8, 2012 / 74 / 24.38 / 32.95% / 23.12 - 44.85  
 4 / Jan 1, 2012 - Feb 8, 2013 / 2,747 / 789.37 / 28.74% / 27.07 - 30.47  
 5 / Jan 27, 2012 - Dec 31, 2012 / 2,058 / 513.21 / 24.94% / 23.10 - 26.87  
 6 / Mar 1, 2012 - Dec 31, 2012 / 2,215 / 632.04 / 28.53% / 26.69 - 30.47  
 7 / Jun 7, 2011 - Dec 31, 2012 / 2,624 / 762.54 / 29.06% / 27.35 - 30.84  
 8 / Apr 1, 2012 - Jun 30, 2012 / 1,316 / 348.84 / 26.51% / 24.18 - 28.98

Mean: 27.62%

Std. Deviation: 3.15%

Min: 22.32%  
 Max: 32.95%  
 Interquartile Range: 3.18%  
 10th Percentile: 22.32%  
 25th Percentile: 25.72%  
 50th Percentile: 28.24%  
 75th Percentile: 28.90%  
 90th Percentile: 32.95%

**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.**

Five recent studies (Boord et al., 2009; Cook et al., 2009; Matheny et al., 2008; Swanson et al., 2011; Wexler et al., 2007) demonstrate high rates of hyperglycemia among hospitalized individuals and indicate a performance gap in glycemic control in the hospital setting. Rates of persistent hyperglycemia (i.e., glucose values >200 mg/dL for three consecutive days) were reported to be 18% and 38% of non-ICU patients with diabetes from the VHA and the University Health System Consortium (UHC), respectively (Wexler et al., 2007). The 200 mg/dL threshold used in the Wexler et al. study is consistent with the definition used in the proposed measure. The rate of hyperglycemia based on a 180 mg/dL threshold was reported in four studies. The rate of hyperglycemia for ICU patient-days ranged from 32.2% (Swanson et al., 2011) to 46.0% (Cook et al., 2009), and non-ICU patient days ranged from 31.7% (Cook et al., 2009) to 54.2% (Matheny et al., 2008). The individual studies and our testing results are described below.

Summary of Published Studies on Variation in Inpatient Hyperglycemia Rates

Boord et al. (2009): This study evaluated glycemic management in the hospital setting using retrospective University Health System Consortium (UHC) data. The study population included patients aged 18 years and older with a 72-hour or longer hospital stay, who were discharged between July and September of 2004 from 37 medical centers with selected diagnosis-related groups (DRGs). A total of 1,718 eligible patients met one of two criteria: either two consecutive blood glucose readings >180 mg/dL within 24 hours, or received insulin treatment any time during hospitalization. Seventy-nine percent of the eligible patients had a prior diagnosis of diabetes and 84.6% received insulin on the second measurement day. Hyperglycemia was common with 50% of all eligible patients having at least one glucose measurement =180 mg/dL on measurement days two and three, and 18% had a median glucose =180 mg/dL on all three measurement days.

Cook et al. (2009): This study used results from 12,559,305 point-of-care bedside glucose tests for adult patients from 126 hospitals from January through December 2007 to estimate glycemic control in U.S. hospitals. Of the analyzed measurements, 2,935,167 were from ICUs, and 9,624,138 were from non-ICUs. The prevalence (% of patient days) of hospital hyperglycemia (patient-day-weighted mean of point-of-care blood glucose >180 mg/dL) was estimated to be 46.0% for ICU and 31.7% for non-ICU patients.

Matheny et al. (2008): This study evaluated the relationship between treatment intensification and blood glucose in 3,613 patients with diabetes hospitalized between January 2003 and August 2004. The study population included patients who were not in an ICU, were not prescribed intravenous insulin or parenteral nutrition, had a length of stay of at least three days, and had at least one point of care blood glucose measurement. The mean age of patients was 64.1 years. Inpatient hyperglycemia (BG =180 mg/dL) was identified at least once in 82.5% of patient hospitalizations and 54.2% of patient days.

Swanson et al. (2011): This study analyzed results from 49,191,313 point-of-care bedside glucose tests for adult patients from 575 hospitals from January 2009 through December 2009 to evaluate glucose control in U.S. hospitals. Of the analyzed measurements, 12,176,299 were from intensive care units and 37,015,014 were non-ICU, representing 653,359 ICU patients and 2,831,436 non-ICU patients. The prevalence of hospital hyperglycemia (BG >180 mg/dL) was estimated to be 32.2% of ICU patient-days and 32.0% of non-ICU patient-days, based on patient-day-weighted mean of point-of-care.

Wexler et al. (2007): This study of hospitalized patients estimated that 18% and 38% of patients with diabetes from the VHA and the University Health System Consortium (UHC), respectively, experienced persistent hyperglycemia (i.e., glucose values >200 mg/dL for three consecutive days) during their hospital stays. The study used inpatient and outpatient data from patient charts for 274 patients, 18 years and older, diagnosed with type 1 and type 2 diabetes, who were admitted as inpatients to 1 of 29 selected medical centers in 20 states (UHC cohort) and data from 725 general medical and surgical patients over 18 years of age with a primary or secondary discharge diagnosis of diabetes (VHA, Inc., cohort).

**Conclusion**

Estimates of inpatient hyperglycemia rates from recently published studies suggest a clear performance gap. The rates of hyperglycemia ranged from 32.2% to 46.0% for ICU patient-days and from 31.7% to 54.2% for non-ICU patient-days.

**Citations for Section 1b.3**

Boord, J. B., Greevy, R. A., Braithwaite, S. S., Arnold, P. C., Selig, P. M., Brake, H., . . . Baldwin, D. (2009). Evaluation of hospital glycemic control at US academic medical centers. *Journal of Hospital Medicine*, 4(1), 35-44.

Cook, C. B., Kongable, G. L., Potter, D. J., Abad, V. J., Leija, D. E., & Anderson, M. (2009). Inpatient glucose control: A glycemic survey of 126 U.S. hospitals. *Journal of Hospital Medicine*, 4(9), E7-E14.

Matheny, M. E., Shubina, M., Kimmel, Z. M., Pendergrass, M. L., & Turchin, A. (2008). Treatment intensification and blood glucose control among hospitalized diabetic patients. *Journal of General Internal Medicine*, 23(2), 184-189.

Swanson, C. M., Potter, D. J., Kongable, G. L., & Cook, C. B. (2011). Update on inpatient glycemic control in hospitals in the United States. *Endocr Pract*, 17(6), 853-861.

Wexler, D. J., Meigs, J. B., Cagliero, E., Nathan, D. M., & Grant, R. W. (2007). Prevalence of hyper- and hypoglycemia among inpatients with diabetes: A national survey of 44 U.S. hospitals. *Diabetes Care*, 30(2), 367-369.

**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.

The measure performance was stratified for disparities by age, race/ethnicity, and payor source (Medicare vs. Medicaid).

**Measure Performance by Age and Race/Ethnicity****Category / Denominator / Numerator / Measure Rate**

All Ages / 13,920 / 3762.42 / 27.03%

White / 10,547 / 2850.67 / 27.03%

African American / 1,154 / 310.40 / 26.90%

Hispanic / 465 / 148.42 / 31.92%

Other / 1,754 / 452.94 / 25.82%

18-24 / 150 / 32.73 / 21.82%

White / 76 / 15.12 / 19.90%

African American / 26 / 6.95 / 26.73%

Hispanic / 18 / 3.5 / 19.44%

Other / 30 / 7.15 / 23.84%

25-44 / 1,063 / 269.93 / 25.39%

White / 520 / 133.50 / 25.67%

African American / 161 / 38.14 / 23.69%

Hispanic / 124 / 34.13 / 27.53%

Other / 258 / 64.16 / 24.87%

45-64 / 4,333 / 1,219.05 / 28.13%

White / 2,794 / 783.89 / 28.06%

African American / 533 / 159.35 / 29.90%

Hispanic / 211 / 78.83 / 37.36%

Other / 795 / 196.98 / 24.78%

65-74 / 3,291 / 909.51 / 27.64%  
White / 2,617 / 719.83 / 27.51%  
African American / 256 / 69.47 / 27.14%  
Hispanic / 71 / 19.95 / 28.10%  
Other / 347 / 100.26 / 28.89%

75-84 / 3,248 / 883.40 / 27.20%  
White / 2,875 / 788.50 / 27.43%  
African American / 112 / 24.17 / 21.58%  
Hispanic / 33 / 10.55 / 31.97%  
Other / 228 / 60.17 / 26.39%

85+ / 1,835 / 447.80 / 24.40%  
White / 1,665 / 409.82 / 24.61%  
African American / 66 / 12.32 / 18.66%  
Hispanic / 8 / 1.45 / 18.13%  
Other / 96 / 24.21 / 25.22%

#### Measure Performance by Payor Source and Age

Medicare / 9,512 / 2,622.13 / 27.57%  
18-24 / 9 / 1.66 / 18.49%  
25-44 / 182 / 54.71 / 30.06%  
45-64 / 1,449 / 449.89 / 31.05%  
65-74 / 2,955 / 818.80 / 27.71%  
75-84 / 3,130 / 855.80 / 27.34%  
85+ / 1,787 / 441.26 / 24.69%

Medicaid / 1,166 / 322.82 / 27.69%  
18-24 / 62 / 16.70 / 26.94%  
25-44 / 270 / 69.68 / 25.81%  
45-64 / 769 / 216.12 / 28.10%  
65-74 / 40 / 13.66 / 34.16%  
75-84 / 16 / 5.05 / 31.56%  
85+ / 9 / 1.60 / 17.80%

Self-Pay / 590 / 175.06 / 29.67%  
18-24 / 16 / 1.73 / 10.83%  
25-44 / 159 / 41.11 / 25.85%  
45-64 / 365 / 119.67 / 32.75%  
65-74 / 30 / 7.28 / 24.25%  
75-84 / 15 / 4.78 / 31.83%  
85+ / 5 / 0.5 / 10.00%

Other / 2,652 / 642.41 / 24.22%  
18-24 / 63 / 12.63 / 20.04%  
25-44 / 452 / 104.43 / 23.11%  
45-64 / 1,750 / 433.37 / 24.76%  
65-74 / 266 / 69.77 / 26.32%  
75-84 / 87 / 17.78 / 20.43%  
85+ / 34 / 4.44 / 13.06%

Hispanics have significantly higher rates than African American (p-value=0.0393), White (p-value=0.0211), and Other (p-value=0.0091). There were no statistical differences between the other race groups.

Patients age 85+ had significantly lower rates than patients ages 45-74 (versus 45 -64, p-value=0.0033; versus 65-74, p-value=0.0276). There were no statistical differences between the remaining age groups.

**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**

In regard to disparities related to race/ethnicity, rates of hyperglycemia were higher among Hispanics than among African Americans and Whites. Two studies are included that describe disparities related to hyperglycemia.

Gentile & Seftchick (2008): In this retrospective study of 960 patients with acute ischemic stroke treated at an urban tertiary care center, Hispanic patients were observed to have higher mean blood glucose levels than African American or White patients at baseline (171.8, 141.9 and 150.2 mg/dL, respectively, p=0.036), 24 hours (162.5, 149.7, and 138.5 mg/dL, p=0.008) and 48 hours after admission (167.2, 140.8, and 135.0 mg/dL, p=0.006).

Jackson, Amdur, White, & Mascata, (2012): Investigators used data from the Veterans Affairs Surgical Quality Improvement Program database for 7,576 and 5,773 colectomy procedures to study the effect of operative day blood glucose levels and postoperative day-1 blood glucose levels, respectively, on patient outcomes. In the sample of postoperative day-1 blood glucose values, the rate of severe hyperglycemia (>200 mg/dL) was higher among Hispanics (11.3%) than among African Americans (8.5%) and Caucasians (9.7%) (p<0.001 for relationship between blood glucose values and race).

Citations for Section 1b.5

Gentile, N., & Seftchick, M. (2008). Poor outcomes in Hispanic and African American patients after acute ischemic stroke: Influence of diabetes and hyperglycemia. *Ethnicity & Disease*, 18, 331-335.

Jackson, R., Amdur, R., White, J., & Mascata, R. (2012). Hyperglycemia is associated with increased risk of morbidity and mortality after colectomy for cancer. *Journal of the American College of Surgeons*, 214(1), 68-80.

## 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):

Endocrine : Diabetes

**De.6. Non-Condition Specific**(check all the areas that apply):

Safety, Safety : Medication

**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.)

**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 an eMeasure Attachment: [Hyperglycemia\\_MAT\\_package\\_new.zip](#)

**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:** [Glycemic\\_Control\\_Measure\\_Value\\_Sets\\_-\\_hyper.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.

**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.

**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.

**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.

[Not applicable](#)

**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).*

[Sum of the percentage of hospital days in hyperglycemia for each admission in the denominator](#)

**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).*

[Hyperglycemic hospital days are defined as days in which:](#)

1. [Two or more blood glucose levels were elevated \(>200 mg/dL \[11.1 mmol/L\]\), measured at least six hours apart;](#)
- [Or](#)
2. [A single blood glucose level was elevated, if only one value was available that day;](#)
- [Or](#)
3. [No blood glucose level was measured that day, and it was not preceded by two normoglycemic days.](#)

**S.6. Denominator Statement** (Brief, narrative description of the target population being measured)

[Total number of admissions with a diagnosis of diabetes mellitus, at least one administration of insulin or any anti-diabetic medication except metformin, or at least one elevated blood glucose value \(>200 mg/dL \[11.1 mmol/L\]\) at any time during the entire hospital stay](#)

**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).*

[For each admission, hospital days included in the analysis are the first 10 calendar days during the hospital stay after excluding:](#)

- [• The 1st day \(date of admission\), if the patient is admitted before noon](#)
- [• The 1st and 2nd day, if the patient is admitted after noon or the patient is admitted before noon with the first glucose level >400 mg/dL](#)
- [• The 1st, 2nd, and 3rd day, if the patient is admitted after noon with the first glucose level >400 mg/dL](#)



- The day of discharge

For cardiothoracic (CT) surgery patients, the calendar days adjacent to the time period from operating room (OR) start time until OR end time plus 18 hours are removed from the analysis.

Table 1.1. Identification of Diabetes Mellitus

ICD-9-CM: 250.xx

ICD-10-CM: E10.10, E10.11, E10.21, E10.22, E10.29, E10.311, E10.319, E10.321, E10.329, E10.331, E10.339, E10.341, E10.349, E10.351, E10.359, E10.36, E10.39, E10.40, E10.41, E10.42, E10.43, E10.44, E10.49, E10.51, E10.52, E10.59, E10.610, E10.618, E10.620, E10.621, E10.622, E10.628, E10.630, E10.638, E10.641, E10.649, E10.65, E10.69, E10.8, E10.9, E11.00, E11.01, E11.21, E11.22, E11.29, E11.311, E11.319, E11.321, E11.329, E11.331, E11.339, E11.341, E11.349, E11.351, E11.359, E11.36, E11.39, E11.40, E11.41, E11.42, E11.43, E11.44, E11.49, E11.51, E11.52, E11.59, E11.610, E11.618, E11.620, E11.621, E11.622, E11.628, E11.630, E11.638, E11.641, E11.649, E11.65, E11.69, E11.8, E11.9, E13.00, E13.01, E13.10, E13.11, E13.21, E13.22, E13.29, E13.311, E13.319, E13.321, E13.329, E13.331, E13.339, E13.341, E13.349, E13.351, E13.359, E13.36, E13.39, E13.40, E13.41, E13.42, E13.43, E13.44, E13.49, E13.51, E13.52, E13.59, E13.610, E13.618, E13.620, E13.621, E13.622, E13.628, E13.630, E13.638, E13.641, E13.649, E13.65, E13.69, E13.8, E13.9

SNOMEDCT: 190329007, 190330002, 190331003, 190368000, 190369008, 190372001, 190389009, 190390000, 199229001, 199230006, 23045005, 237599002, 237618001, 26298008, 28032008, 313435000, 313436004, 314771006, 314772004, 314893005, 314903002, 314904008, 359642000, 44054006, 46635009, 71771000119100, 75682002, 81531005, 9859006

The following are the diabetic medications by class for the denominator. The route of administration includes all oral, inhalation, and injectable formulations of the medications listed below.

Table 1.2. Anti-Diabetic Medications Excluding Metformin

Generic names – Brand Names – Rx Norm Codes:

Alpha-glucosidase inhibitors:

acarbose – (Precose) – (199150, 200132, 199149, 209247, 209248, 213170)

miglitol – (Glyset) – (205331, 205329, 205330, 213485, 213486, 213487)

Anti-diabetic amylin analogs:

pramlintide – (Symlin) – (861042, 861044, 861039, 861041, 861043, 861045)

Anti-diabetic combinations:

glipizide-metformin (Metaglip, Glipizide/Metformin HCL) – (861731, 861736, 861740, 861733, 861738, 861742)

glyburide-metformin (Glucovance, Glyburide/Metformin HCL) – (861743, 861748, 861753, 861747, 861752, 861757)

linagliptin-metformin (Jentadueto)

pioglitazone-glimepiride (Duetact) – (647237, 647239, 731457, 731463)

pioglitazone-metformin (Actoplus MET) – (899989, 899996, 899993, 900000, 861783, 861822, 861785, 861824)

rosiglitazone-glimepiride (Avandaryl) – (602544, 602549, 706895, 602550, 706896, 847708, 847712, 847716, 847724)

rosiglitazone-metformin (Avandamet) – (861760, 861762, 861763, 861765, 861806, 8618086, 861816, 861818)

saxagliptin-metformin (Kombiglyze) – (1043563, 1043567, 1043570, 1043574, 1043578, 1043582)

sitagliptin-metformin (Janumet) – (861769, 861771, 861819, 861821)

repaglinide-metformin (Prandimet) – (861787, 861789, 861790, 861792)

sitagliptin-simvastatin (Juvisync) – (1189804, 1189808, 1189821)

Dipeptidyl peptidase-4 (dpp-4) inhibitors:

sitagliptin – (Januvia) – (665033, 665036, 665038, 665040, 665042, 665044)

saxagliptin – (Onglyza) – (858042, 858036, 858040, 858044)

linagliptin – (Tradjenta) – (1100702, 1100706)



#### Incretin mimetics:

exenatide – (Byetta, Bydureon) – (847915, 847910, 847913, 847917)  
 liraglutide – (Victoza) – (897122, 897126)

#### Insulin:

insulin detemir – (Levemir) – (847239, 484322, 616238, 847241)  
 insulin glargine – (Lantus, Solostar) – (285018, 847230, 311041, 847232)  
 insulin isophane & reg (human) – (Humulin, Novolin, Relion) – (245265, 311048, 847187, 847256, 106892, 213442, 847189)  
 insulin isophane (human) – (Humulin, Novolin, Relion) – (311026, 311027, 311028, 847278, 847199)

#### Rapid/Short-acting Insulin:

insulin aspart – (Novolog) – (311040, 1653196, 1653198, 1653202, 1653204)  
 insulin aspart protamine & aspart (human) – (Novolog) – (847191, 351297, 977840, 977842)  
 insulin glulisine – (Apidra) – (847259, 485210, 803194, 847261)  
 insulin lispro (human) – (Humalog) – (242120, 1652639, 1652640, 1652644, 1652646, 865098)  
 insulin lispro protamine & lispro (human) – (Humalog) – (847252, 847211, 259111, 260265, 731281, 752388, 847213, 847254)  
 insulin regular (human) includes inhalation – (Humulin, Exubera, Novolin) – (763020, 763015, 847417, 847203, 763013, 763014, 311034, 249220, 311033, 311036, 351859, 763017, 763018, 763019, 763080)

#### Meglitinides:

nateglinide – (Starlix) – (311919, 314142, 284529, 284530)  
 repaglinide – (Prandin) – (200257, 200256, 200258, 213218, 213219, 213220)

#### Sulfonylureas:

chlorpropamide – (Diabinese) – (197495, 197496)  
 glimepiride – (Amaryl) – (199245, 199246, 199247, 153591, 153843, 153845)  
 glipizide – (Glucotrol) – (315107, 310489, 314006, 310488, 310490, 205828, 205830, 865568, 865571, 865573)  
 glyburide – (Micronase, Diabeta) – (197737, 310534, 310537, 205872, 205873, 205875, 205876, 205879, 205880, 252960)  
 tolazamide – (Tolazamide) – (198292, 198293)  
 tolbutamide – (Tolbutamide) – (198294)  
 glyburide micronized – (Glynase, Glycron) – (252960, 310536, 310539, 314000, 881407, 881409, 881411)

#### Thiazolidinediones:

pioglitazone – (Actos) – (317573, 312440, 312441, 261266, 261267, 261268)  
 rosiglitazone – (Avandia) – (312859, 312860, 312861, 261241, 261242, 261243)

#### Table 1.3. LOINC Codes Used to Identify Glucose Tests\*

2339-0 – Glucose [Mass/Volume] in Blood  
 2340-8 – Glucose [Mass/Volume] in Blood by Test Strip Auto  
 2341-6 – Glucose [Mass/Volume] in Blood by Test Strip Manual  
 2345-7 – Glucose [Mass/Volume] in Serum or Plasma  
 32016-8 – Glucose [Mass/Volume] in Capillary Blood  
 41651-1 – Glucose [Mass/Volume] in Arterial Blood  
 41652-9 – Glucose [Mass/Volume] in Venous Blood  
 41653-7 – Glucose [Mass/Volume] in Capillary Blood by Glucometer

\*Definition of eligible glucose tests: random or peri-prandial blood (capillary, serum, plasma, whole blood) glucose tests excluding fasting or post-glucose

Note: Laboratory and point-of-care glucose tests are both required for the calculated measure rate to be valid.

#### Table 1.4. Codes Used to Identify Cardiac Procedures

ICD-10-CM: 0210093, 0210098, 0210099, 021009C, 021009F, 021009W, 02100A3, 02100A8, 02100A9, 02100AC, 02100AF, 02100AW, 02100J3, 02100J8, 02100J9, 02100JC, 02100JF, 02100JW, 02100K3, 02100K8, 02100K9, 02100KC, 02100KF, 02100KW,



02RF3KZ, 02RF47Z, 02RF48Z, 02RF4JZ, 02RF4KZ, 02RG07Z, 02RG08Z, 02RG0JZ, 02RG0KZ, 02RG37H, 02RG37Z, 02RG38H, 02RG38Z, 02RG3JH, 02RG3JZ, 02RG3KH, 02RG3KZ, 02RG47Z, 02RG48Z, 02RG4JZ, 02RG4KZ, 02RH07Z, 02RH08Z, 02RH0JZ, 02RH0KZ, 02RH37H, 02RH37Z, 02RH38H, 02RH38Z, 02RH3JH, 02RH3JZ, 02RH3KH, 02RH3KZ, 02RH47Z, 02RH48Z, 02RH4JZ, 02RH4KZ, 02RJ07Z, 02RJ08Z, 02RJ0JZ, 02RJ0KZ, 02RJ47Z, 02RJ48Z, 02RJ4JZ, 02RJ4KZ, 02RK07Z, 02RK08Z, 02RK0JZ, 02RK0KZ, 02RK47Z, 02RK48Z, 02RK4JZ, 02RK4KZ, 02RL07Z, 02RL08Z, 02RL0JZ, 02RL0KZ, 02RL47Z, 02RL48Z, 02RL4JZ, 02RL4KZ, 02RM07Z, 02RM08Z, 02RM0JZ, 02RM0KZ, 02RM47Z, 02RM48Z, 02RM4JZ, 02RM4KZ, 02RN07Z, 02RN08Z, 02RN0JZ, 02RN0KZ, 02RN47Z, 02RN48Z, 02RN4JZ, 02RN4KZ, 02RP0JZ, 02RQ07Z, 02RQ0JZ, 02RR07Z, 02RR0JZ, 02SP0ZZ, 02SW0ZZ, 02T50ZZ, 02T53ZZ, 02T54ZZ, 02T80ZZ, 02T90ZZ, 02T93ZZ, 02T94ZZ, 02TD0ZZ, 02TD3ZZ, 02TD4ZZ, 02TH0ZZ, 02TH3ZZ, 02TH4ZZ, 02TM0ZZ, 02TM3ZZ, 02TM4ZZ, 02U507Z, 02U508Z, 02U50JZ, 02U50KZ, 02U537Z, 02U538Z, 02U53JZ, 02U53KZ, 02U547Z, 02U548Z, 02U54JZ, 02U54KZ, 02U607Z, 02U608Z, 02U60JZ, 02U60KZ, 02U637Z, 02U638Z, 02U63JZ, 02U63KZ, 02U647Z, 02U648Z, 02U64JZ, 02U64KZ, 02U707Z, 02U708Z, 02U70JZ, 02U70KZ, 02U737Z, 02U738Z, 02U73KZ, 02U747Z, 02U748Z, 02U74KZ, 02U907Z, 02U908Z, 02U90JZ, 02U90KZ, 02U937Z, 02U938Z, 02U93JZ, 02U93KZ, 02U947Z, 02U948Z, 02U94JZ, 02U94KZ, 02UA07Z, 02UA08Z, 02UA0JZ, 02UA0KZ, 02UA37Z, 02UA38Z, 02UA3JZ, 02UA3KZ, 02UA47Z, 02UA48Z, 02UA4JZ, 02UA4KZ, 02UD07Z, 02UD08Z, 02UD0JZ, 02UD0KZ, 02UD37Z, 02UD38Z, 02UD3JZ, 02UD3KZ, 02UD47Z, 02UD48Z, 02UD4JZ, 02UD4KZ, 02UF07Z, 02UF08Z, 02UF0JZ, 02UF0KZ, 02UF37Z, 02UF38Z, 02UF3JZ, 02UF3KZ, 02UF47Z, 02UF48Z, 02UF4JZ, 02UF4KZ, 02UG07Z, 02UG08Z, 02UG0JZ, 02UG0KZ, 02UG37Z, 02UG38Z, 02UG3JZ, 02UG3KZ, 02UG47Z, 02UG48Z, 02UG4JZ, 02UG4KZ, 02UH07Z, 02UH08Z, 02UH0JZ, 02UH0KZ, 02UH37Z, 02UH38Z, 02UH3JZ, 02UH3KZ, 02UH47Z, 02UH48Z, 02UH4JZ, 02UH4KZ, 02UJ07Z, 02UJ08Z, 02UJ0JZ, 02UJ0KZ, 02UJ37Z, 02UJ38Z, 02UJ3JZ, 02UJ3KZ, 02UJ47Z, 02UJ48Z, 02UJ4JZ, 02UJ4KZ, 02UK07Z, 02UK08Z, 02UK0JZ, 02UK0KZ, 02UK37Z, 02UK38Z, 02UK3JZ, 02UK3KZ, 02UK47Z, 02UK48Z, 02UK4JZ, 02UK4KZ, 02UL07Z, 02UL08Z, 02UL0JZ, 02UL0KZ, 02UL37Z, 02UL38Z, 02UL3JZ, 02UL3KZ, 02UL47Z, 02UL48Z, 02UL4JZ, 02UL4KZ, 02UM07Z, 02UM08Z, 02UM0JZ, 02UM0KZ, 02UM37Z, 02UM38Z, 02UM3JZ, 02UM3KZ, 02UM47Z, 02UM48Z, 02UM4JZ, 02UM4KZ, 02UN07Z, 02UN08Z, 02UN0JZ, 02UN0KZ, 02UN37Z, 02UN38Z, 02UN3JZ, 02UN3KZ, 02UN47Z, 02UN48Z, 02UN4JZ, 02UN4KZ, 02VA0CZ, 02VA0ZZ, 02VA3CZ, 02VA3ZZ, 02VA4CZ, 02VA4ZZ, 02VR0ZT, 02WA02Z, 02WA03Z, 02WA07Z, 02WA08Z, 02WA0CZ, 02WA0DZ, 02WA0KZ, 02WA0QZ, 02WA0RZ, 02WA32Z, 02WA33Z, 02WA37Z, 02WA38Z, 02WA3CZ, 02WA3DZ, 02WA3JZ, 02WA3KZ, 02WA3QZ, 02WA3RZ, 02WA42Z, 02WA43Z, 02WA47Z, 02WA48Z, 02WA4CZ, 02WA4DZ, 02WA4JZ, 02WA4KZ, 02WA4QZ, 02WA4RZ, 0KXF0ZZ, 0KXG0ZZ, OPT10ZZ, OPT20ZZ, OWFD0ZZ, OWFD3ZZ, OWFD4ZZ, OWFDXZZ, 5A02116

#### S.8. Denominator Exclusions (Brief narrative description of exclusions from the target population)

The following admissions are excluded from the denominator:

- Admissions with diagnosis of diabetic ketoacidosis (DKA) or hyperglycemic hyperosmolar syndrome (HHS)
- Admissions without any hospital days included in analysis
- Admissions with lengths of stay greater than 120 days

**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.)

Table 1.5. Identification of Diabetic Ketoacidosis

SNOMEDCT: 111556005, 190406000, 26298008, 420270002, 420422005, 421750000, 421075007, 421847006

Table 1.6. Identification of Hyperglycemic Hyperosmolar Syndrome

ICD-9-CM: 250.20, 250.21, 250.22, 250.23, 249.20, 249.21

ICD-10-CM: E08.00, E08.01, E08.65, E09.00, E09.01, E10.65, E10.69, E11.00, E11.01, E11.65, E13.00, E13.01

SNOMEDCT: 190329007, 190330002, 190331003, 310505005, 314771006, 395204000, 421164006, 422126006, 428896009

**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.)

Depending on the operational use of the measure, measure results will be stratified by:

- Care units (intensive care unit vs. non-intensive care unit)
- Hospital days will be assigned to the unit with the majority of time.
- Type of patients (medical vs. surgical)

- Daily cumulative steroid dose (=10 mg, 10-499 mg, =500 mg prednisone equivalents)

Table 1.7 MSDRG Codes Used to Identify Surgical Patients

001, 002, 003, 004, 005, 006, 007, 008, 009, 010, 011, 012, 013, 014, 015, 016, 017, 020, 021, 022, 023, 024, 025, 026, 027, 028, 029, 030, 031, 032, 033, 034, 035, 036, 037, 038, 039, 040, 041, 042, 049, 050, 051, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 400, 401, 402, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 525, 526, 527, 528, 529, 530, 531, 532, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 765, 766, 767, 768, 769, 770, 799, 800, 801, 802, 803, 804, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 853, 854, 855, 856, 857, 858, 876, 901, 902, 903, 904, 905, 906, 907, 908, 909, 927, 928, 929, 939, 940, 941, 955, 956, 957, 958, 959, 969, 970, 981, 982, 983, 984, 985, 986, 987, 988, 989

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

Stratification by risk category/subgroup

If other:

**S.12. Type of score:**

Ratio

If other:

**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.)

Target Population

Inpatient admissions/encounters where individuals are at least 18 years of age on admission date, both admission and discharge dates are within the measurement period, and the length of stay is less than 120 days

Denominator: Total number of admissions with a diagnosis of diabetes mellitus, at least one administration of insulin or any oral anti-diabetic medication except metformin, or at least one elevated blood glucose value (>200 mg/dL [11.1 mmol/L]) at any time during the entire hospital stay

1. Was the admission during the measurement period? If Yes, go to Step 2. If No, exclude.
2. Determine the patient's age in years. The patient's age is equal to the admission date minus the birth date. If the patient is at least 18 years old, go to Step 3. If less than 18 years old, exclude from the measure population.
3. Determine the length of hospital stay in days. The length of stay is equal to the discharge date minus the admission date. If the length of stay is less than or equal to 120 days, move to step 4. If the length of stay is greater than 120 days, exclude from the measure population.
4. During the admission did the patient have a diagnosis of diabetes mellitus (on Table 1.1), or receive an anti-diabetic medication excluding Metformin (on Table 1.2), or have at least one elevated blood glucose level greater than 200 mg/dL (on Table 1.3)? If Yes, go to Step 5. If No, exclude from the measure population.
5. Determine if, during the admission, any random or peri-prandial blood glucose tests (on Table 1.3) were conducted. If Yes,

go to Step 6. If No, exclude from the measure population.

6. If there was no diagnosis of diabetic ketoacidosis (DKA on Table 1.5) during the admission, go to Step 7. If there was a diagnosis of DKA, exclude from the measure population.

7. If there was no diagnosis of hyperglycemic hyperosmolar syndrome (HHS on Table 1.6) during the admission, determine the measureable days, as described in Step 8. If there was a diagnosis of HHS, exclude from the measure population.

8. To determine the measureable days in the admission:

a. Remove the admission and discharge day.

b. Remove the first day following the admission date, if the patient was admitted after noon or the patient was admitted before noon with the first blood glucose level greater than 400 mg/dL.

c. Remove the first and second day following the admission date, if the patient was admitted after noon with the first glucose level greater than 400 mg/dL.

d. Remove any days in which any part of the day was covered by the patient in the operating room (OR) for a cardio-thoracic procedure (on Table 1.4) through 18 hours after they leave the OR.

9. Is there at least one measurable day left? If Yes, go to Step 10. If No, exclude from the measure population.

10. If there were 10 calendar days or less, go to Step 11. Exclude any calendar days over 10 days from the measure population.

11. Count the number of admissions left. The total number of the qualifying admissions is the measure denominator.

Numerator: Sum of the percentage of hospital days in hyperglycemia for all admissions in the denominator

1. For each calendar day identified in Step 10 of the denominator logic, extract the test results that are from either random or peri-prandial blood glucose tests. Sort them by the collection time in ascending order.

2. For each day, determine if there were at least six hours between the first elevated blood glucose level (> 200 mg/dL) and the last elevated blood glucose level; or there was one single elevated blood glucose level (if only one value was available); or no blood glucose level was measured and two normoglycemic days did not precede it. If Yes, mark the day as a Hyperglycemic Day. If No, exclude the day from the numerator population.

3. For each admission, count the number of Hyperglycemic Days (from Numerator Step 2) and the number of measureable days qualified for the measure (from Denominator Step 10).

4. Calculate the percentage of hospitals days in hyperglycemia, which is equal to Hyperglycemic Days divided by measureable days.

5. Add the percentages calculated in Step 4 from all the admissions in the denominator. The sum of the percentage is the measure numerator.

**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; this measure does not use a sample or survey.

**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; this measure does not use a sample or survey.

**S.17. Data Source** (Check ONLY the sources for which the measure is SPECIFIED AND TESTED).

If other, please describe in S.18.

Electronic Health Records, Electronic Health Records : Electronic Health Record, Laboratory, Pharmacy

**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.

- Hospital electronic health record (EHR) data

- For measure calculation, the following EHR data were required:

- o Inpatient (IP) Master Patient file with demographic, diagnostic, and procedural information for inpatients

- o Glucose test file with the names, results, and times of glucose tests for both laboratory and point-of-care testing

- o Medication administration records (MARs) for anti-diabetic drugs

- o Location file with the care units and the start and end times of patients' stays

**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)

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.)

Not applicable

## **2. Validity – See attached Measure Testing Submission Form**

[Glycemic\\_Control\\_Hyperglycemia\\_Measure\\_Testing\\_Form.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.*

### **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.*

### **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.*

## **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.**

Generated or collected by and used by healthcare personnel during the provision of care (e.g., blood pressure, lab value, diagnosis, depression score)

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 health records (EHRs)

**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.**

The measure was specified as an eCQM to standardize data collection from the hospital EHR. For hospitals that did not have standard value sets implemented, electronic data extraction could be fully automated by programming the measure using the algorithm/data extraction protocol defined in the measure specifications (i.e., customization of the HQMF/XML to the specific hospital) and developing a site-specific crosswalk to the standardized data elements and value sets. Specifically, field testing hospitals currently use legacy value sets to refer to laboratory tests and other data elements in their EHRs, rather than the standard values developed by the National Library of Medicine (e.g., SNOMED-CT). Therefore, identification of all laboratory tests that evaluate blood glucose levels required a free-text search that was applied to both the label for ordered tests and posted tests. At the formative testing site, the ordered tests omitted frequently the term "glucose" and were therefore not retrieved via free text search. Thus, posted test result labels emerged as the most appropriate method to identify all tests. Because the labels were unique to each site, data extraction protocols that utilized various value sets and free-text search terms were developed to ensure retrieval of all relevant tests. An additional example of non-standard value sets included reliance on various commercial drug databases (e.g., Medi-Span, First Databank), rather than RxNorm at field testing hospitals. Again, very specific data extraction protocols were developed using the various commercial systems to ensure that the data extraction sample was valid. Until standard value sets have achieved widespread implementation, validation of a sample of records will ensure that hospitals are correctly extracting the data for measure calculation.

**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).**

Not applicable

## **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)
	<a href="#">Not in use</a> <a href="#">Not applicable</a> <a href="#">Not applicable</a>

**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

[Not applicable](#)

**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; the measure is being submitted for initial endorsement.](#)

**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.)**

[The measure has been submitted through the Measures Under Consideration process for the CMS Hospital Inpatient Quality Reporting Program and Meaningful Use Stage 3.](#)

**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.

**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.****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.

**4a2.2.2. Summarize the feedback obtained from those being measured.****4a2.2.3. Summarize the feedback obtained from other users****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.**

## 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.**

Adoption of this performance measure has the potential to improve the quality of care for individuals with hyperglycemia and, therefore, advance the quality of care in the area of patient safety, a priority area identified by the National Quality Strategy. Specifically, this measure will encourage providers to develop interventions to improve glycemic control for hospitalized patients. Better glycemic control among hospitalized individuals would be expected to result in shorter lengths of stay and lower mortality and infection rates. In addition, this measure is proposed as a balancing measure to Glycemic Control – Hypoglycemia to avoid unintended consequences with inappropriate glycemic control.

## 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.**

No unintended negative consequences were identified during testing. The measure was designed to prevent bias inherent in measurement error. Three criteria to define patients at risk for hyperglycemia were used to ensure full capture of admissions, where glucose control may have been compromised. Furthermore, associations between increased vigilance and higher measure rates (i.e., increased glucose monitoring might lead to increased detection of hyperglycemia) were limited by incorporating failure to monitor into the numerator definition and by utilizing hospital days as the unit of analysis.

As with many drugs with narrow therapeutic ranges, optimal titration of anti-diabetic medications is challenging, resulting in risk for both over- and under-dosing. Unintended consequences in causing hypoglycemic events by monitoring performance with respect to hyperglycemia are alleviated by the recommendations to use this measure in conjunction with its companion balancing measure, which focuses on hypoglycemia.

**4b2.2. Please explain any unexpected benefits from implementation of this measure.**

## 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.  
Yes

**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.**

None identified

**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?**

No

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

This proposed measure is a new measure. The definition of diabetes in the measure was harmonized, where feasible, with NQF-endorsed NCQA measures (#0055, 0056, 0057, 0059, 0061, 0062, 0063, 0064, and 0575) and NQF-endorsed CMS measures (#0519 and 0545). The measure specifications of the proposed measure are not completely harmonized with NQF #0300 Cardiac Surgery Patients with Controlled Postoperative Blood Glucose, which has the same measure focus (hyperglycemia in the inpatient hospital setting) as the proposed measure. Below we describe the differences between the proposed measure and NQF #0300 as well as the implications of those differences. Data Source - Difference: The proposed measure uses hospital EHR data as the data source. NQF #0300 uses administrative claims and paper medical records as the data source for the measure. Rationale: The utilization of hospital EHR data should streamline data collection and analysis and therefore require less time and resources. Impact on interpretability: Hospital EHR data should be more accurate than abstraction of paper medical records for blood glucose levels. Data collection burden: Because the proposed measure is based on hospital EHR data, it should require less time and resources than the analysis of claims data and abstraction of paper medical records that are required for NQF #0300. Definition of Target Population Used in the Measures - Difference: The target population for the proposed measure is all inpatient admissions 18 years or older with specified exclusions. The target population for NQF #0300 is all cardiac surgery patients 18 years or older with specified exclusions. Rationale: The proposed measure adds value because it includes all patients at risk of hyperglycemia in the inpatient hospital setting, rather than only cardiac surgery patients as in NQF #0300. The impact of the proposed measure should be higher because it focuses on a broader set of patients. Impact on interpretability: By broadening the target population to include all inpatient admissions, the proposed measure should be easier to interpret. Data collection burden: Because the proposed measure is based on hospital EHR data, identifying the target population should require less time and resources than the analysis of claims data and abstraction of paper medical records that are required for NQF #0300. Definition of Denominator - Difference: The denominator of the proposed measure includes all patients who meet at least one of the following 3 criteria: a diagnosis of diabetes mellitus, or at least one administration of insulin or any anti-diabetic medication except metformin, or at least one elevated blood glucose value (>200 mg/dL [11.1 mmol/L]) at any time during the entire hospital stay. The denominator of NQF #0300 includes patients who had cardiac surgery during the hospital stay and have no evidence of prior infection. Rationale: The proposed measure adds value because it includes all patients at risk of hyperglycemia in the inpatient hospital setting, rather than only cardiac surgery patients as in NQF #0300. The impact of the proposed measure should be higher because it includes a broader set of patients. Impact on interpretability: By including all patients at risk of hyperglycemia, the proposed measure should be easier to interpret. Data collection burden: Because the proposed measure is based on hospital EHR data, identifying individuals for the denominator should require less time and resources than the analysis of claims data and abstraction of paper medical records that are required for NQF #0300. Blood Glucose Threshold Used in the Measures - Difference: A glucose threshold of >200 mg/dL is used in the proposed measure to define hyperglycemia. A glucose threshold of =180 mg/dL is used to define normoglycemia in NQF #0300. Rationale: A glucose threshold of >200 mg/dL to define hyperglycemia is supported by evidence from the literature (Wexler et al., 2007) and recommendations from clinical practice guidelines (Qaseem et al., 2011). Since the proposed measure includes all hospital admissions, the Technical Expert Panel recommended that the highest blood glucose threshold recommended should be 200 mg/dL. Impact on interpretability: By using a threshold of >200 mg/dL rather than the threshold of >180 mg/dL used in NQF #0300, the proposed measure focuses on a subset of patients with more severe hyperglycemia. Data collection burden: Because the proposed measure is based on hospital EHR data, identifying blood glucose values should require less time and resources than the analysis of claims data and abstraction of paper medical records that are required for NQF #0300. Time Period Covered by Measures - Difference: The proposed measure covers the entire hospital stay, whereas NQF #0300 focuses on the 18 to 24 hours after anesthesia end time. Rationale: The impact of the proposed measure would be higher because it includes all days during the hospital stay, rather than being limited to the 18-24 hours following surgery. Impact on interpretability: By including the entire hospital stay, the proposed measure should be easier to interpret. Data collection burden: Because the proposed measure is based on hospital EHR data, calculating the measure should require less time and resources than the analysis of claims data and abstraction of paper medical records that are required for NQF #0300. Citations - Qaseem, A., Humphrey, L., Chou, R., Snow, V., &

Shekelle, M. (2011). Use of intensive insulin therapy for the management of glycemic control in hospitalized patients: A Clinical Practice Guideline from the American College of Physicians. *Annals of Internal Medicine*, 154(4), 260-267. Retrieved July 25, 2013, from <http://annals.org/article.aspx?articleid=746815> 2. Wexler, D. J., Meigs, J. B., Cagliero, E., Nathan, D. M., & Grant, R. W. (2007). Prevalence of hyper- and hypoglycemia among inpatients with diabetes: A national survey of 44 U.S. hospitals. *Diabetes Care*, 30(2), 367-369.

#### 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; there are no NQF-endorsed measures that compete with the proposed measure.](#)

## 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: Glycemic\\_Control\\_Hyperglycemia\\_Algorithm\\_Flowchart.pdf](#)

## Contact Information

**Co.1 Measure Steward (Intellectual Property Owner):** [Centers for Medicare and Medicaid Services](#)

**Co.2 Point of Contact:** [Kristie, Baus, Kristie.baus@cms.hhs.gov](#), 410-786-8161-

**Co.3 Measure Developer if different from Measure Steward:** [CMS/FMQAI](#)

**Co.4 Point of Contact:** [Kyle, Campbell, kcampbell@flqio.sdps.org](#), 813-865-3199-

## 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.**

[Measure Work Group Members](#)

[Amy Rosenberg, Pharmacy Specialist, Medication Safety and Quality, UF Health Shands Hospital](#)

[Thomas Johns, Assistant Director, Pharmacy Services, UF Health Shands Hospital](#)

[Aimee LeClaire, Assistant Director, Inpatient Pharmacy Services, UF Health Shands Hospital](#)

[Suzanne Quinn, Associate Professor of Medicine, University of Florida](#)

[Crystal Riley, Associate Director, Federal Relations, The Joint Commission](#)

[Dale Bratzler, Professor and Associate Dean, College of Public Health, University of Oklahoma Health Sciences Center](#)

[Frank Briggs III, Vice President, Quality and Patient Safety, West Virginia University Healthcare](#)

[Robert Feroli, Medication Safety Officer, Johns Hopkins Hospital](#)

[Marybeth Farquhar, Vice President of Research & Measurement, Utilization Review Accreditation Commission \(URAC\)](#)

The measure work group established clinical definitions of the event being measured and operationalized the measure specifications. Work group members reviewed results from validity testing and feasibility assessments and continued to be involved in the iterative process of measure specifications revisions.

[Technical Expert Panel \(TEP\) Members](#)

[Dale Bratzler, TEP Chair, Professor and Associate Dean, College of Public Health, University of Oklahoma Health Sciences Center](#)

[Mary Brennan-Taylor, Adjunct Research Instructor of Family Medicine, School of Medicine and Biomedical Sciences, University of Buffalo](#)

Frank Briggs III, Vice President, Quality and Patient Safety, West Virginia University Healthcare  
Daniel Castillo, Medical Director, Healthcare Quality Evaluation, The Joint Commission  
Joan Ching, Administrative Director, Hospital Quality & Safety, Virginia Mason Medical Center  
Edward Eisenberg, Senior Vice President, Performance Measurement and Strategic Alliances, Pharmacy Quality Alliance  
Floyd Eisenberg, President, iParsimony, LLC  
Marybeth Farquhar, Vice President of Research & Measurement, URAC  
Frank Federico, Executive Director for Strategic Partners, Institute for Healthcare Improvement  
Robert Feroli, Medication Safety Officer, Johns Hopkins Hospital  
Tejal Gandhi, President, National Patient Safety Foundation  
P. Michael Ho, Staff Cardiologist, VA Eastern Colorado Health Care System  
Mark Holtsman, Co-Director, Inpatient Pain Service and Pain Management Service Pharmacist, UC Davis Medical Center  
Clifford Ko, Director, ACS Division of Research and Optimal Patient Care  
Janet Maurer, Operations Medical Director, National Imaging Associates, Health Dialog  
David Nau, Senior Director, Research & Performance Measurement, Pharmacy Quality Alliance  
Michael Neuss, Chief Medical Officer, Vanderbilt-Ingram Cancer Center  
Crystal Riley, Associate Director, Federal Relations, The Joint Commission  
N. Lee Rucker, Senior Advisor, National Council on Patient Information and Education  
Edward Septimus, Medical Director, Infection Prevention and Epidemiology Clinical Service Group, HCA Healthcare System  
Nathan Spell, Chief Quality Officer, Emory University Hospital  
Stephen Traub, Chair, Department of Emergency Medicine, Mayo Clinic  
Darren Triller, TEP Co-Chair, Senior Director, Quality Improvement, IPRO QIO

**Federal Guests on TEP**

Mary Andrawis, Contract Officer Representative & Medication Safety Co-Lead, Centers for Medicare & Medicaid Services, Center for Medicare & Medicaid Innovation  
Andrew Geller, Epidemic Intelligence Service Officer, Medication Safety Program, Division of Healthcare Quality Promotion, Centers for Disease Control and Prevention  
Sherriann Moore, Deputy Director, U.S. Department of Health and Human Services, Indian Health Service, Office of Urban Indian Health Programs  
Nadine Shehab, Senior Service Fellow, Division of Healthcare Quality Promotion, Centers for Disease Control and Prevention  
Arjun Srinivasan, Team Leader, Epidemiology Team, Division of Healthcare Quality Promotion, Centers for Disease Control and Prevention

The TEP evaluated the proposed measure drafted by FMQAI in regard to the 4 primary measure evaluation criteria used in the NQF consensus endorsement process (importance, scientific acceptability, feasibility, and usability). The TEP discussed the strengths and weaknesses of the proposed measure and made recommendations regarding measure specifications, inclusion and exclusion criteria, and appropriate risk adjustment, as applicable.

**Measure Developer/Steward Updates and Ongoing Maintenance**

**Ad.2 Year the measure was first released:**

**Ad.3 Month and Year of most recent revision:**

**Ad.4 What is your frequency for review/update of this measure?**

**Ad.5 When is the next scheduled review/update for this measure?**

**Ad.6 Copyright statement:** Limited proprietary coding is contained in the measure specifications for user convenience. Use of these codes may require permission from the code owner or agreement to a license.

ICD-10 codes are copyright © World Health Organization (WHO), Fourth Edition, 2010. The LOINC® codes are copyright © 1995-2013, Regenstrief Institute, Inc. and the Logical Observation Identifiers Names and Codes (LOINC) Committee. SNOMED CT® was originally created by The College of American Pathologists. "SNOMED" and "SNOMED CT" are registered trademarks of the International Health Terminology Standards Development Organisation (IHTSDO), copyright © 2002-2013. All rights reserved.

**Ad.7 Disclaimers:** This performance measure does not establish a standard of medical care and has not been tested for all potential applications.

**Ad.8 Additional Information/Comments:** Not applicable