



## 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 subcriterion 1b).

### Brief Measure Information

**NQF #:** 2363

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

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

**De.3. Brief Description of Measure:** The rate of hypoglycemic events following the administration of an anti-diabetic agent

**1b.1. Developer Rationale:** This safety measure relates to glycemic control and hypoglycemia management in the hospital inpatient setting and is proposed with its companion balancing measure related to hyperglycemia (Glycemic Control: Hyperglycemia). Hypoglycemia is an intermediate outcome that occurs in the inpatient setting, despite serious consequences, including longer lengths of stay and increased risk mortality. Several important benefits related to quality improvement are envisioned with the implementation of this measure. Specifically, the measure will help providers to identify individuals who develop hypoglycemia in the hospital inpatient setting. Furthermore, this measure will encourage providers to develop interventions to improve glycemic control for hospital inpatients. Lower rates of hypoglycemia among hospitalized individuals would be expected to result in shorter lengths of stay and lower mortality. Adoption of this performance measure has the potential to improve quality of care for individuals with hypoglycemia and, therefore, advance the quality of care in the area of patient safety, a priority area identified by the National Quality Strategy.

**S.4. Numerator Statement:** Total number of hypoglycemic events (<40 mg/dL) that were preceded by administration of rapid/short-acting insulin within 12 hours or an anti-diabetic agent other than short-acting insulin within 24 hours, were not followed by another glucose value greater than 80 mg/dL within five minutes, and were at least 20 hours apart

Optional numerator: Total number of hypoglycemic events (<70 mg/dL) that were preceded by administration of rapid/short-acting insulin within 12 hours or an anti-diabetic agent other than short-acting insulin within 24 hours, were not followed by another glucose value greater than 80 mg/dL within five minutes, and were at least 20 hours apart

**S.7. Denominator Statement:** Total number of hospital days with at least one anti-diabetic agent administered

**S.10. Denominator Exclusions:** Admissions with lengths of stay greater than 120 days are excluded.

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

**S.23. Data Source:** Electronic Clinical Data, Electronic Clinical Data : Electronic Health Record, Electronic Clinical Data : Laboratory, Electronic Clinical Data : Pharmacy

**S.26. 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 another measure, Glycemic Control – Hyperglycemia. 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 subcriteria 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\\_Hypoglycemia\\_Evidence\\_Form.docx](#)

**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., the benefits or improvements in quality envisioned by use of this measure)**

This safety measure relates to glycemic control and hypoglycemia management in the hospital inpatient setting and is proposed with its companion balancing measure related to hyperglycemia (Glycemic Control: Hyperglycemia). Hypoglycemia is an intermediate outcome that occurs in the inpatient setting, despite serious consequences, including longer lengths of stay and increased risk mortality. Several important benefits related to quality improvement are envisioned with the implementation of this measure. Specifically, the measure will help providers to identify individuals who develop hypoglycemia in the hospital inpatient setting. Furthermore, this measure will encourage providers to develop interventions to improve glycemic control for hospital inpatients. Lower rates of hypoglycemia among hospitalized individuals would be expected to result in shorter lengths of stay and lower mortality. Adoption of this performance measure has the potential to improve quality of care for individuals with hypoglycemia and, therefore, advance the quality of care in the area of patient safety, a priority area identified by 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 endorsement maintenance. 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 included). This information also will be used to address the subcriterion on improvement (4b.1) under Usability and Use.**

The measure was tested with 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 one 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 measure rate by hospital, follows.

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

1 / Jul 1, 2011 - Oct 1, 2011 / 11,530 / 66 / 0.57% / 0.44 - 0.73  
 2 / Apr 1, 2012 - Aug 31, 2012 / 6,149 / 22 / 0.36% / 0.22 - 0.54  
 3 / Jan 3, 2011 - Jan 8, 2012 / 340 / 3 / 0.88% / 0.18 - 2.56  
 4 / Jan 1, 2012 - Feb 8, 2013 / 11,939 / 80 / 0.67% / 0.53 - 0.83  
 5 / Jan 27, 2012 - Dec 31, 2012 / 11,827 / 68 / 0.57% / 0.44 - 0.73  
 6 / Mar 1, 2012 - Dec 31, 2012 / 9,812 / 87 / 0.89% / 0.71 - 1.09  
 7 / Jun 7, 2011 - Dec 31, 2012 / 13,316 / 76 / 0.57% / 0.45 - 0.71  
 8 / Apr 1, 2012 - Jun 30, 2012 / 7,045 / 29 / 0.41% / 0.28 - 0.59

Mean: 0.62%

Std. Deviation: 0.19%

Min: 0.36%

Max: 0.89%

Interquartile Range: 0.29%

10th Percentile: 0.36%

25th Percentile: 0.49%

50th Percentile: 0.57%

75th Percentile: 0.78%

90th Percentile: 0.89%

The measure proposes an optional numerator for including mild hypoglycemic events (blood glucose between 41 to 69 mg/dL) in the measure. The definition for the optional numerator is defined as the total number of hypoglycemic events (<70 mg/dL) that were preceded by administration of rapid/short-acting insulin within 12 hours or an anti-diabetic agent other than short-acting insulin within 24 hours, were not followed by another glucose value greater than 80 mg/dL within five minutes, and were at least 20 hours apart.

The optional numerator was tested with the same dataset. The measure performance, including the denominator, numerator, and measure rate by hospital, follows.

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

1 / Jul 1, 2011 - Oct 1, 2011 / 11,530 / 716 / 6.21% / 5.78%-6.67%  
 2 / Apr 1, 2012 - Aug 31, 2012 / 6,149 / 274 / 4.46% / 3.96%-5.00%  
 3 / Jan 3, 2011 - Jan 8, 2012 / 340 / 23 / 6.76% / 4.36%-9.98%  
 4 / Jan 1, 2012 - Feb 8, 2013 / 11,939 / 678 / 5.68% / 5.27%-6.11%  
 5 / Jan 27, 2012 - Dec 31, 2012 / 11,827 / 709 / 5.99% / 5.57%-6.44%  
 6 / Mar 1, 2012 - Dec 31, 2012 / 9,812 / 696 / 7.09% / 6.59%-7.62%  
 7 / Jun 7, 2011 - Dec 31, 2012 / 13,316 / 778 / 5.84% / 5.45%-6.25%  
 8 / Apr 1, 2012 - Jun 30, 2012 / 7,045 / 459 / 6.52% / 5.95%-7.12%

Mean: 6.07 %

Std. Deviation: 0.81 %

Min: 4.46 %

Max: 7.09 %

Interquartile Range: 0.88 %

10th Percentile: 4.46 %

25th Percentile: 5.76 %

50th Percentile: 6.10 %

75th Percentile: 6.64 %

90th Percentile: 7.09 %

Although not all mild hypoglycemia events may be preventable, the Technical Expert Panel recommended establishing the optional numerator for including mild hypoglycemia for the purpose of internal quality improvement in the hospitals.

**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.**

Six recent studies (Boord et al., 2009; Cook et al., 2009; Matheny, Shubina, Kimmel, Pendergrass, & Turchin, 2008; Nirantharakumar et al., 2012; Turchin et al., 2009; Wexler, Meigs, Cagliero, Nathan, & Grant, 2007) demonstrated rates of hypoglycemia among hospitalized individuals that indicate a performance gap in glycemic control in the hospital setting. Rates of severe hypoglycemia, defined as <40 mg/dL, consistent with the definition used in the proposed measure, were reported to be 0.4% of all non-ICU patient-days (Cook et al., 2009), 1.9% among ICU patient-days (Cook et al., 2009), 2.3% of diabetic admissions (Nirantharakumar et al., 2012), and 3-5% of hospitalized patients with diabetes (Wexler et al., 2007). The rate of hypoglycemia, defined as <50 mg/dL, was reported in three studies: 2.8% of all patient days (Boord et al., 2009), 1.8% of all hospitalized days (Matheny et al., 2008), and 7.7% of admissions (Turchin et al., 2009). The published studies and the testing results are described below.

Summary of Published Studies on Variation in Inpatient Hypoglycemia 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. Eligible patients had either two consecutive blood glucose readings >180 mg/dL within 24 hours or received insulin treatment at any time during hospitalization. Seventy-nine percent of the patients had a prior diagnosis of diabetes, and 84.6% received insulin on the second measurement day. Hypoglycemia (<50 mg/dL) was experienced on 2.8% of all patient days. Intravenous insulin use in the ICU was associated with a significantly higher proportion of patients who had hypoglycemia than those with subcutaneous insulin only on day one.

Cook et al. (2009): Using inpatient point-of-care bedside glucose data for 12 months during 2007, a recent study estimated the prevalence of hypoglycemia (<70 mg/dL) to be 10.1% among ICU patient-days and 3.5% among non-ICU patient-days. The prevalence of severe hypoglycemia (=40 mg/dL) was 1.9% among ICU patient-days and 0.4% among non-ICU patient-days. The hypoglycemia estimates for the ICU and non-ICU patients were based on 2,935,167 and 9,624,138 measurements, respectively, from a total of 126 self-selected hospitals in the automated laboratory system. Overall, 21.3% of patients had at least one hypoglycemic point-of-care blood glucose value.

Matheny et al. (2008): This study evaluated the relationship between anti-diabetic treatment intensification and blood glucose in 3,613 diabetics hospitalized between January 2003 and August 2004. The study population included patients who were not in an ICU, were not prescribed IV 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. Patients had one or more hypoglycemic episodes (<50 mg/dL) for 1.8% of all hospitalized days (434/24,653).

Nirantharakumar et al. (2012): This study used electronic data to retrospectively analyze 6,374 admissions among diabetics who had either a lab or point-of-care blood glucose value to evaluate the length of stay and inpatient mortality associated with hypoglycemic episodes. In this cohort, 2.3% of diabetic admissions experienced severe hypoglycemia (=2.2 mmol/L or =40 mg/dL), and 7.8% of diabetic admissions experienced mild to moderate hypoglycemia (2.2-3.9 mmol/L or 40-70 mg/dL). After adjustment, length of stay for those with mild hypoglycemia was higher when compared to those without hypoglycemia (odds ratio 1.51, 95% confidence interval 1.35-1.68). Odds of inpatient mortality was higher for those with hypoglycemia, when compared to those without hypoglycemia (1.62, 95% confidence interval 1.24-3.38 for those with mild to moderate hypoglycemia and 2.05, 95% confidence interval 1.24-3.38 for those with severe hypoglycemia).

Turchin et al. (2009): This retrospective cohort study of clinical outcomes associated with hypoglycemia in hospitalized diabetics analyzed data from 4,368 admissions of 2,582 patients hospitalized from January 2003 to August 2004. Hypoglycemia (=50 mg/dL) was present in 7.7% of admissions. The inpatient mortality rate increased from 1.9% for patients with blood glucose >39 mg/dL to 8.2% in those with lowest glucose <30 mg/dL.

Wexler et al. (2007): This study used inpatient and outpatient data from patient charts for 274 patients 18 years and older with diagnosed type 1 and type 2 diabetes who were admitted as inpatients to one of 29 selected medical centers in 20 states (University Health System Consortium [UHC] cohort) and data from 725 general medical and surgical patients over age 18 with a primary or secondary discharge diagnosis of diabetes (VHA, Inc. cohort). In this study, 12% of the patients from the UHC cohort and 18% of the VHA, Inc. cohort experienced at least one episode of hypoglycemia (<60 mg/dL) during their hospitalization. Severe hypoglycemia (<40 mg/dL) was rare, occurring in 3% and 5% of patients in the UHC and VHA cohorts, respectively.

#### Conclusion

Estimates of inpatient hypoglycemia rates from recently published studies suggest a clear performance gap. Severe hypoglycemia can be avoided with blood glucose monitoring and safe use of anti-diabetic drugs. While published rates of severe hypoglycemia (<40 mg/dL) during hospitalizations vary from less than 1% to more than 2%, depending on the study population and methods, these rates represent performance gaps and opportunities for improvement in the treatment of individuals with hypoglycemia associated with the administration of anti-diabetic medications.

#### 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 U.S. 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.
- Nirantharakumar, K., Marshall, T., Kennedy, A., Narendran, P., Hemming, K., & Coleman, J. J. (2012). Hypoglycaemia is associated with increased length of stay and mortality in people with diabetes who are hospitalized. *Diabetic Medicine*, 29(12), e445-e448.
- Turchin, A., Matheny, M. E., Shubina, M., Scanlon, J. V., Greenwood, B., & Pendergrass, M. L. (2009). Hypoglycemia and clinical outcomes in patients with diabetes hospitalized in the general ward. *Diabetes Care*, 32(7), 1153-1157.
- 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 endorsement maintenance. 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 subcriterion on improvement (4b.1) under Usability and Use.*

The measure performance was stratified for disparities by age, race/ethnicity, and payor source.

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

All Ages / 71,383 / 427 / 0.60%

White / 54,981 / 329 / 0.60%

African American / 10,692 / 72 / 0.67%

Hispanic / 3,222 / 13 / 0.40%

Other / 2,488 / 13 / 0.52%

18-24 / 660 / 7 / 1.06%

White / 394 / 2 / 0.51%

African American / 189 / 5 / 2.65%

Hispanic / 48 / 0 / 0.00%

Other / 29 / 0 / 0.00%

25-44 / 5,633 / 35 / 0.62%

White / 3,109 / 23 / 0.74%

African American / 1,375 / 8 / 0.58%

Hispanic / 801 / 3 / 0.37%

Other / 348 / 1 / 0.29%

45-64 / 24,499 / 145 / 0.59%

White / 16,348 / 102 / 0.62%

African American / 5,495 / 33 / 0.60%

Hispanic / 1,682 / 5 / 0.30%

Other / 974 / 5 / 0.51%

65-74 / 17,248 / 91 / 0.53%

White / 14,017 / 70 / 0.50%

African American / 2,200 / 16 / 0.73%

Hispanic / 411 / 4 / 0.97%

Other / 620 / 1 / 0.16%

75-84 / 15,716 / 100 / 0.64%

White / 14,092 / 87 / 0.62%

African American / 967 / 7 / 0.72%

Hispanic / 262 / 1 / 0.38%

Other / 395 / 5 / 1.27%

85+ / 7,627 / 49 / 0.64%

White / 7,021 / 45 / 0.64%

African American / 466 / 3 / 0.64%

Hispanic / 18 / 0 / 0.00%

Other / 122 / 1 / 0.82%

Measure Performance by Payor Source and Age  
Category/Denominator/Numerator/Measure Rate

Medicare / 46,886 / 299 / 0.64%

18-24 / 31 / 0 / 0.00%  
 25-44 / 985 / 9 / 0.91%  
 45-64 / 8,033 / 58 / 0.72%  
 65-74 / 15,289 / 87 / 0.57%  
 75-84 / 15,072 / 96 / 0.64%  
 85+ / 7,476 / 49 / 0.66%

Medicaid / 6,611 / 46 / 0.70%  
 18-24 / 309 / 2 / 0.65%  
 25-44 / 1,376 / 11 / 0.80%  
 45-64 / 4,551 / 27 / 0.59%  
 65-74 / 207 / 3 / 1.45%  
 75-84 / 108 / 3 / 2.78%  
 85+ / 60 / 0 / 0.00%

Self-Pay / 3,531 / 16 / 0.45%  
 18-24 / 100 / 0 / 0.00%  
 25-44 / 833 / 3 / 0.36%  
 45-64 / 2,290 / 12 / 0.52%  
 65-74 / 197 / 0 / 0.00%  
 75-84 / 106 / 1 / 0.94%  
 85+ / 5 / 0 / 0.00%

Other / 14,355 / 66 / 0.46%  
 18-24 / 220 / 5 / 2.27%  
 25-44 / 2,439 / 12 / 0.49%  
 45-64 / 9,625 / 48 / 0.50%  
 65-74 / 1,555 / 1 / 0.06%  
 75-84 / 430 / 0 / 0.00%  
 85+ / 86 / 0 / 0.00%

There are no significant differences between race groups or between age groups.

**1b.5. If no or limited data on disparities from the measure as specified is reported in 1b4, then provide a summary of data from the literature that addresses disparities in care on the specific focus of measurement. Include citations.**

Disparities in the rates of inpatient hypoglycemia have been observed across gender, age, and race/ethnicity in published studies. The studies described in this section reported higher rates of hypoglycemia among patients with acute myocardial infarction and patients with diabetes who were older, female, and non-white.

Curkendall et al. (2009): This retrospective cohort study was designed to estimate the clinical and economic impact of hypoglycemia that develops during a hospital stay among patients with diabetes. Data were derived from the Health Facts® electronic health record database for 215,922 patients with diabetes treated in 70 hospitals between January 2000 and December 2006. Hypoglycemia (blood glucose <70 mg/dL) was identified in 3,923 patients within the first 24 hours of admission and in 8,234 patients more than 24 hours after admission. Hypoglycemia was not detected among the remaining 95,579 patients who were admitted. Patients with hypoglycemia were more likely to be older (mean age of 67.8 vs. 65.7 years), female (53.1% vs. 51.1%), and African American (19.6% vs. 14.6%) ( $p < 0.01$ ).

Kosiborod et al. (2009): This study assessed the risk of mortality associated with hypoglycemic events in acute myocardial infarction (AMI) patients who developed hypoglycemia spontaneously and those who developed it as a result of insulin therapy. Using data from Health Facts® for 7,820 patients hospitalized from January 1, 2000, to December 31, 2005, patients experiencing hypoglycemia (<60 mg/dL) overall were older (mean=72.9 [standard deviation (SD)=12.3] vs. 71.2 [SD=13.1],  $p=0.006$ ), more likely to be female (53.5% vs. 46.6%,  $p=0.003$ ), and white (79.9% vs. 85.9%,  $p < 0.001$ ). When separated by insulin treatment status, those developing hypoglycemia spontaneously were less likely to be white (74.3% vs. 86.0%,  $p < 0.001$ ). Among patients receiving insulin treatment, patients developing hypoglycemia were older (mean age 72.5 [SD=12.1] vs. 69.9 [SD=12.6],  $p < 0.001$ ).

Citations for Section 1b.5

Curkendall, S. M., Natoli, J. L., Alexander, C. M., Nathanson, B. H., Haidar, T., & Dubois, R. W. (2009). Economic and clinical impact of inpatient diabetic hypoglycemia. *Endocr Pract*, 15(4), 302-312.

Kosiborod, M., Inzucchi, S. E., Goyal, A., Krumholz, H., Masoudi, F., Xiao, L., & Spertus, J. (2009). Relationship between spontaneous and iatrogenic hypoglycemia and mortality in patients hospitalized with acute myocardial infarction. *The Journal of the American Medical Association*, 301(15), 1556-1564.

**1c. High Priority** (previously referred to as High Impact)

The measure addresses:

- a specific national health goal/priority identified by DHHS or the National Priorities Partnership convened by NQF; OR
- a demonstrated high-priority (high-impact) aspect of healthcare (e.g., affects large numbers of patients and/or has a substantial impact for a smaller population; leading cause of morbidity/mortality; high resource use (current and/or future); severity of illness; and severity of patient/societal consequences of poor quality).

**1c.1. Demonstrated high priority aspect of healthcare**

High resource use, Other

**1c.2. If Other: Leading cause of adverse drug events in the hospital setting**

**1c.3. Provide epidemiologic or resource use data that demonstrates the measure addresses a high priority aspect of healthcare.**

**List citations in 1c.4.**

This safety measure relates to glycemic control and hypoglycemia management in the hospital inpatient setting. Hyperglycemia is an intermediate outcome that occurs in the inpatient setting, despite serious consequences, including longer lengths of stay and increased risk of mortality. Recognizing the quality concerns related to adverse events, the National Quality Strategy has identified “making care safer” among the top priorities for quality improvement in the nation’s healthcare (U.S. Department of Health and Human Services, 2012). Furthermore, the National Quality Forum (National Quality Forum, 2013) has identified gaps in the measurement system with regard to patient safety, specifically adverse drug events (ADEs), and the draft National Action Plan for ADE Prevention has also listed both severe and mild hypoglycemia as quality measure concepts that can potentially advance hypoglycemic ADE prevention (U.S. Department of Health and Human Services, 2013).

**Leading Cause of Adverse Drug Events in the Hospital Setting**

ADEs in the hospital setting are relatively common. An estimated 888,000 ADEs occurred in 2004 among hospitalized Medicare patients in the United States (Classen, Jaser, & Budnitz, 2010). In a recent study of Medicare patients published by the Office of the Inspector General (OIG), ADEs represented one-third of all adverse events in hospitals; of those events, hypoglycemia represented the third most common ADE (Office of the Inspector General, 2010). Furthermore, nearly all cases of hypoglycemia were considered preventable.

**Patient/Societal Consequences of Poor Quality**

Severe hypoglycemia is an ADE in the inpatient setting with potentially serious patient and societal consequences. Acute symptoms include dizziness, confusion, anxiety, loss of consciousness, or seizure. While most individuals with hypoglycemia fully recover, hypoglycemia that is not reversed can progress from lethargy to coma to death (Diabetes Control and Complications Trial Research Group, 1993). Rates of severe hypoglycemia (<40 mg/dL) have been reported to range from 2.3% (Nirantharakumar et al., 2012) to 5% (Wexler, Meigs, Cagliero, Nathan, & Grant, 2007) of hospitalized patients and from 0.4% of non-ICU patient days to 1.9% of ICU patient days (Cook et al., 2009).

Hypoglycemia in the inpatient setting has been associated with poor outcomes, including higher in-hospital mortality. A retrospective cohort study, using encounter level data from the Health Facts® electronic medical record database (Cerner Corporation; Kansas City, Missouri), analyzed 215,922 non-pregnant adult patients with diabetes, showing patients who developed hypoglycemia (<70 mg/dL after 24 hours) had a higher mortality (odds ratio 1.07, 95% confidence interval (CI) 1.02-1.11) during hospitalization (Curkendall et al., 2009). Using a lower threshold of =50 mg/dL produced similar results for mortality with larger differences (odds ratio 1.16, 95% confidence interval 1.09-1.30) (Curkendall et al., 2009). Another retrospective cohort study of 2,582 patients with diabetes in the general ward of a teaching hospital in 2003-2004 (Turchin et al., 2009) found that crude inpatient mortality was 2.96% for patients with at least one hypoglycemic episode (=50 mg/dL) during the hospital stay, compared to 0.82% without any (p=0.0013). After adjusting for other factors, the odds of in-hospital mortality rose by 85.3% for each additional day with a hypoglycemic episode (p=0.009). The odds of inpatient death also rose threefold for every 10 mg/dL decrease in the lowest blood glucose during hospitalization (p=0.0058). A case-control study conducted in an adult intensive care unit of a university-affiliated



community hospital reported in-hospital mortality of 55.9% among the 102 patients with at least one episode of severe hypoglycemia (<40 mg/dL) and 39.5% among the 306 controls ( $p=0.0057$ ). Severe hypoglycemia was an independent predictor of mortality with the odds ratio of 2.28 (95% CI 1.41–3.70) (Krinsley & Grover, 2007). Another study of diabetic patients in a non-critical care setting found that the odds ratio of inpatient mortality was 1.62 (95% CI 1.16-2.27) in the group with mild to moderate hypoglycemia (40-70 mg/dL) and 2.05 (95% CI 1.24-3.38) in the group with severe hypoglycemia (<40 mg/dL), when compared to patients without a hypoglycemic episode (>70 mg/dL) (Nirantharakumar et al., 2012). In a retrospective study of 107,312 hospitalizations in 2005-2007, the adjusted odds ratios for inpatient mortality were 1.45 among those with non-severe hypoglycemia (>50-70 mg/dL) and 1.44 among those with severe hypoglycemia ( $\leq 50$  mg/dL) (Brodevicz et al., 2013).

#### High Resource Use

Hypoglycemia in the inpatient setting has also been associated with increased length of stay. The occurrence of hypoglycemia events (<70 mg/dL) during ICU hospitalizations is associated with longer hospital stays by 2 to 4 days (Krinsley et al., 2011). Having a minimum blood glucose <50 mg/dL was associated with a prolonged ICU stay (OR 1.78, 95% CI 1.39-2.29) (Krinsley et al., 2011). A study of length of stay of diabetic patients in a non-critical care setting found that length of stay was 1.51 times higher (95% CI 1.35-1.68) in the group with mild to moderate hypoglycemia (40-70 mg/dL) and 2.33 times higher (95% CI 1.91-2.84) in the group with severe hypoglycemia ( $\leq 40$  mg/dL) (Nirantharakumar et al., 2012). In a 2003-2004 study of clinical outcomes associated with hypoglycemia in hospitalized diabetics, patients who had at least one hypoglycemic episode ( $\leq 50$  mg/dL) were hospitalized 2.8 days longer than patients who did not experience hypoglycemia (Turchin et al., 2009).

Regarding the economic burden of hypoglycemia, a retrospective cohort study showed hospitalized patients with diabetes who developed hypoglycemia (<70 mg/dL) had 38.9% higher charges, lengths of stay three days longer, and higher odds of being discharged to a skilled nursing facility (odds ratio 1.58; 95% CI 1.48-1.69) than diabetic patients without hypoglycemia ( $p<0.01$  for all) (Curkendall et al., 2009). Patients with a blood glucose <50 mg/dL had 50% higher charges, lengths of stay of 4.2 days longer, and higher odds of being discharged to a skilled nursing facility (odds ratio 1.84, 95% CI 1.65-2.04,  $p<0.001$ ) (Curkendall et al., 2009).

In conclusion, severe hypoglycemia is a condition that, if not detected early and corrected, can have severe consequences to patients and increase medical costs overall. Lower blood glucose is associated with higher mortality rates and longer lengths of stay.

#### 1c.4. Citations for data demonstrating high priority provided in 1a.3

Brodevicz, K. G., Mehta, V., Zhang, Q. Y., Zhao, C. G., Davies, M. J., Chen, J. L., . . . Engel, S. S. (2013). Association between hypoglycemia and inpatient mortality and length of hospital stay in hospitalized, insulin-treated patients. *Current Medical Research and Opinion*, 29(2), 101-107.

Classen, D. C., Jaser, L., & Budnitz, D. S. (2010). Adverse drug events among hospitalized Medicare patients: Epidemiology and national estimates from a new approach to surveillance. *Jt Comm J Qual Patient Saf*, 36(1), 12-21.

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**1c.5. If a PRO-PM (e.g. HRQoL/functional status, symptom/burden, experience with care, health-related behaviors), provide evidence that the target population values the measured PRO and finds it meaningful. (Describe how and from whom their input was obtained.)**

Not applicable

## 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 subcriteria 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. Cross Cutting Areas** (check all the areas that apply):

Safety, Safety : Medication Safety

**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: [Hypoglcemia\\_MAT\\_package\\_new-635979588003870183.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\\_-\\_hypo-635979588220558350.xlsx](#)

**S.3. For endorsement maintenance**, please briefly describe any changes to the measure specifications since last endorsement date 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)*

IF an OUTCOME MEASURE, state the outcome being measured. Calculation of the risk-adjusted outcome should be described in the calculation algorithm.

Total number of hypoglycemic events (<40 mg/dL) that were preceded by administration of rapid/short-acting insulin within 12 hours or an anti-diabetic agent other than short-acting insulin within 24 hours, were not followed by another glucose value greater than 80 mg/dL within five minutes, and were at least 20 hours apart

Optional numerator: Total number of hypoglycemic events (<70 mg/dL) that were preceded by administration of rapid/short-acting insulin within 12 hours or an anti-diabetic agent other than short-acting insulin within 24 hours, were not followed by another glucose value greater than 80 mg/dL within five minutes, and were at least 20 hours apart

**S.5. Time Period for Data** *(What is the time period in which data will be aggregated for the measure, e.g., 12 mo, 3 years, look back to August for flu vaccination? Note if there are different time periods for the numerator and denominator.)*

Measure data will be aggregated annually (12 months) and reported on a rolling quarter.

**S.6. 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, 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.

Table 2.2 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.

**S.7. Denominator Statement** *(Brief, narrative description of the target population being measured)*

Total number of hospital days with at least one anti-diabetic agent administered

**S.8. Target Population Category** *(Check all the populations for which the measure is specified and tested if any):*

Populations at Risk

**S.9. Denominator Details** *(All information required to identify and calculate the target population/denominator such as definitions, 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 2.1 Anti-Diabetic Medications:

Generic Names – Brand Names – Rx Norm Codes:

Metformin:

metformin – (Glucophage, Riomet, Glumetza, Fortamet, Appformin) – (860996, 860975, 860981, 861025, 861004, 861007, 861010)

Alpha-glucosidase inhibitors:

acarbose – (Precose) – (199150, 200132, 370504, 199149, 1153649, 1153650)

miglitol – (Glyset) – (205331, 205329, 205330, 372926, 1157268, 1157269)

Anti-diabetic amylin analogs:

pramlintide – (Symlin) – (861042, 861044, 861039, 1161690, 486505)

Anti-diabetic combinations:

glipizide-metformin (Metaglip, Glipizide/Metformin HCL) – (378730, 861731, 861736, 861740, 1165205, 1165206)  
glyburide-metformin (Glucovance, Glyburide/Metformin HCL) – (861743, 861748, 861753, 1156197, 1165845)  
linagliptin-metformin (1243016, 1243017, 1243018, 1243020, 1243027, 1243034)  
pioglitazone-glimepiride (Duetact) – (647236, 647237, 647239, 1157240, 1157241)  
pioglitazone-metformin (Actoplus MET) – (577093, 899988, 899989, 899996, 861783, 861822, 1161597, 1161598)  
rosiglitazone-glimepiride (Avandaryl) – (602543, 602544, 602549, 706895, 602550, 706896, 1157242, 1157243)  
rosiglitazone-metformin (Avandamet) – (378729, 861760, 861763, 861795, 861806, 861816, 1161603, 1161604)  
saxagliptin-metformin (Kombiglyze) – (1043561, 1043563, 1043570, 1043578, 1161605, 1161606)  
sitagliptin-metformin (Janumet) – (700516, 861769, 861819, 1161607, 1161608, 1243826, 1243827, 1243842, 1243846)  
repaglinide-metformin (Prandimet) – (802742, 861787, 861790, 1161599, 1161600)  
sitagliptin-simvastatin (Juvissync) – (1189802, 1189804, 1189808, 1189821, 1312409, 1312416, 1312423)

Dipeptidyl peptidase-4 (dpp-4) inhibitors:

sitagliptin – (Januvia) – (665033, 665038, 665042, 1159662, 1159663)  
saxagliptin – (Onglyza) – (858042, 858035, 858036, 1158518, 1158519)  
linagliptin – (Tradjenta) – (1100701, 1100702, 1164670, 1164671)

Incretin mimetics:

exenatide – (Byetta, Bydureon) – (847915, 847910, 1163790, 1242963)  
liraglutide – (Victoza) – (897122, 1163230)

Insulin:

insulin detemir – (Levemir) – (847239, 484321, 484322, 1160696)  
insulin glargine – (Lantus, Solostar) – (847230, 311041, 378864, 1157459)  
insulin isophane & reg (human) – (Humulin, Novolin, Relion) – (245264, 245265, 311048, 378857, 392660, 847186, 847187, 847256)  
insulin isophane (human) – (Humulin, Novolin, Relion) – (311028, 847278, 847197)

Short-acting insulin:

insulin aspart – (Novolog) – (311040, 378914, 1157463,)  
insulin aspart protamine & aspart (human) – (Novolog) – (833159, 847191, 351297, 379056, 1157462)  
insulin glulisine – (Apidra) – (847259, 485210)  
insulin lispro (human) – (Humalog) – (242120, 1652639, 1652644)  
insulin lispro protamine & lispro (human) – (Humalog) – (847252, 847211, 259111, 260265)  
insulin regular (human) includes inhalation – (Humulin, Exubera, Novolin) – (763019, 763020, 763015, 763080, 847417, 847203, 763013, 763014, 311034, 249220, 1164824, 359125, 359126, 359127, 376915, 833159, 847202)

Meglitinides:

nateglinide – (Starlix) – (311919, 314142)  
repaglinide – (Prandin) – (200257, 200256, 200258, 373759, 1157407, 1157408)

Sulfonylureas:

chlorpropamide – (Diabinese) – (197495, 197496)  
glimepiride – (Amaryl) – (199245, 199246, 199247)  
glipizide – (Glucotrol) – (315107, 310489, 314006, 310488, 372320, 379804, 310490, 700835, 1165207, 1165208)  
glyburide – (Micronase, Diabeta) – (197737, 310534, 310537, 372333, 1156200, 1156201)  
tolazamide – (Tolazamide) – (198292, 198293)  
tolbutamide – (Tolbutamide) – (198294)  
glyburide micronized – (Glynase, Glycron) – (252960, 310536, 310539, 314000)

Thiazolidinediones:

pioglitazone – (Actos) – (317573, 312440, 312441, 374606, 1163231, 1163232)  
rosiglitazone – (Avandia) – (312859, 312860, 312861, 373801, 1157987, 1157988)

Optional Denominator: The number of patients with anti-diabetic drug therapy

**S.10. Denominator Exclusions** (Brief narrative description of exclusions from the target population)

Admissions with lengths of stay greater than 120 days are excluded.

**S.11. Denominator Exclusion Details** (All information required to identify and calculate exclusions from the denominator such as definitions, 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)

Not applicable

**S.12. Stratification Details/Variables** (All information required to stratify the measure results including the stratification variables, definitions, 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 with at S.2b)

None

**S.13. Risk Adjustment Type** (Select type. Provide specifications for risk stratification in S.12 and for statistical model in S.14-15)

No risk adjustment or risk stratification

If other:

**S.14. Identify the statistical risk model method and variables** (Name the statistical method - e.g., logistic regression and list all the risk factor variables. Note - risk model development and testing should be addressed with measure testing under Scientific Acceptability)

Not applicable

**S.15. Detailed risk model specifications** (must be in attached data dictionary/code list Excel or csv file. Also indicate if available at measure-specific URL identified in S.1.)

Note: Risk model details (including coefficients, equations, codes with descriptors, definitions), should be provided on a separate worksheet in the suggested format in the Excel or csv file with data dictionary/code lists at S.2b.

**S.15a. Detailed risk model specifications** (if not provided in excel or csv file at S.2b)

**S.16. Type of score:**

Ratio

If other:

**S.17. 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.18. Calculation Algorithm/Measure Logic** (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; 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 hospital days with at least one anti-diabetic agent administered

1. Was the admission during the measurement period? If Yes, go to Step 2. If No, exclude from measure population.
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. Determine if there was at least one anti-diabetic medication (Table 2.1) administered. If Yes, go to Step 5. If No, exclude

from the measure population.

5. For each admission, determine the number of hospital days that had at least one anti-diabetic medication administered.
6. Sum the number of hospital days identified in Step 5 from all the qualifying admissions and this is the denominator for the measure population.

Numerator: Total number of hypoglycemic events (<40 mg/dL) that were preceded by administration of rapid/short-acting insulin within 12 hours or an anti-diabetic agent other than rapid/short-acting insulin within 24 hours, were not followed by another glucose value greater than 80 mg/dL within five minutes, and were at least 20 hours apart

7. Determine if, during the admission, any random or peri-prandial blood glucose tests were conducted. If Yes, go to Step 7. If No, exclude from the measure population.
8. Determine if the admission included blood glucose results of less than 40 mg/dL from the blood glucose tests that are either random or peri-prandial. If Yes, go to Step 8. If No, exclude from the measure population. Each result of less than 40 mg/dL from a random or peri-prandial blood glucose test indicates a Hypoglycemic Event.
9. For each Hypoglycemic Event identified in the admission, determine if there was an administration of a rapid/short-acting insulin within 12 hours or other anti-diabetic medication within 24 hours before the event. If Yes, go to Step 10. If No, then the event is excluded from the measure population.
10. For each remaining Hypoglycemic Event, determine that there was not a blood glucose result that was greater than 80 mg/dL within five minutes of the event. If Yes, go to Step 11. If No, exclude the event from the measure population.
11. For each remaining Hypoglycemic Event, determine if this event occurred more than 20 hours after the previous event. If Yes, then this event is a valid event, go to Step 12. If No, exclude the event from the measure population.
12. Determine the total number of valid Hypoglycemic Events remaining from all the qualifying admissions. This is the numerator for the measure population.

**S.19. Calculation Algorithm/Measure Logic Diagram URL or Attachment** (You also may provide a diagram of the Calculation Algorithm/Measure Logic described above at measure-specific Web page URL identified in S.1 OR in attached appendix at A.1)  
No diagram provided

**S.20. Sampling** (If measure is based on a sample, provide instructions for obtaining the sample and guidance on minimum sample size.)

IF a PRO-PM, identify whether (and how) proxy responses are allowed.

Not applicable; this measure does not use a sample or survey.

**S.21. Survey/Patient-reported data** (If measure is based on a survey, provide instructions for conducting the survey and guidance on minimum response rate.)

IF a PRO-PM, specify calculation of response rates to be reported with performance measure results.

Not applicable; this measure does not use a sample or survey.

**S.22. Missing data** (specify how missing data are handled, e.g., imputation, delete case.)

Required for Composites and PRO-PMs.

Missing data in the EHR environment can occur due to oversight or when ascertainment or documentation is not considered relevant for clinical or administrative purposes. One concern is that patients may not have certain laboratory values because they are not deemed clinically indicated by the respective provider. This scenario will create missing data, which can only be remediated if ascertainment and documentation were required for measurement purposes (as they are not for clinical reasons). In order to optimize the validity of available information, safeguards have been incorporated into the measure specifications, where hospital variation may introduce bias in measurement or documentation.

Formative and field testing revealed that distinct data fields that were expected to be fully populated did not have missing values. This concerned socio-demographic and payer information, assignment of at least one diagnosis code, and admission and discharge dates.

**S.23. Data Source** (Check ONLY the sources for which the measure is SPECIFIED AND TESTED).

If other, please describe in S.24.

Electronic Clinical Data, Electronic Clinical Data : Electronic Health Record, Electronic Clinical Data : Laboratory, Electronic Clinical Data : Pharmacy

**S.24. Data Source or Collection Instrument** (*Identify the specific data source/data collection instrument e.g. name of database, clinical registry, collection instrument, etc.*)

IF a PRO-PM, identify the specific PROM(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 Tests file with the names, results, and times of glucose tests
  - 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.25. 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.26. Level of Analysis** (*Check ONLY the levels of analysis for which the measure is SPECIFIED AND TESTED*)

Facility

**S.27. Care Setting** (*Check ONLY the settings for which the measure is SPECIFIED AND TESTED*)

Hospital/Acute Care Facility

If other:

**S.28. 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

**2a. Reliability** – See attached Measure Testing Submission Form

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

Glycemic\_Control\_Hypoglycemia\_Measure\_Testing\_Form.docx

### 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*)

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.**

**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.**

## Attachment Attachment: Supplement\_Hypoglycemia\_Feasibility\_3b3.docx

**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. Describe what you have learned/modified 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 a PRO-PM, consider implications for both individuals providing PROM 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 utilize 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.

Planned	Current Use (for current use provide URL)
	Not in use Not applicable Not applicable

**4a.1. For each CURRENT use, checked above, provide:**

- Name of program and sponsor



- Purpose
- Geographic area and number and percentage of accountable entities and patients included

Not applicable

**4a.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.

**4a.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.

#### 4b. 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.

**4b.1. Progress on Improvement. (Not required for initial endorsement unless available.)**

Performance results on this measure (current and over time) should be provided in 1b.2 and 1b.4. Discuss:

- Progress (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

Not applicable

**4b.2. 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 quality of care for individuals with hypoglycemia and therefore, advance the quality of care in the area of patient safety, a priority area identified by the National Quality Strategy. Specifically, the measure will help providers to identify individuals who develop hypoglycemia in the hospital inpatient setting. Furthermore, this measure will encourage providers to develop interventions to improve glycemic control for hospitalized patients. Lower rates of hypoglycemia among hospitalized individuals would be expected to result in shorter lengths of stay and lower mortality.

#### 4c. 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).

**4c.1. Were any unintended negative consequences to individuals or populations identified during testing; OR has evidence of unintended negative consequences to individuals or populations been reported since implementation? If so, identify the negative unintended consequences and describe how benefits outweigh them or actions taken to mitigate them.**

The expert panel considered the providers' level of aggressiveness in treating hyperglycemia as a risk for inducing hypoglycemia. For example, use of basal/bolus approaches or continuous insulin infusions have been shown to result in better control of hyperglycemia, but they also carry a greater risk for hypoglycemia if monitoring and vigilance are not adequate. This implies that sole use of a hypoglycemia measure could result in unintended consequences, where providers use less effective but "safer" hyperglycemia management regimen in order to decrease the risk for hypoglycemia. Because the proposed measure is designed to be used in combination with a balancing hyperglycemia measure, this concern is alleviated. In addition, the measure is designed to prevent bias inherent in measurement error. Numerator criteria that restrict hypoglycemia to time periods directly following anti-diabetic medication administration ensure causality of drug therapy. Lastly, false positives were eliminated by including a rule in the measure to detect a blood glucose value >80 mg/dL five minutes following the hypoglycemic event.

## 5. Comparison to Related or Competing Measures

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

### 5. Relation to Other NQF-endorsed Measures

Are there related measures (conceptually, either same measure focus or target population) or competing measures (conceptually both the same measure focus and same target population)? If yes, list the NQF # and title of all related and/or competing measures.

No

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

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

### 5a. Harmonization

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 completely harmonized?

No

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

Not applicable; there are no NQF-endorsed measures that are related (i.e., have either the same measure focus or target population) to the proposed measure.

### 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 (i.e., have the same measure focus and the same target population) 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\\_Hypoglycemia\\_Algorithm\\_Flowchart.pdf](#)

## Contact Information

**Co.1 Measure Steward (Intellectual Property Owner):** Centers for Medicare & Medicaid Services

**Co.2 Point of Contact:** Helen, Dollar-Maples, [Helen.Dollar-Maples@cms.hhs.gov](mailto:Helen.Dollar-Maples@cms.hhs.gov), 410-786-7214-

**Co.3 Measure Developer if different from Measure Steward:** CMS/FMQAI

**Co.4 Point of Contact:** Kyle, Campbell, [kcampbell@flqio.sdps.org](mailto: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.

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**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