Pioneers in Quality Expert to Expert Webinar Series

# eCQM New Measure Review:
## Hospital Harm - Severe Hypoglycemia
## Hospital Harm - Severe Hyperglycemia

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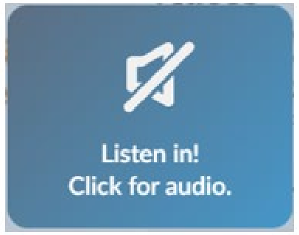
February 17, 2022

AIR Advancing Evidence. Improving Lives.
CMS CENTERS FOR MEDICARE & MEDICAID SERVICES
Mathematica Progress Together
The Joint Commission

# Webinar – Information & Tips



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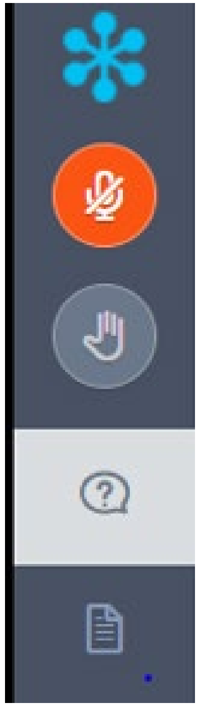

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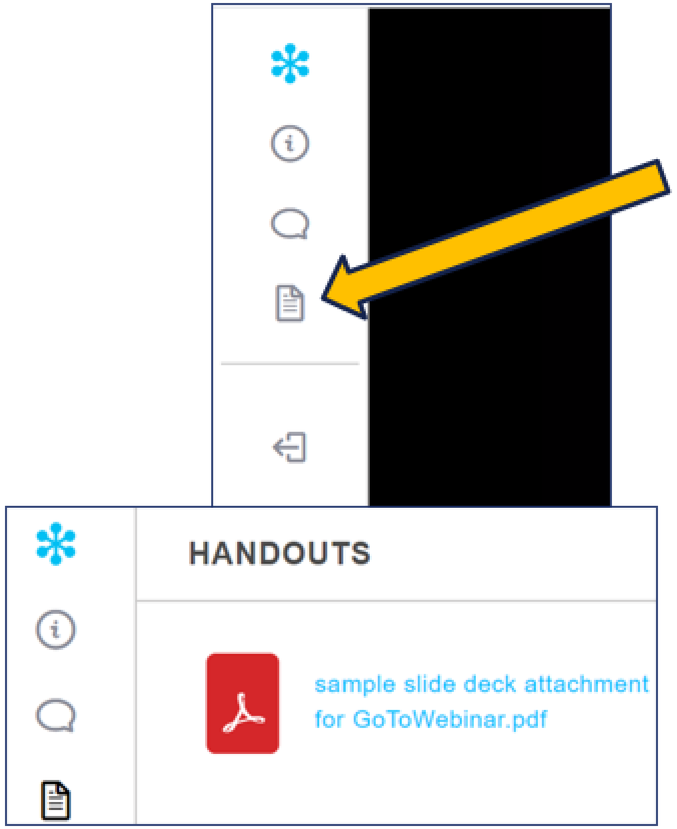

HANDOUTS

sample slide deck attachment for GoToWebinar.pdf

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# Expert to Expert Webinar Series

## Upcoming 2021-2022 eCQM Annual Updates Webinars will address:

- VTE Measures (Broadcast Dec 9)
- Stroke Measures (Broadcast Jan 18)
- PC-05 Exclusive Breast Milk Feeding (Broadcast Jan 18)
- ED-2 Median Admit Decision Time to ED Departure Time (Broadcast Jan 25)
- Safe Use of Opioids- Concurrent Prescribing (Mar 1)
- Joint Commission-only ePC measures (On Demand Feb 1 – Mar 14)

## 2021-2022 New Measure Review Webinars will address:

- Hospital Harm - Severe Hypoglycemia (Today)
- Hospital Harm - Severe Hyperglycemia (Today)
- Joint Commission-only PC-07 Severe Obstetric Complications eCQM (Mar 8)

**Expert to Expert Series webpage:** https://www.jointcommission.org/measurement/pioneers-in-quality/pioneers-in-quality-expert-to-expert-series/
**eCQI Resource Center:** https://ecqi.healthit.gov/general-ecqm-and-ecqi-education

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American Nurses Credentialing Center (ANCC)

American College of Healthcare Executives (ACHE)

California Board of Registered Nursing

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# At the end of this webinar, participants should be able to:

1. Apply concepts about measure specifications and prepare to implement the Hospital Harm - Severe Hyperglycemia and Severe Hypoglycemia eCQMs.

2. Locate eCQM resources to assist in quality improvement activities.

# Disclosure Statement

**These staff and speakers have disclosed that they do not have any financial arrangements or affiliations with corporate organizations that either provide educational grants to this program or may be referenced in this activity:**

—Susan Funk, MPH, LSSGB Associate Project Director, Measurement Coordination and Outreach, The Joint Commission

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—Michelle Lefebvre, BSN, RN, Research Associate, eCQM Measure Lead

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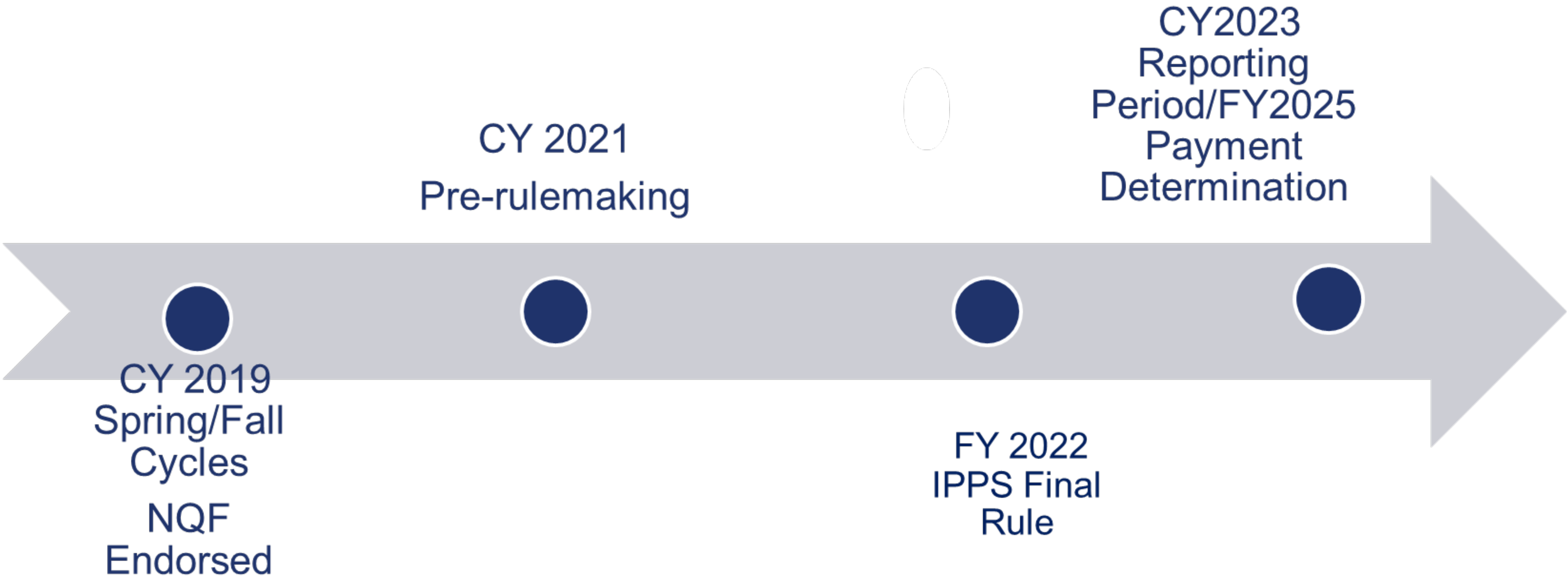
# Timeline- Severe Hyperglycemia and Severe Hypoglycemia



CY 2019 Spring/Fall Cycles

NQF Endorsed

CY 2021

Pre-rulemaking

FY 2022 IPPS Final Rule

CY2023 Reporting Period/FY2025 Payment Determination

CY= Calendar Year
FY= Fiscal Year
IPPS= Inpatient prospective payment system
NQF= National Quality Forum

Technical Overview

# Global Common Library (GCL) Functions

## GCLs used in Hypoglycemia and Hyperglycemia

# Global.NormalizeInterval() function

**Global.NormalizeInterval (pointInTime DateTime, period Interval<DateTime>)**

```
if pointInTime is not null then Interval[pointInTime, pointInTime]
    else if period is not null then period
        else null as Interval<DateTime>
```

- **QDM data types have both a relevantDatetime and relevantPeriod -**
  - Assessment, Performed
  - Device, Applied
  - Diagnostic Study, Performed
  - Intervention, Performed
  - Laboratory Test, Performed
  - Medication, Active
  - Medication, Administered
  - Medication, Dispensed
  - Physical Exam, Performed
  - Procedure, Performed
  - Substance, Administered

# Global.NormalizeInterval() function Cont.

**Global.NormalizeInterval (pointInTime DateTime, period Interval<DateTime>)**

```
- if pointInTime is not null then Interval[pointInTime, pointInTime]
     else if period is not null then period
        else null as Interval<DateTime>
```

- **A case with Procedure Performed -**
  - When relevantDatetime 2022-01-10 08:00:00 is available in the patient data → The function returns

    **Interval[2022-01-10 08:00:00, 2022-01-10 08:00:00]**

  - When relevantPeriod is available in the patient data as starts @ 2022-01-10 08:00:00 and ends @ 2022-01-10 11:00:00 → The function returns

    **Interval[2022-01-10 08:00:00, 2022-01-10 11:00:00]**

# Global.HospitalizationWithObservation function

## Global.HospitalizationWithObservation (Encounter “Encounter, Performed”)

```
 Encounter Visit
       let ObsVisit: Last(["Encounter, Performed": "Observation Services"] LastObs
                     where LastObs.relevantPeriod ends 1 hour or less on or before start of Visit.relevantPeriod
                     sort by end of relevantPeriod),
       VisitStart: Coalesce(start of ObsVisit.relevantPeriod, start of Visit.relevantPeriod),
       EDVisit: Last(["Encounter, Performed": "Emergency Department Visit"] LastED
                     where LastED.relevantPeriod ends 1 hour or less on or before VisitStart
                     sort by end of relevantPeriod)
       return Interval[Coalesce(start of EDVisit.relevantPeriod, VisitStart), end of Visit.relevantPeriod]
```

- Hospitalization with Observation returns the total interval from the start of any immediately prior (within 1 hour) emergency department visit through the observation visit to the discharge of the given encounter

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# Global.CalendarAgeInYearsAt function

**Global.CalendarAgeInYearsAt(BirthDateTime DateTime, AsOf DateTime)**

years between ToDate(BirthDateTime) and ToDate(AsOf)

**Used in the 'Qualifying Encounters' definition in both measures:**

**Qualifying Encounters**

```
["Encounter, Performed": "Encounter Inpatient"] InpatientEncounter
  with ["Patient Characteristic Birthdate": "Birth date"] BirthDate
    such that Global."CalendarAgeInYearsAt" ( BirthDate.birthDatetime, start of
Global."HospitalizationWithObservation" ( InpatientEncounter ) ) >= 18
```

# Measure Overview –
# Hospital Harm – Severe Hypoglycemia
## (CMS816v1)

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# Rationale/Intent- Severe Hypoglycemia

- Severe Hypoglycemia is a hospital harm event
- One of the most common adverse drug events
- Rates of inpatient hypoglycemia events indicate quality of care
- Preventable by careful use antihyperglycemic medications

Goals:

- Improve safety for patients at risk
- Track and trend performance
- Drive implementation of best practices

# Hospital Harm – Severe Hypoglycemia

**Description:**
The proportion of inpatient hospitalizations for patients 18 years of age or older at admission, who were administered at least one hypoglycemic medication during the encounter and who suffer the harm of a severe hypoglycemic event during the encounter.

**Initial Population / Denominator:**
Inpatient hospitalizations for patients 18 years of age or older at the start of the encounter who were administered at least one hypoglycemic medication during the encounter.

**Numerator:**
Inpatient hospitalizations where the patient suffers the harm of a severe hypoglycemic event during the encounter.

A severe hypoglycemic event (harm) is defined as a test for blood glucose with a result less than 40 mg/dL, where the hypoglycemic medication was given within the 24 hours prior to the start of the low blood glucose event (and administered during the encounter).

# Initial Population – Severe Hypoglycemia

Inpatient hospitalizations for patients age 18 and older and at least one hypoglycemic medication was administered during the encounter.

**Initial Population: "Qualifying Encounters with Hypoglycemic Medication Administration")**

**Qualifying Encounters with Hypoglycemic Medication Administration**

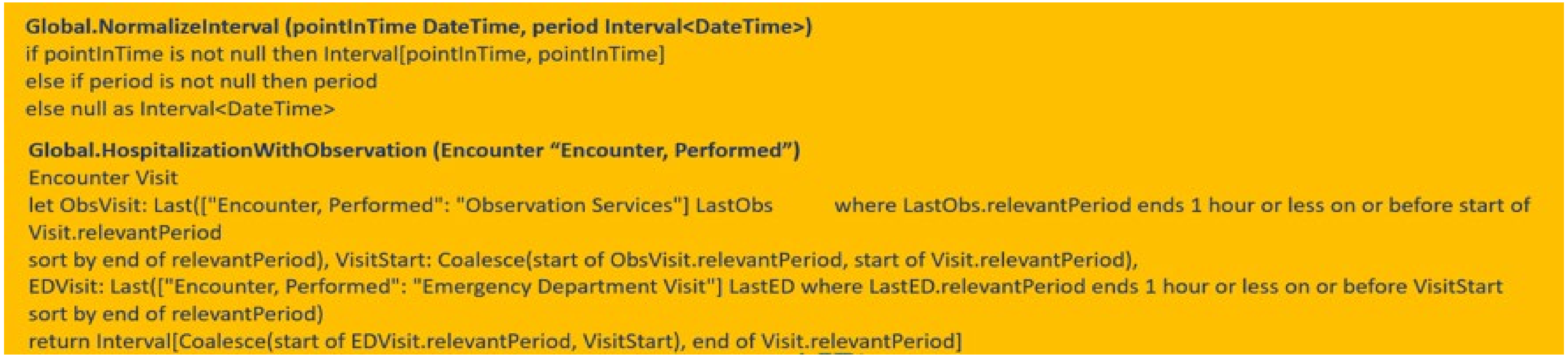
```
  "Qualifying Encounters" QualifyingEncounter
   with "Hypoglycemic Medication Administration" HypoglycemicMedicationAdministration
   such that Global."NormalizeInterval" ( HypoglycemicMedicationAdministration.relevantDatetime, HypoglycemicMedicationAdministration.relevantPeriod )
    starts during Global.HospitalizationWithObservation ( QualifyingEncounter )
```

**Qualifying Encounters**

```
  ["Encounter, Performed": "Encounter Inpatient"] InpatientEncounter
  with ["Patient Characteristic Birthdate": "Birth date"] BirthDate
   such that InpatientEncounter.relevantPeriod ends during "Measurement Period"
   and Global."CalendarAgeInYearsAt" ( BirthDate.birthDatetime, start of Global."HospitalizationWithObservation" ( InpatientEncounter ) ) >= 18
```

**Hypoglycemic Medication Administration**

```
    ["Medication, Administered": "Hypoglycemics Severe Hypoglycemia"]
```



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sort by end of relevantPeriod)
return Interval[Coalesce(start of EDVisit.relevantPeriod, VisitStart), end of Visit.relevantPeriod]
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# Initial Population – Severe Hypoglycemia

Inpatient hospitalizations for patients age 18 and older and at least one hypoglycemic medication was administered during the encounter.

**Initial Population: "Qualifying Encounters with Hypoglycemic Medication Administration")**

```
Qualifying Encounters with Hypoglycemic Medication Administration
"Qualifying Encounters" QualifyingEncounter
       with "Hypoglycemic Medication Administration" HypoglycemicMedicationAdministration
         such that Global."NormalizeInterval" ( HypoglycemicMedicationAdministration.relevantDatetime,
     HypoglycemicMedicationAdministration.relevantPeriod )
     starts during Global.HospitalizationWithObservation ( QualifyingEncounter )
```

```
     Qualifying Encounters
       ["Encounter, Performed": "Encounter Inpatient"] InpatientEncounter
            with ["Patient Characteristic Birthdate": "Birth date"] BirthDate
       such that InpatientEncounter.relevantPeriod ends during "Measurement Period"
       and Global."CalendarAgeInYearsAt" ( BirthDate.birthDatetime, start of
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```

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# Initial Population – Severe Hypoglycemia

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**Qualifying Encounters**

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**Qualifying Encounters**

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starts during Global.HospitalizationWithObservation ( QualifyingEncounter )
```

**Hypoglycemic Medication Administration**

```
["Medication, Administered": "Hypoglycemics Severe Hypoglycemia"]
```

# Initial Population – Severe Hypoglycemia

Inpatient hospitalizations for patients age 18 and older and at least one hypoglycemic medication was administered during the encounter.

**Initial Population: "Qualifying Encounters with Hypoglycemic Medication Administration"**)

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      starts during Global.HospitalizationWithObservation ( QualifyingEncounter )
```
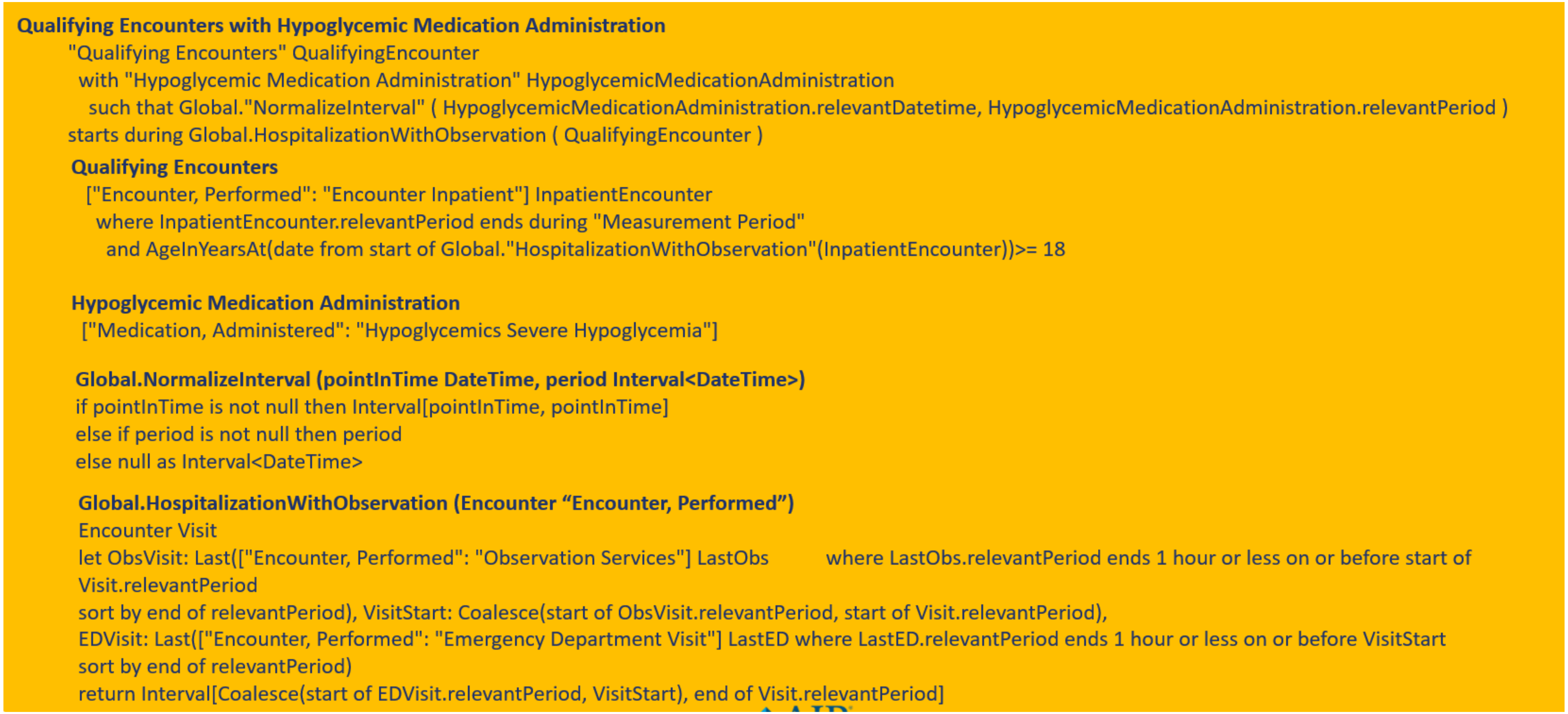

**Hypoglycemic Medication Administration**

```
    ["Medication, Administered": "Hypoglycemics Severe Hypoglycemia"]
```

# Denominator – Severe Hypoglycemia

**Denominator:** "Initial Population"



```
Qualifying Encounters with Hypoglycemic Medication Administration
     "Qualifying Encounters" QualifyingEncounter
      with "Hypoglycemic Medication Administration" HypoglycemicMedicationAdministration
       such that Global."NormalizeInterval" ( HypoglycemicMedicationAdministration.relevantDatetime, HypoglycemicMedicationAdministration.relevantPeriod )
     starts during Global.HospitalizationWithObservation ( QualifyingEncounter )
      Qualifying Encounters
        ["Encounter, Performed": "Encounter Inpatient"] InpatientEncounter
         where InpatientEncounter.relevantPeriod ends during "Measurement Period"
          and AgeInYearsAt(date from start of Global."HospitalizationWithObservation"(InpatientEncounter))>= 18

      Hypoglycemic Medication Administration
       ["Medication, Administered": "Hypoglycemics Severe Hypoglycemia"]

      Global.NormalizeInterval (pointInTime DateTime, period Interval<DateTime>)
      if pointInTime is not null then Interval[pointInTime, pointInTime]
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      EDVisit: Last(["Encounter, Performed": "Emergency Department Visit"] LastED where LastED.relevantPeriod ends 1 hour or less on or before VisitStart
      sort by end of relevantPeriod)
      return Interval[Coalesce(start of EDVisit.relevantPeriod, VisitStart), end of Visit.relevantPeriod]
```

# Numerator– Severe Hypoglycemia

Inpatient hospitalizations which include ALL three:

1. A severe hypoglycemic event during the encounter, defined as a test (laboratory or point-of-care (POC)) for blood glucose with a result <40 mg/dL
2. A hypoglycemic medication administered within 24 hours prior to the start of the severe hypoglycemic event and during the encounter
3. No subsequent repeat test for blood glucose with a result > 80 mg/dL within five minutes of the start of the initial low blood glucose test.

**Numerator: “Severe Hypoglycemic Harm Event")**

```
    "Denominator" QualifyingEncounter
 where exists ( ["Laboratory Test, Performed": "Glucose lab test"] BloodGlucoseLab1
   with ["Medication, Administered": "Hypoglycemics Severe Hypoglycemia"] HypoglycemicMeds
    such that Global."NormalizeInterval" ( HypoglycemicMeds.relevantDatetime, HypoglycemicMeds.relevantPeriod )
starts 24 hours or less before or on BloodGlucoseLab1.relevantDatetime
     and Global."NormalizeInterval" ( HypoglycemicMeds.relevantDatetime, HypoglycemicMeds.relevantPeriod ) starts
during Global."HospitalizationWithObservation" ( QualifyingEncounter )
   without ["Laboratory Test, Performed": "Glucose lab test"] BloodGlucoseLab2
    such that BloodGlucoseLab2.relevantDatetime during Global."HospitalizationWithObservation"
( QualifyingEncounter )
     and BloodGlucoseLab2.relevantDatetime 5 minutes or less after BloodGlucoseLab1.relevantDatetime
     and BloodGlucoseLab2.result > 80 'mg/dL'
   where BloodGlucoseLab1.relevantDatetime during Global."HospitalizationWithObservation" ( QualifyingEncounter )
    and BloodGlucoseLab1.result < 40 'mg/dL' )
```

# Numerator– Severe Hypoglycemia

Inpatient hospitalizations which include ALL three:

1. A severe hypoglycemic event during the encounter, defined as a test (laboratory or point-of-care (POC)) for blood glucose with a result <40 mg/dL

**Numerator: “Severe Hypoglycemic Harm Event")**

```
        "Denominator" QualifyingEncounter
 where exists ( ["Laboratory Test, Performed": "Glucose lab test"] BloodGlucoseLab1
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starts 24 hours or less before or on BloodGlucoseLab1.relevantDatetime
        and Global."NormalizeInterval" ( HypoglycemicMeds.relevantDatetime, HypoglycemicMeds.relevantPeriod ) starts
during Global."HospitalizationWithObservation" ( QualifyingEncounter )
    without ["Laboratory Test, Performed": "Glucose lab test"] BloodGlucoseLab2
      such that BloodGlucoseLab2.relevantDatetime during Global."HospitalizationWithObservation"
( QualifyingEncounter )
        and BloodGlucoseLab2.relevantDatetime 5 minutes or less after BloodGlucoseLab1.relevantDatetime
        and BloodGlucoseLab2.result > 80 'mg/dL'
    where BloodGlucoseLab1.relevantDatetime during Global."HospitalizationWithObservation" ( QualifyingEncounter )
      and BloodGlucoseLab1.result < 40 'mg/dL' )
```

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# Numerator– Severe Hypoglycemia

Inpatient hospitalizations which include ALL three:

2. A hypoglycemic medication administered within 24 hours prior to the start of the severe hypoglycemic event and during the encounter

## Numerator: “Severe Hypoglycemic Harm Event")

```
      "Denominator" QualifyingEncounter
  where exists ( ["Laboratory Test, Performed": "Glucose lab test"] BloodGlucoseLab1
     with ["Medication, Administered": "Hypoglycemics Severe Hypoglycemia"] HypoglycemicMeds
      such that Global."NormalizeInterval" ( HypoglycemicMeds.relevantDatetime, HypoglycemicMeds.relevantPeriod )
starts 24 hours or less before or on BloodGlucoseLab1.relevantDatetime
       and Global."NormalizeInterval" ( HypoglycemicMeds.relevantDatetime, HypoglycemicMeds.relevantPeriod ) starts
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     without ["Laboratory Test, Performed": "Glucose lab test"] BloodGlucoseLab2
      such that BloodGlucoseLab2.relevantDatetime during Global."HospitalizationWithObservation"
( QualifyingEncounter )
       and BloodGlucoseLab2.relevantDatetime 5 minutes or less after BloodGlucoseLab1.relevantDatetime
       and BloodGlucoseLab2.result > 80 'mg/dL'
     where BloodGlucoseLab1.relevantDatetime during Global."HospitalizationWithObservation" ( QualifyingEncounter )
      and BloodGlucoseLab1.result < 40 'mg/dL' )
```

# Numerator– Severe Hypoglycemia

Inpatient hospitalizations which include ALL three:

3. No subsequent repeat test for blood glucose with a result > 80 mg/dL within five minutes of the start of the initial low blood glucose test.

## Numerator: “Severe Hypoglycemic Harm Event")

```
        "Denominator" QualifyingEncounter
  where exists ( ["Laboratory Test, Performed": "Glucose lab test"] BloodGlucoseLab1
      with ["Medication, Administered": "Hypoglycemics Severe Hypoglycemia"] HypoglycemicMeds
        such that Global."NormalizeInterval" ( HypoglycemicMeds.relevantDatetime, HypoglycemicMeds.relevantPeriod )
starts 24 hours or less before or on BloodGlucoseLab1.relevantDatetime
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during Global."HospitalizationWithObservation" ( QualifyingEncounter )
      without ["Laboratory Test, Performed": "Glucose lab test"] BloodGlucoseLab2
        such that BloodGlucoseLab2.relevantDatetime during Global."HospitalizationWithObservation"
( QualifyingEncounter )
          and BloodGlucoseLab2.relevantDatetime 5 minutes or less after BloodGlucoseLab1.relevantDatetime
          and BloodGlucoseLab2.result > 80 'mg/dL'
      where BloodGlucoseLab1.relevantDatetime during Global."HospitalizationWithObservation" ( QualifyingEncounter )
        and BloodGlucoseLab1.result < 40 'mg/dL' )
```

# Measure Overview – Hospital Harm – Severe Hyperglycemia

(CMS871v1)

# Proportion vs Ratio

**Proportion**

Numerator is a subset of Denominator

**Example**

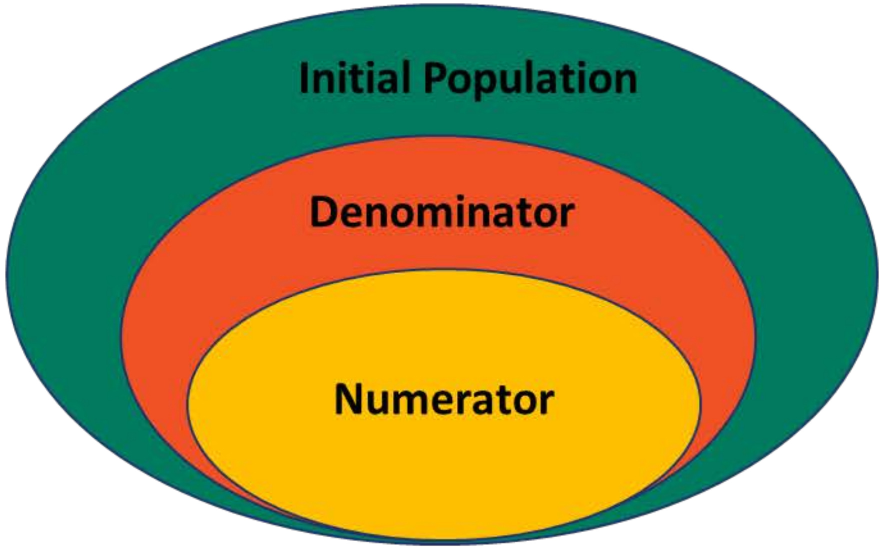
$$\frac{\text{Patients with hemorrhagic stroke discharged with antithrombotics}}{\text{Patients with hemorrhagic stroke}}$$

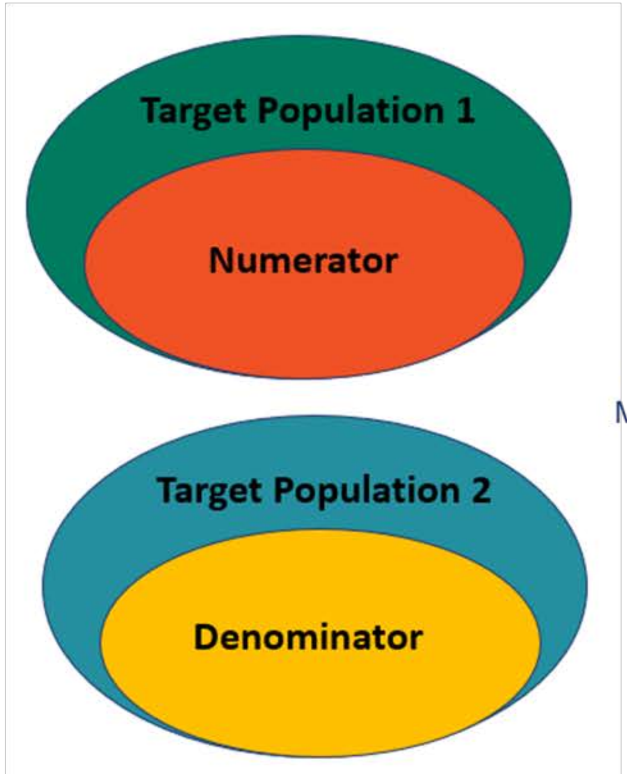
**Ratio**

Numerator and Denominator come from 2 different populations

**Example**

$$\frac{\text{Number of patients with central lines with infection}}{\text{Number of central line days}}$$





**Ratio Components (required)**

Initial Population

Denominator

Numerator

Measure Observation for Numerator

Measure Observation for Denominator

# Intent/Rationale- Severe Hyperglycemia

- Assess occurrence and extent of severe hyperglycemia
- Intended to be used in combination with its companion measure Severe Hypoglycemia to reduce unintended consequences.
- Patients with blood glucose of >200mg/DL are at high risk
- Associated with increased in-hospital mortality, infection rates, and hospital LOS
- Lowering rate improves patient care while reducing costs
- Rates of inpatient severe hyperglycemia events indicate quality of care
- Preventable with proper glycemic management

# Hospital Harm – Severe Hyperglycemia

**Description:**
This ratio measure assesses the number of inpatient hospital days with a hyperglycemic event (harm) per the total qualifying days for patients 18 years of age or older at admission.

**Initial Population / Denominator:**
Inpatient hospitalizations for patients 18 years of age or older at the start of the encounter with either:

- A diagnosis of diabetes that starts before or during the encounter; OR
- Administration of at least one dose of insulin or hypoglycemic medication during the encounter; OR
- Presence of at least one blood glucose value >= 200 mg/dL during the encounter

**Numerator:**
Inpatient hospitalizations with a severe hyperglycemic event within the first 10 days of the encounter minus the first 24-hour period.

A severe hyperglycemic event (harm) is defined as either:

- A day with at least one blood glucose value >300 mg/dL; OR
- A day where a blood glucose was not measured, and it was preceded by two consecutive days where at least one glucose value during each of the two days was >= 200 mg/dL.

# Hospital Harm – Severe Hyperglycemia

**Measure Observation – Associated with the Denominator:**
The total number of qualifying days which match the initial population/denominator criteria.

**Measure Observation – Associated with the Numerator:**
The total number of days with a hyperglycemic event (harm).

Days are measured in 24-hour periods starting from the time of arrival to the hospital including the ED and Observation. The first 24-hour period after arrival is not counted. The last day before discharge is not counted if it was less than 24 hours.

# Initial Population – Severe Hyperglycemia

**Inpatient hospitalizations for patients age 18 and older with either:**

- A diagnosis of diabetes that starts before or during the encounter; OR
- Administration of at least one dose of insulin or hypoglycemic medication during the encounter; OR
- Presence of at least one blood glucose value >= 200 mg/dL during the encounter

```
Initial Population: "Qualifying Encounters with Existing Diabetes Diagnosis")
                     union “Qualifying Encounters with Hypoglycemic Medication”
                     union “Qualifying Encounters with Elevated Blood Glucose Lab”
```

**Qualifying Encounters with Existing Diabetes Diagnosis**

```
    "Qualifying Encounters with Hospitalization Period" EncounterWithHospitalization
     with ["Diagnosis": "Diabetes"] DiabetesDiagnosis
      such that DiabetesDiagnosis.prevalencePeriod starts before
      end of EncounterWithHospitalization.hospitalizationPeriod
     return EncounterWithHospitalization.encounter
```

**Qualifying Encounters with Hypoglycemic Medication**

```
    "Qualifying Encounters with Hospitalization Period" EncounterWithHospitalization
     with ["Medication, Administered": "Hypoglycemics Treatment Medications"] HypoglycemicMedication
      such that Global."NormalizeInterval" ( HypoglycemicMedication.relevantDatetime, HypoglycemicMedication.relevantPeriod )      starts during
   EncounterWithHospitalization.hospitalizationPeriod
     return EncounterWithHospitalization.encounter“
```

**Qualifying Encounters with Elevated Blood Glucose Lab**

```
    "Qualifying Encounters with Hospitalization Period" EncounterWithHospitalization
     with ["Laboratory Test, Performed": "Glucose lab test"] BloodGlucoseLab
      such that BloodGlucoseLab.relevantDatetime during EncounterWithHospitalization.hospitalizationPeriod
       and BloodGlucoseLab.result >= 200 'mg/dL'
     return EncounterWithHospitalization.encounter
```

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# Initial Population – Severe Hyperglycemia

Inpatient hospitalizations for patients age 18 and older with either:

- A diagnosis of diabetes that starts before or during the encounter;

**Initial Population: "Qualifying Encounters with Existing Diabetes Diagnosis"**

**Qualifying Encounters with Existing Diabetes Diagnosis**

```
"Qualifying Encounters with Hospitalization Period" EncounterWithHospitalization
  with ["Diagnosis": "Diabetes"] DiabetesDiagnosis
    such that DiabetesDiagnosis.prevalencePeriod starts before end of EncounterWithHospitalization.hospitalizationPeriod
  return EncounterWithHospitalization.encounter
```

**Qualifying Encounters with Hospitalization Period**

```
"Qualifying Encounters" QualifyingEncounter
    return Tuple { encounter: QualifyingEncounter, hospitalizationPeriod:
Global."HospitalizationWithObservation" ( QualifyingEncounter )  }
```

**Qualifying Encounters**

```
["Encounter, Performed": "Encounter Inpatient"] InpatientEncounter
  with ["Patient Characteristic Birthdate": "Birth date"] BirthDate
    such that InpatientEncounter.relevantPeriod ends during "Measurement Period"
    and Global."CalendarAgeInYearsAt" ( BirthDate.birthDatetime, start of Global."HospitalizationWithObservation" (
InpatientEncounter ) ) >= 18
```

# Initial Population – Severe Hyperglycemia

Inpatient hospitalizations for patients age 18 and older with either:

- A diagnosis of diabetes that starts before or during the encounter;

**Initial Population: "Qualifying Encounters with Existing Diabetes Diagnosis"**

**Qualifying Encounters with Existing Diabetes Diagnosis**

```
"Qualifying Encounters with Hospitalization Period" EncounterWithHospitalization
  with ["Diagnosis": "Diabetes"] DiabetesDiagnosis
    such that DiabetesDiagnosis.prevalencePeriod starts before end of EncounterWithHospitalization.hospitalizationPeriod
  return EncounterWithHospitalization.encounter
```

**Qualifying Encounters with Hospitalization Period**

```
"Qualifying Encounters" QualifyingEncounter
    return Tuple { encounter: QualifyingEncounter, hospitalizationPeriod:
Global."HospitalizationWithObservation" ( QualifyingEncounter )  }
```

**Qualifying Encounters**

```
["Encounter, Performed": "Encounter Inpatient"] InpatientEncounter
  with ["Patient Characteristic Birthdate": "Birth date"] BirthDate
    such that InpatientEncounter.relevantPeriod ends during "Measurement Period"
    and Global."CalendarAgeInYearsAt" ( BirthDate.birthDatetime, start of Global."HospitalizationWithObservation" (
InpatientEncounter ) ) >= 18
```

# Initial Population – Severe Hyperglycemia

Inpatient hospitalizations for patients age 18 and older with either:

- A diagnosis of diabetes that starts before or during the encounter;

**Initial Population: "Qualifying Encounters with Existing Diabetes Diagnosis"**

**Qualifying Encounters with Existing Diabetes Diagnosis**

```
"Qualifying Encounters with Hospitalization Period" EncounterWithHospitalization
  with ["Diagnosis": "Diabetes"] DiabetesDiagnosis
    such that DiabetesDiagnosis.prevalencePeriod starts before end of EncounterWithHospitalization.hospitalizationPeriod
  return EncounterWithHospitalization.encounter
```

**Qualifying Encounters with Hospitalization Period**

```
"Qualifying Encounters" QualifyingEncounter
    return Tuple { encounter: QualifyingEncounter, hospitalizationPeriod:
Global."HospitalizationWithObservation" ( QualifyingEncounter )  }
```

**Qualifying Encounters**

```
["Encounter, Performed": "Encounter Inpatient"] InpatientEncounter
  with ["Patient Characteristic Birthdate": "Birth date"] BirthDate
    such that InpatientEncounter.relevantPeriod ends during "Measurement Period"
    and Global."CalendarAgeInYearsAt" ( BirthDate.birthDatetime, start of Global."HospitalizationWithObservation" (
InpatientEncounter ) ) >= 18
```

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# Initial Population – Severe Hyperglycemia

Inpatient hospitalizations for patients age 18 and older with either:

- A diagnosis of diabetes that starts before or during the encounter;

**Initial Population: "Qualifying Encounters with Existing Diabetes Diagnosis"**

**Qualifying Encounters with Existing Diabetes Diagnosis**

```
"Qualifying Encounters with Hospitalization Period" EncounterWithHospitalization
  with ["Diagnosis": "Diabetes"] DiabetesDiagnosis
    such that DiabetesDiagnosis.prevalencePeriod starts before end of EncounterWithHospitalization.hospitalizationPeriod
  return EncounterWithHospitalization.encounter
```

**Qualifying Encounters with Hospitalization Period**

```
"Qualifying Encounters" QualifyingEncounter
   return Tuple { encounter: QualifyingEncounter, hospitalizationPeriod:
Global."HospitalizationWithObservation" ( QualifyingEncounter )  }
```

**Qualifying Encounters**

```
["Encounter, Performed": "Encounter Inpatient"] InpatientEncounter
  with ["Patient Characteristic Birthdate": "Birth date"] BirthDate
    such that InpatientEncounter.relevantPeriod ends during "Measurement Period"
    and Global."CalendarAgeInYearsAt" ( BirthDate.birthDatetime, start of Global."HospitalizationWithObservation" (
InpatientEncounter ) ) >= 18
```

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# Initial Population – Severe Hyperglycemia

Inpatient hospitalizations for patients age 18 and older with either:

- A diagnosis of diabetes that starts before or during the encounter;

**Initial Population: "Qualifying Encounters with Existing Diabetes Diagnosis"**

```
Qualifying Encounters with Existing Diabetes Diagnosis
"Qualifying Encounters with Hospitalization Period" EncounterWithHospitalization
  with ["Diagnosis": "Diabetes"] DiabetesDiagnosis
    such that DiabetesDiagnosis.prevalencePeriod starts before end of EncounterWithHospitalization.hospitalizationPeriod
  return EncounterWithHospitalization.encounter
```

```
        Qualifying Encounters with Hospitalization Period
        "Qualifying Encounters" QualifyingEncounter
            return Tuple { encounter: QualifyingEncounter, hospitalizationPeriod:
Global."HospitalizationWithObservation" ( QualifyingEncounter )  }
```

```
                Qualifying Encounters
                    ["Encounter, Performed": "Encounter Inpatient"] InpatientEncounter
                      with ["Patient Characteristic Birthdate": "Birth date"] BirthDate
                        such that InpatientEncounter.relevantPeriod ends during "Measurement Period"
                        and Global."CalendarAgeInYearsAt" ( BirthDate.birthDatetime, start of Global."HospitalizationWithObservation" (
                    InpatientEncounter ) ) >= 18
```

# Initial Population – Severe Hyperglycemia

Inpatient hospitalizations for patients age 18 and older with either:

- Administration of at least one dose of insulin or hypoglycemic medication during the encounter; OR

**Initial Population: " Qualifying Encounters with Hypoglycemic Medication "**

**Qualifying Encounters with Hypoglycemic Medication**

```
 "Qualifying Encounters with Hospitalization Period" EncounterWithHospitalization
  with ["Medication, Administered": "Hypoglycemics Treatment Medications"] HypoglycemicMedication
    such that Global."NormalizeInterval" ( HypoglycemicMedication.relevantDatetime,
HypoglycemicMedication.relevantPeriod )
starts during EncounterWithHospitalization.hospitalizationPeriod
  return EncounterWithHospitalization.encounter“
```

**Qualifying Encounters with Hospitalization Period**

```
"Qualifying Encounters" QualifyingEncounter
  return Tuple { encounter: QualifyingEncounter, hospitalizationPeriod: Global."HospitalizationWithObservation" (     QualifyingEncounter )  }
```

**Qualifying Encounters**

```
["Encounter, Performed": "Encounter Inpatient"] InpatientEncounter
  with ["Patient Characteristic Birthdate": "Birth date"] BirthDate
   such that InpatientEncounter.relevantPeriod ends during "Measurement Period"
   and Global."CalendarAgeInYearsAt" ( BirthDate.birthDatetime, start of Global."HospitalizationWithObservation" ( InpatientEncounter ) ) >= 18
```

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# Initial Population – Severe Hyperglycemia

Inpatient hospitalizations for patients age 18 and older with either:

- Administration of at least one dose of insulin or hypoglycemic medication during the encounter; OR

**Initial Population: " Qualifying Encounters with Hypoglycemic Medication "**

**Qualifying Encounters with Hypoglycemic Medication**

```
 "Qualifying Encounters with Hospitalization Period" EncounterWithHospitalization
  with ["Medication, Administered": "Hypoglycemics Treatment Medications"] HypoglycemicMedication
    such that Global."NormalizeInterval" ( HypoglycemicMedication.relevantDatetime,
HypoglycemicMedication.relevantPeriod )
starts during EncounterWithHospitalization.hospitalizationPeriod
  return EncounterWithHospitalization.encounter“
```

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# Initial Population – Severe Hyperglycemia

Inpatient hospitalizations for patients age 18 and older with either:

- Administration of at least one dose of insulin or hypoglycemic medication during the encounter; OR

**Initial Population: " Qualifying Encounters with Hypoglycemic Medication "**

```
Qualifying Encounters with Hypoglycemic Medication
 "Qualifying Encounters with Hospitalization Period" EncounterWithHospitalization
  with ["Medication, Administered": "Hypoglycemics Treatment Medications"] HypoglycemicMedication
    such that Global."NormalizeInterval" ( HypoglycemicMedication.relevantDatetime,
HypoglycemicMedication.relevantPeriod )
starts during EncounterWithHospitalization.hospitalizationPeriod
  return EncounterWithHospitalization.encounter“
```

# Initial Population – Severe Hyperglycemia

Inpatient hospitalizations for patients age 18 and older with either:

- Presence of at least one blood glucose value >= 200 mg/dL during the encounter

**Initial Population: " Qualifying Encounters with Elevated Blood Glucose Lab "**

```
Qualifying Encounters with Elevated Blood Glucose Lab
 "Qualifying Encounters with Hospitalization Period" EncounterWithHospitalization
  with ["Laboratory Test, Performed": "Glucose lab test"] BloodGlucoseLab
    such that BloodGlucoseLab.relevantDatetime during EncounterWithHospitalization.hospitalizationPeriod
      and BloodGlucoseLab.result >= 200 'mg/dL'
  return EncounterWithHospitalization.encounter
```

```
Qualifying Encounters with Hospitalization Period
"Qualifying Encounters" QualifyingEncounter
  return Tuple { encounter: QualifyingEncounter, hospitalizationPeriod: Global."HospitalizationWithObservation" (     QualifyingEncounter )  }

        Qualifying Encounters
              ["Encounter, Performed": "Encounter Inpatient"] InpatientEncounter
                with ["Patient Characteristic Birthdate": "Birth date"] BirthDate
                 such that InpatientEncounter.relevantPeriod ends during "Measurement Period"
                 and Global."CalendarAgeInYearsAt" ( BirthDate.birthDatetime, start of Global."HospitalizationWithObservation" ( InpatientEncounter ) ) >= 18
```

# Initial Population – Severe Hyperglycemia

Inpatient hospitalizations for patients age 18 and older with either:

- Presence of at least one blood glucose value >= 200 mg/dL during the encounter

**Initial Population: " Qualifying Encounters with Elevated Blood Glucose Lab "**

```
Qualifying Encounters with Elevated Blood Glucose Lab
 "Qualifying Encounters with Hospitalization Period" EncounterWithHospitalization
  with ["Laboratory Test, Performed": "Glucose lab test"] BloodGlucoseLab
    such that BloodGlucoseLab.relevantDatetime during EncounterWithHospitalization.hospitalizationPeriod
      and BloodGlucoseLab.result >= 200 'mg/dL'
  return EncounterWithHospitalization.encounter
```

# Initial Population – Severe Hyperglycemia

Inpatient hospitalizations for patients age 18 and older with either:

- Presence of at least one blood glucose value >= 200 mg/dL during the encounter

**Initial Population: " Qualifying Encounters with Elevated Blood Glucose Lab "**

**Qualifying Encounters with Elevated Blood Glucose Lab**

```
"Qualifying Encounters with Hospitalization Period" EncounterWithHospitalization
 with ["Laboratory Test, Performed": "Glucose lab test"] BloodGlucoseLab
   such that BloodGlucoseLab.relevantDatetime during EncounterWithHospitalization.hospitalizationPeriod
     and BloodGlucoseLab.result >= 200 'mg/dL'
 return EncounterWithHospitalization.encounter
```

# Denominator – Severe Hyperglycemia

**Denominator**: "Initial Population"

**Qualifying Encounters with Existing Diabetes Diagnosis**

```
   "Qualifying Encounters with Hospitalization Period" EncounterWithHospitalization
    with ["Diagnosis": "Diabetes"] DiabetesDiagnosis
      such that DiabetesDiagnosis.prevalencePeriod starts before
      end of EncounterWithHospitalization.hospitalizationPeriod
    return EncounterWithHospitalization.encounter
```

**Qualifying Encounters with Hypoglycemic Medication**

```
    "Qualifying Encounters with Hospitalization Period" EncounterWithHospitalization
     with ["Medication, Administered": "Hypoglycemics Treatment Medications"] HypoglycemicMedication
       such that Global."NormalizeInterval" ( HypoglycemicMedication.relevantDatetime, HypoglycemicMedication.relevantPeriod )      starts
   during EncounterWithHospitalization.hospitalizationPeriod
     return EncounterWithHospitalization.encounter“
```

**Qualifying Encounters with Elevated Blood Glucose Lab**

```
    "Qualifying Encounters with Hospitalization Period" EncounterWithHospitalization
     with ["Laboratory Test, Performed": "Glucose lab test"] BloodGlucoseLab
       such that BloodGlucoseLab.relevantDatetime during EncounterWithHospitalization.hospitalizationPeriod
         and BloodGlucoseLab.result >= 200 'mg/dL'
     return EncounterWithHospitalization.encounter
```

# Numerator– Severe Hyperglycemia

Inpatient hospitalizations with severe hyperglycemic event day(s) within the first 10 days of the encounter (minus the first 24-hour period)

A hyperglycemic event is defined as:

1. A day with at least one blood glucose value >300 mg/dL; OR
2. A day where a blood glucose was not measured, and it was preceded by 2 consecutive days where at least one glucose value during each of the two days was >=200 mg/dL.

```
Numerator: "Pertinent Encounters with Hyperglycemic Event Days" EncounterWithEventDays
                    where exists ( EncounterWithEventDays.eligibleEventDays EligibleEventDay where
EligibleEventDay.hasHyperglycemicEvent )
                       return EncounterWithEventDays.encounter
```

# Numerator– Severe Hyperglycemia

Inpatient hospitalizations with severe hyperglycemic event day(s) within the first 10 days of the encounter (minus the first 24-hour period)

```
Numerator: "Pertinent Encounters with Hyperglycemic Event Days" EncounterWithEventDays
                        where exists ( EncounterWithEventDays.eligibleEventDays EligibleEventDay where EligibleEventDay.hasHyperglycemicEvent )
                       return EncounterWithEventDays.encounter
```

**Pertinent Encounters with Days**

```
    "Initial Population" PertinentEncounter
        let period: Global."HospitalizationWithObservation" ( PertinentEncounter ),
      relevantPeriod: "Crop Interval to 10 Days"(period)
      return Tuple {encounter: PertinentEncounter, hospitalizationPeriod: period,
      relevantPeriod: relevantPeriod, relevantDays: "Days In Period"(relevantPeriod)}
```

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# Numerator– Severe Hyperglycemia

Inpatient hospitalizations with severe hyperglycemic event day(s) within the first 10 days of the encounter (minus the first 24-hour period)

**Pertinent Encounters with Days**

```
    "Initial Population" PertinentEncounter
      let period: Global."HospitalizationWithObservation" ( PertinentEncounter ), relevantPeriod: "Crop
     Interval to 10 Days"(period)
     return Tuple {encounter: PertinentEncounter, hospitalizationPeriod: period, relevantPeriod:
     relevantPeriod, relevantDays: "Days In Period"(relevantPeriod)}
```

**Qualifying Encounters with Existing Diabetes Diagnosis**

```
    "Qualifying Encounters with Hospitalization Period" EncounterWithHospitalization
     with ["Diagnosis": "Diabetes"] DiabetesDiagnosis
       such that DiabetesDiagnosis.prevalencePeriod starts before
       end of EncounterWithHospitalization.hospitalizationPeriod
     return EncounterWithHospitalization.encounter
```

**Qualifying Encounters with Hypoglycemic Medication**

```
     "Qualifying Encounters with Hospitalization Period" EncounterWithHospitalization
     with ["Medication, Administered": "Hypoglycemics Treatment Medications"] HypoglycemicMedication
       such that Global."NormalizeInterval" ( HypoglycemicMedication.relevantDatetime, HypoglycemicMedication.relevantPeriod ) starts during
    EncounterWithHospitalization.hospitalizationPeriod
     return EncounterWithHospitalization.encounter"
```

**Qualifying Encounters with Elevated Blood Glucose Lab**

```
     "Qualifying Encounters with Hospitalization Period" EncounterWithHospitalization
     with ["Laboratory Test, Performed": "Glucose lab test"] BloodGlucoseLab
       such that BloodGlucoseLab.relevantDatetime during EncounterWithHospitalization.hospitalizationPeriod
         and BloodGlucoseLab.result >= 200 'mg/dL'
     return EncounterWithHospitalization.encounter
```

# Numerator– Severe Hyperglycemia

Inpatient hospitalizations with severe hyperglycemic event day(s) within the first 10 days of the encounter (minus the first 24-hour period)

**Pertinent Encounters with Days**

```
"Initial Population" PertinentEncounter
  let period: Global."HospitalizationWithObservation" ( PertinentEncounter ), relevantPeriod: "Crop Interval to 10
  Days"(period)
  return Tuple {encounter: PertinentEncounter, hospitalizationPeriod: period, relevantPeriod: relevantPeriod, relevantDays:
  "Days In Period"(relevantPeriod)}
```

**Crop Interval to 10 Days(Period Interval<DateTime>)**

```
Interval[start of Period, Min({
  end of Period, start of Period + 10 days })]
```

**Days In Period(Period Interval<DateTime>)**

```
( "Interval To Day Numbers"(Period)) DayIndex
  let startPeriod: start of Period + ( 24 hours * ( DayIndex - 1 ) ),
  endPeriod: if ( hours between startPeriod and
    end of Period < 24 ) then startPeriod
    else start of Period + ( 24 hours * DayIndex )
  return Tuple { dayIndex: DayIndex, dayPeriod: Interval[startPeriod, endPeriod
)  }
```

**Interval To Day Numbers(Period Interval<DateTime>)**

```
( expand { Interval[1, days between start of Period and
end of Period]} ) DayExpand
  return
  end of DayExpand
```

# Numerator– Severe Hyperglycemia

Inpatient hospitalizations with severe hyperglycemic event day(s) within the first 10 days of the encounter (minus the first 24-hour period)

```
Pertinent Encounters with Days
    "Initial Population" PertinentEncounter
      let period: Global."HospitalizationWithObservation" ( PertinentEncounter ), relevantPeriod: "Crop Interval to 10
     Days"(period)
     return Tuple {encounter: PertinentEncounter, hospitalizationPeriod: period, relevantPeriod: relevantPeriod,
     relevantDays: "Days In Period"(relevantPeriod)}

     Crop Interval to 10 Days(Period Interval<DateTime>)
     Interval[start of Period, Min({
      end of Period, start of Period + 10 days })]

    Days In Period(Period Interval<DateTime>)
    ( "Interval To Day Numbers"(Period)) DayIndex
     let startPeriod: start of Period + ( 24 hours * ( DayIndex - 1 ) ),
     endPeriod: if ( hours between startPeriod and
      end of Period < 24 ) then startPeriod
      else start of Period + ( 24 hours * DayIndex )
     return Tuple { dayIndex: DayIndex, dayPeriod: Interval[startPeriod, endPeriod
    )  }
          Interval To Day Numbers(Period Interval<DateTime>)
          ( expand { Interval[1, days between start of Period and
          end of Period]} ) DayExpand
           return
           end of DayExpand
```

# Numerator– Severe Hyperglycemia

Inpatient hospitalizations with severe hyperglycemic event day(s) within the first 10 days of the encounter (minus the first 24-hour period)

**Pertinent Encounters with Days**

```
"Initial Population" PertinentEncounter
    let period: Global."HospitalizationWithObservation" ( PertinentEncounter ), relevantPeriod: "Crop Interval to 10
  Days"(period)
  return Tuple {encounter: PertinentEncounter, hospitalizationPeriod: period, relevantPeriod: relevantPeriod,
  relevantDays: "Days In Period"(relevantPeriod)}
```

**Crop Interval to 10 Days(Period Interval<DateTime>)**

```
Interval[start of Period, Min({
  end of Period, start of Period + 10 days })]
```

**Days In Period(Period Interval<DateTime>)**

```
( "Interval To Day Numbers"(Period)) DayIndex
  let startPeriod: start of Period + ( 24 hours * ( DayIndex - 1 ) ),
  endPeriod: if ( hours between startPeriod and
    end of Period < 24 ) then startPeriod
    else start of Period + ( 24 hours * DayIndex )
  return Tuple { dayIndex: DayIndex, dayPeriod: Interval[startPeriod, endPeriod
) }
```

**Interval To Day Numbers(Period Interval<DateTime>)**

```
( expand { Interval[1, days between start of Period and
end of Period]} ) DayExpand
  return
  end of DayExpand
```

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# Numerator– Severe Hyperglycemia

A hyperglycemic event is defined as:

1. A day with at least one blood glucose value >300 mg/dL; OR

```
Numerator: "Pertinent Encounters with Hyperglycemic Event Days" EncounterWithEventDays
                      where exists ( EncounterWithEventDays.eligibleEventDays EligibleEventDay where EligibleEventDay.hasHyperglycemicEvent )
                     return EncounterWithEventDays.encounter
```

**Pertinent Encounters with Hyperglycemic Event Days**

```
     "Pertinent Encounters with Glucose Result Days" EncounterWithResultDays
      let eligibleEventDays: EncounterWithResultDays.relevantDays EncounterDay where EncounterDay.dayIndex > 1
        return Tuple { dayIndex: EncounterDay.dayIndex, dayPeriod: EncounterDay.dayPeriod, hasHyperglycemicEvent: ( EncounterDay.hasSevereResult
             or ( EncounterDay.hasNoResult and EncounterWithResultDays.relevantDays[EncounterDay.dayIndex - 2].hasElevatedResult
                and EncounterWithResultDays.relevantDays[EncounterDay.dayIndex - 3].hasElevatedResult ) ) }
      return Tuple { encounter: EncounterWithResultDays.encounter, relevantPeriod: EncounterWithResultDays.relevantPeriod, eligibleEventDays:
     eligibleEventDays }
```

**Pertinent Encounters With Glucose Result Days**

```
"Pertinent Encounters With Days" PertinentEncounterDays
  return Tuple { encounter: PertinentEncounterDays.encounter,  relevantPeriod: PertinentEncounterDays.relevantPeriod,
    relevantDays: ( PertinentEncounterDays.relevantDays EncounterDay return Tuple { dayIndex: EncounterDay.dayIndex, dayPeriod:
EncounterDay.dayPeriod,
          hasSevereResult: exists ( ["Laboratory Test, Performed": "Glucose lab test"] BloodGlucoseLab1
              where BloodGlucoseLab1.result > 300 'mg/dL’  and BloodGlucoseLab1.relevantDatetime during EncounterDay.dayPeriod),
          hasElevatedResult: exists ( ["Laboratory Test, Performed": "Glucose lab test"] BloodGlucoseLab2
              where BloodGlucoseLab2.result >= 200 'mg/dL’ and BloodGlucoseLab2.relevantDatetime during EncounterDay.dayPeriod),
          hasNoResult: not exists ( ["Laboratory Test, Performed": "Glucose lab test"] BloodGlucoseLab3
              where BloodGlucoseLab3.relevantDatetime during EncounterDay.dayPeriod)}))}
```

# Numerator– Severe Hyperglycemia

A hyperglycemic event is defined as:
1. A day with at least one blood glucose value >300 mg/dL; OR

```
Numerator: "Pertinent Encounters with Hyperglycemic Event Days" EncounterWithEventDays
              where exists ( EncounterWithEventDays.eligibleEventDays EligibleEventDay where EligibleEventDay.hasHyperglycemicEvent )
             return EncounterWithEventDays.encounter
```

**Pertinent Encounters with Hyperglycemic Event Days**

```
    "Pertinent Encounters with Glucose Result Days" EncounterWithResultDays
     let eligibleEventDays: EncounterWithResultDays.relevantDays EncounterDay where EncounterDay.dayIndex > 1
      return Tuple { dayIndex: EncounterDay.dayIndex, dayPeriod: EncounterDay.dayPeriod, hasHyperglycemicEvent: ( EncounterDay.hasSevereResult
         or ( EncounterDay.hasNoResult and EncounterWithResultDays.relevantDays[EncounterDay.dayIndex - 2].hasElevatedResult
           and EncounterWithResultDays.relevantDays[EncounterDay.dayIndex - 3].hasElevatedResult ) ) }
     return Tuple { encounter: EncounterWithResultDays.encounter, relevantPeriod: EncounterWithResultDays.relevantPeriod, eligibleEventDays:
    eligibleEventDays }
```

**Pertinent Encounters With Glucose Result Days**

```
"Pertinent Encounters With Days" PertinentEncounterDays
  return Tuple { encounter: PertinentEncounterDays.encounter,  relevantPeriod: PertinentEncounterDays.relevantPeriod,
    relevantDays: ( PertinentEncounterDays.relevantDays EncounterDay return Tuple { dayIndex: EncounterDay.dayIndex, dayPeriod:
EncounterDay.dayPeriod,
          hasSevereResult: exists ( ["Laboratory Test, Performed": "Glucose lab test"] BloodGlucoseLab1
            where BloodGlucoseLab1.result > 300 'mg/dL’  and BloodGlucoseLab1.relevantDatetime during EncounterDay.dayPeriod),
          hasElevatedResult: exists ( ["Laboratory Test, Performed": "Glucose lab test"] BloodGlucoseLab2
            where BloodGlucoseLab2.result >= 200 'mg/dL’ and BloodGlucoseLab2.relevantDatetime during EncounterDay.dayPeriod),
          hasNoResult: not exists ( ["Laboratory Test, Performed": "Glucose lab test"] BloodGlucoseLab3
            where BloodGlucoseLab3.relevantDatetime during EncounterDay.dayPeriod)})}
```

# Numerator– Severe Hyperglycemia

A hyperglycemic event is defined as:
1. A day with at least one blood glucose value >300 mg/dL; OR

```
Numerator: "Pertinent Encounters with Hyperglycemic Event Days" EncounterWithEventDays
                    where exists ( EncounterWithEventDays.eligibleEventDays EligibleEventDay where EligibleEventDay.hasHyperglycemicEvent )
                   return EncounterWithEventDays.encounter
```

**Pertinent Encounters with Hyperglycemic Event Days**

```
     "Pertinent Encounters with Glucose Result Days" EncounterWithResultDays
       let eligibleEventDays: EncounterWithResultDays.relevantDays EncounterDay where EncounterDay.dayIndex > 1
         return Tuple { dayIndex: EncounterDay.dayIndex, dayPeriod: EncounterDay.dayPeriod, hasHyperglycemicEvent: ( EncounterDay.hasSevereResult
               or ( EncounterDay.hasNoResult and EncounterWithResultDays.relevantDays[EncounterDay.dayIndex - 2].hasElevatedResult
                   and EncounterWithResultDays.relevantDays[EncounterDay.dayIndex - 3].hasElevatedResult ) ) }
       return Tuple { encounter: EncounterWithResultDays.encounter, relevantPeriod: EncounterWithResultDays.relevantPeriod, eligibleEventDays:
     eligibleEventDays }
```

**Pertinent Encounters With Glucose Result Days**

```
"Pertinent Encounters With Days" PertinentEncounterDays
  return Tuple { encounter: PertinentEncounterDays.encounter,  relevantPeriod: PertinentEncounterDays.relevantPeriod,
    relevantDays: ( PertinentEncounterDays.relevantDays EncounterDay return Tuple { dayIndex: EncounterDay.dayIndex, dayPeriod:
EncounterDay.dayPeriod,
          hasSevereResult: exists ( ["Laboratory Test, Performed": "Glucose lab test"] BloodGlucoseLab1
              where BloodGlucoseLab1.result > 300 'mg/dL'  and BloodGlucoseLab1.relevantDatetime during EncounterDay.dayPeriod),
          hasElevatedResult: exists ( ["Laboratory Test, Performed": "Glucose lab test"] BloodGlucoseLab2
              where BloodGlucoseLab2.result >= 200 'mg/dL' and BloodGlucoseLab2.relevantDatetime during EncounterDay.dayPeriod),
          hasNoResult: not exists ( ["Laboratory Test, Performed": "Glucose lab test"] BloodGlucoseLab3
              where BloodGlucoseLab3.relevantDatetime during EncounterDay.dayPeriod)}))}
```

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# Numerator– Severe Hyperglycemia

A hyperglycemic event is defined as:
1. A day with at least one blood glucose value >300 mg/dL; OR

```
Numerator: "Pertinent Encounters with Hyperglycemic Event Days" EncounterWithEventDays
                    where exists ( EncounterWithEventDays.eligibleEventDays EligibleEventDay where EligibleEventDay.hasHyperglycemicEvent )
                   return EncounterWithEventDays.encounter
```

**Pertinent Encounters with Hyperglycemic Event Days**

```
    "Pertinent Encounters with Glucose Result Days" EncounterWithResultDays
      let eligibleEventDays: EncounterWithResultDays.relevantDays EncounterDay where EncounterDay.dayIndex > 1
        return Tuple { dayIndex: EncounterDay.dayIndex, dayPeriod: EncounterDay.dayPeriod, hasHyperglycemicEvent: ( EncounterDay.hasSevereResult
             or ( EncounterDay.hasNoResult and EncounterWithResultDays.relevantDays[EncounterDay.dayIndex - 2].hasElevatedResult
                and EncounterWithResultDays.relevantDays[EncounterDay.dayIndex - 3].hasElevatedResult ) ) }
      return Tuple { encounter: EncounterWithResultDays.encounter, relevantPeriod: EncounterWithResultDays.relevantPeriod, eligibleEventDays:
    eligibleEventDays }
```

**Pertinent Encounters With Glucose Result Days**

```
"Pertinent Encounters With Days" PertinentEncounterDays
  return Tuple { encounter: PertinentEncounterDays.encounter,  relevantPeriod: PertinentEncounterDays.relevantPeriod,
    relevantDays: ( PertinentEncounterDays.relevantDays EncounterDay return Tuple { dayIndex: EncounterDay.dayIndex, dayPeriod:
EncounterDay.dayPeriod,
          hasSevereResult: exists ( ["Laboratory Test, Performed": "Glucose lab test"] BloodGlucoseLab1
             where BloodGlucoseLab1.result > 300 'mg/dL'  and BloodGlucoseLab1.relevantDatetime during EncounterDay.dayPeriod),
          hasElevatedResult: exists ( ["Laboratory Test, Performed": "Glucose lab test"] BloodGlucoseLab2
             where BloodGlucoseLab2.result >= 200 'mg/dL' and BloodGlucoseLab2.relevantDatetime during EncounterDay.dayPeriod),
          hasNoResult: not exists ( ["Laboratory Test, Performed": "Glucose lab test"] BloodGlucoseLab3
             where BloodGlucoseLab3.relevantDatetime during EncounterDay.dayPeriod)})}
```

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# Numerator– Severe Hyperglycemia

A hyperglycemic event is defined as:
2. A day where a blood glucose was not measured, and it was preceded by 2 consecutive days where at least one glucose value during each of the two days was >=200 mg/dL.

```
Numerator: "Pertinent Encounters with Hyperglycemic Event Days" EncounterWithEventDays
                 where exists ( EncounterWithEventDays.eligibleEventDays EligibleEventDay where EligibleEventDay.hasHyperglycemicEvent )
                return EncounterWithEventDays.encounter
```

**Pertinent Encounters with Hyperglycemic Event Days**

```
    "Pertinent Encounters with Glucose Result Days" EncounterWithResultDays
     let eligibleEventDays: EncounterWithResultDays.relevantDays EncounterDay where EncounterDay.dayIndex > 1
      return Tuple { dayIndex: EncounterDay.dayIndex, dayPeriod: EncounterDay.dayPeriod, hasHyperglycemicEvent: ( EncounterDay.hasSevereResult
         or ( EncounterDay.hasNoResult and EncounterWithResultDays.relevantDays[EncounterDay.dayIndex - 2].hasElevatedResult
           and EncounterWithResultDays.relevantDays[EncounterDay.dayIndex - 3].hasElevatedResult ) ) }
     return Tuple { encounter: EncounterWithResultDays.encounter, relevantPeriod: EncounterWithResultDays.relevantPeriod, eligibleEventDays:
    eligibleEventDays }
```

**Pertinent Encounters With Glucose Result Days**

```
"Pertinent Encounters With Days" PertinentEncounterDays
 return Tuple { encounter: PertinentEncounterDays.encounter,  relevantPeriod: PertinentEncounterDays.relevantPeriod,
  relevantDays: ( PertinentEncounterDays.relevantDays EncounterDay return Tuple { dayIndex: EncounterDay.dayIndex, dayPeriod:
EncounterDay.dayPeriod,
     hasSevereResult: exists ( ["Laboratory Test, Performed": "Glucose lab test"] BloodGlucoseLab1
       where BloodGlucoseLab1.result > 300 'mg/dL’  and BloodGlucoseLab1.relevantDatetime during EncounterDay.dayPeriod),
     hasElevatedResult: exists ( ["Laboratory Test, Performed": "Glucose lab test"] BloodGlucoseLab2
       where BloodGlucoseLab2.result >= 200 'mg/dL’ and BloodGlucoseLab2.relevantDatetime during EncounterDay.dayPeriod),
     hasNoResult: not exists ( ["Laboratory Test, Performed": "Glucose lab test"] BloodGlucoseLab3
       where BloodGlucoseLab3.relevantDatetime during EncounterDay.dayPeriod)})}
```

# Numerator– Severe Hyperglycemia

A hyperglycemic event is defined as:
2. A day where a blood glucose was not measured, and it was preceded by 2 consecutive days where at least one glucose value during each of the two days was >=200 mg/dL.

```
Numerator: "Pertinent Encounters with Hyperglycemic Event Days" EncounterWithEventDays
                              where exists ( EncounterWithEventDays.eligibleEventDays EligibleEventDay where EligibleEventDay.hasHyperglycemicEvent )
                             return EncounterWithEventDays.encounter
```

**Pertinent Encounters with Hyperglycemic Event Days**

```
      "Pertinent Encounters with Glucose Result Days" EncounterWithResultDays
        let eligibleEventDays: EncounterWithResultDays.relevantDays EncounterDay where EncounterDay.dayIndex > 1
          return Tuple { dayIndex: EncounterDay.dayIndex, dayPeriod: EncounterDay.dayPeriod, hasHyperglycemicEvent: ( EncounterDay.hasSevereResult
                or ( EncounterDay.hasNoResult and EncounterWithResultDays.relevantDays[EncounterDay.dayIndex - 2].hasElevatedResult
                    and EncounterWithResultDays.relevantDays[EncounterDay.dayIndex - 3].hasElevatedResult ) ) }
        return Tuple { encounter: EncounterWithResultDays.encounter, relevantPeriod: EncounterWithResultDays.relevantPeriod, eligibleEventDays:
      eligibleEventDays }
```

**Pertinent Encounters With Glucose Result Days**

```
"Pertinent Encounters With Days" PertinentEncounterDays
  return Tuple { encounter: PertinentEncounterDays.encounter,  relevantPeriod: PertinentEncounterDays.relevantPeriod,
    relevantDays: ( PertinentEncounterDays.relevantDays EncounterDay return Tuple { dayIndex: EncounterDay.dayIndex, dayPeriod:
EncounterDay.dayPeriod,
          hasSevereResult: exists ( ["Laboratory Test, Performed": "Glucose lab test"] BloodGlucoseLab1
              where BloodGlucoseLab1.result > 300 'mg/dL’  and BloodGlucoseLab1.relevantDatetime during EncounterDay.dayPeriod),
          hasElevatedResult: exists ( ["Laboratory Test, Performed": "Glucose lab test"] BloodGlucoseLab2
              where BloodGlucoseLab2.result >= 200 'mg/dL’ and BloodGlucoseLab2.relevantDatetime during EncounterDay.dayPeriod),
          hasNoResult: not exists ( ["Laboratory Test, Performed": "Glucose lab test"] BloodGlucoseLab3
              where BloodGlucoseLab3.relevantDatetime during EncounterDay.dayPeriod)})}
```

# Numerator– Severe Hyperglycemia

A hyperglycemic event is defined as:
2. A day where a blood glucose was not measured, and it was preceded by 2 consecutive days where at least one glucose value during each of the two days was >=200 mg/dL.

```
Numerator: "Pertinent Encounters with Hyperglycemic Event Days" EncounterWithEventDays
                          where exists ( EncounterWithEventDays.eligibleEventDays EligibleEventDay where EligibleEventDay.hasHyperglycemicEvent )
                         return EncounterWithEventDays.encounter
```

**Pertinent Encounters with Hyperglycemic Event Days**

```
    "Pertinent Encounters with Glucose Result Days" EncounterWithResultDays
      let eligibleEventDays: EncounterWithResultDays.relevantDays EncounterDay where EncounterDay.dayIndex > 1
        return Tuple { dayIndex: EncounterDay.dayIndex, dayPeriod: EncounterDay.dayPeriod, hasHyperglycemicEvent: ( EncounterDay.hasSevereResult
            or ( EncounterDay.hasNoResult and EncounterWithResultDays.relevantDays[EncounterDay.dayIndex - 2].hasElevatedResult
              and EncounterWithResultDays.relevantDays[EncounterDay.dayIndex - 3].hasElevatedResult ) ) }
      return Tuple { encounter: EncounterWithResultDays.encounter, relevantPeriod: EncounterWithResultDays.relevantPeriod, eligibleEventDays:
    eligibleEventDays }
```

**Pertinent Encounters With Glucose Result Days**

```
"Pertinent Encounters With Days" PertinentEncounterDays
  return Tuple { encounter: PertinentEncounterDays.encounter,  relevantPeriod: PertinentEncounterDays.relevantPeriod,
    relevantDays: ( PertinentEncounterDays.relevantDays EncounterDay return Tuple { dayIndex: EncounterDay.dayIndex, dayPeriod:
EncounterDay.dayPeriod,
        hasSevereResult: exists ( ["Laboratory Test, Performed": "Glucose lab test"] BloodGlucoseLab1
          where BloodGlucoseLab1.result > 300 'mg/dL’  and BloodGlucoseLab1.relevantDatetime during EncounterDay.dayPeriod),
        hasElevatedResult: exists ( ["Laboratory Test, Performed": "Glucose lab test"] BloodGlucoseLab2
          where BloodGlucoseLab2.result >= 200 'mg/dL’ and BloodGlucoseLab2.relevantDatetime during EncounterDay.dayPeriod),
        hasNoResult: not exists ( ["Laboratory Test, Performed": "Glucose lab test"] BloodGlucoseLab3
          where BloodGlucoseLab3.relevantDatetime during EncounterDay.dayPeriod)})}
```

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# Numerator– Severe Hyperglycemia

Inpatient hospitalizations with severe hyperglycemic event day(s) within the first 10 days of the encounter (minus the first 24-hour period)

A hyperglycemic event is defined as:

1. A day with at least one blood glucose value >300 mg/dL; OR
2. A day where a blood glucose was not measured, and it was preceded by 2 consecutive days where at least one glucose value during each of the two days was >=200 mg/dL.

```
Numerator: "Pertinent Encounters with Hyperglycemic Event Days" EncounterWithEventDays
                    where exists ( EncounterWithEventDays.eligibleEventDays EligibleEventDay where
EligibleEventDay.hasHyperglycemicEvent )
                     return EncounterWithEventDays.encounter
```

**Numerator**

```
"Pertinent Encounters with Hyperglycemic Event Days" EncounterWithEventDays
                    where exists ( EncounterWithEventDays.eligibleEventDays EligibleEventDay where
EligibleEventDay.hasHyperglycemicEvent )
                      return EncounterWithEventDays.encounter
```

# Measure Observation 1 – Severe Hyperglycemia

The total number of qualifying days which match the initial population/denominator criteria.

```
Measure Observation 1 (Association: Denominator):
        Sum (singleton from ( "Pertinent Encounters With Hyperglycemic Event Days" EncounterWithEventDays
           where EncounterWithEventDays.encounter = QualifyingEncounter
         return Count(EncounterWithEventDays.eligibleEventDays)))
```

**Measure Observation 1**

```
        Sum (singleton from ( "Pertinent Encounters With Hyperglycemic Event Days"
        EncounterWithEventDays
           where EncounterWithEventDays.encounter = QualifyingEncounter
         return Count(EncounterWithEventDays.eligibleEventDays)))
```

**Denominator Observation Function**

```
singleton from ( "Pertinent Encounters With Hyperglycemic Event Days"
EncounterWithEventDays
   where EncounterWithEventDays.encounter = QualifyingEncounter
 return Count(EncounterWithEventDays.eligibleEventDays)
```

# Measure Observation 2 – Severe Hyperglycemia

Associated with the Numerator: The total number of hyperglycemic days across inpatient hospitalizations

**Measure Observation 2 (Association: Numerator):**

```
    Count (singleton from ( "Pertinent Encounters With Hyperglycemic Event Days" EncounterWithEventDays
      where EncounterWithEventDays.encounter = QualifyingEncounter
      return Count(EncounterWithEventDays.eligibleEventDays EligibleEventDay where EligibleEventDay.hasHyperglycemicEvent)))
```

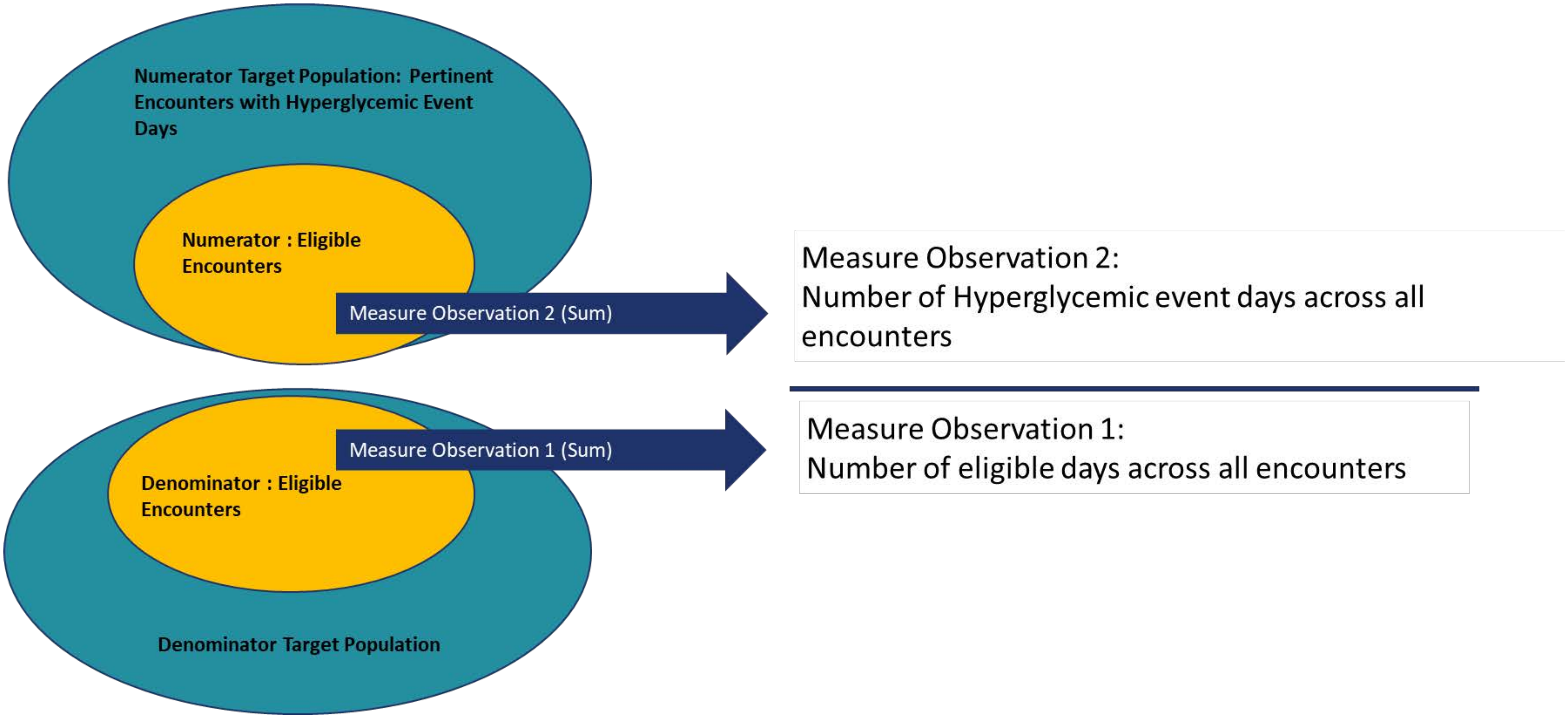
**Measure Observation 2 (Association: Numerator):**

```
Count (singleton from ( "Pertinent Encounters With Hyperglycemic Event Days" EncounterWithEventDays
  where EncounterWithEventDays.encounter = QualifyingEncounter
  return Count(EncounterWithEventDays.eligibleEventDays EligibleEventDay where
EligibleEventDay.hasHyperglycemicEvent)))
```

**Numerator Observations(QualifyingEncounter "Encounter, Performed")**

```
singleton from ( "Pertinent Encounters With Hyperglycemic Event Days" EncounterWithEventDays
  where EncounterWithEventDays.encounter = QualifyingEncounter
  return Count(EncounterWithEventDays.eligibleEventDays EligibleEventDay
    where EligibleEventDay.hasHyperglycemicEvent))
```

# Measure Observation Calculation– Severe Hyperglycemia



Numerator Target Population: Pertinent Encounters with Hyperglycemic Event Days

Numerator : Eligible Encounters

Measure Observation 2 (Sum)

Measure Observation 2:
Number of Hyperglycemic event days across all encounters

Measure Observation 1:
Number of eligible days across all encounters

Measure Observation 1 (Sum)

Denominator : Eligible Encounters

Denominator Target Population

# Resources

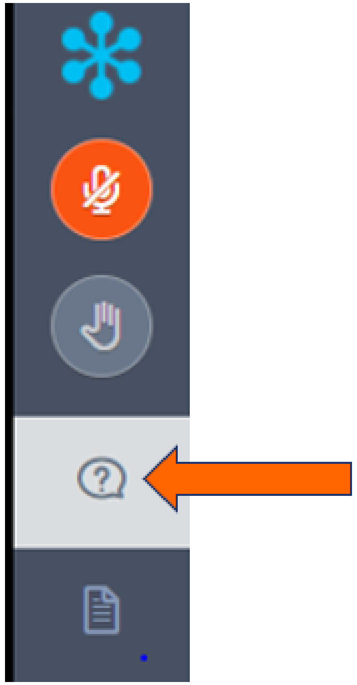
eCQI Resource Center – EH Measures:
https://ecqi.healthit.gov/eligible-hospital/critical-access-hospital-ecqms

Pioneers In Quality
https://www.jointcommission.org/measurement/pioneers-in-quality/

ONC Issue Tracking System
https://oncprojecttracking.healthit.gov/

Previous Webinars
https://www.jointcommission.org/measurement/quality-measurement-webinars-and-videos/

# Live Q&A Segment



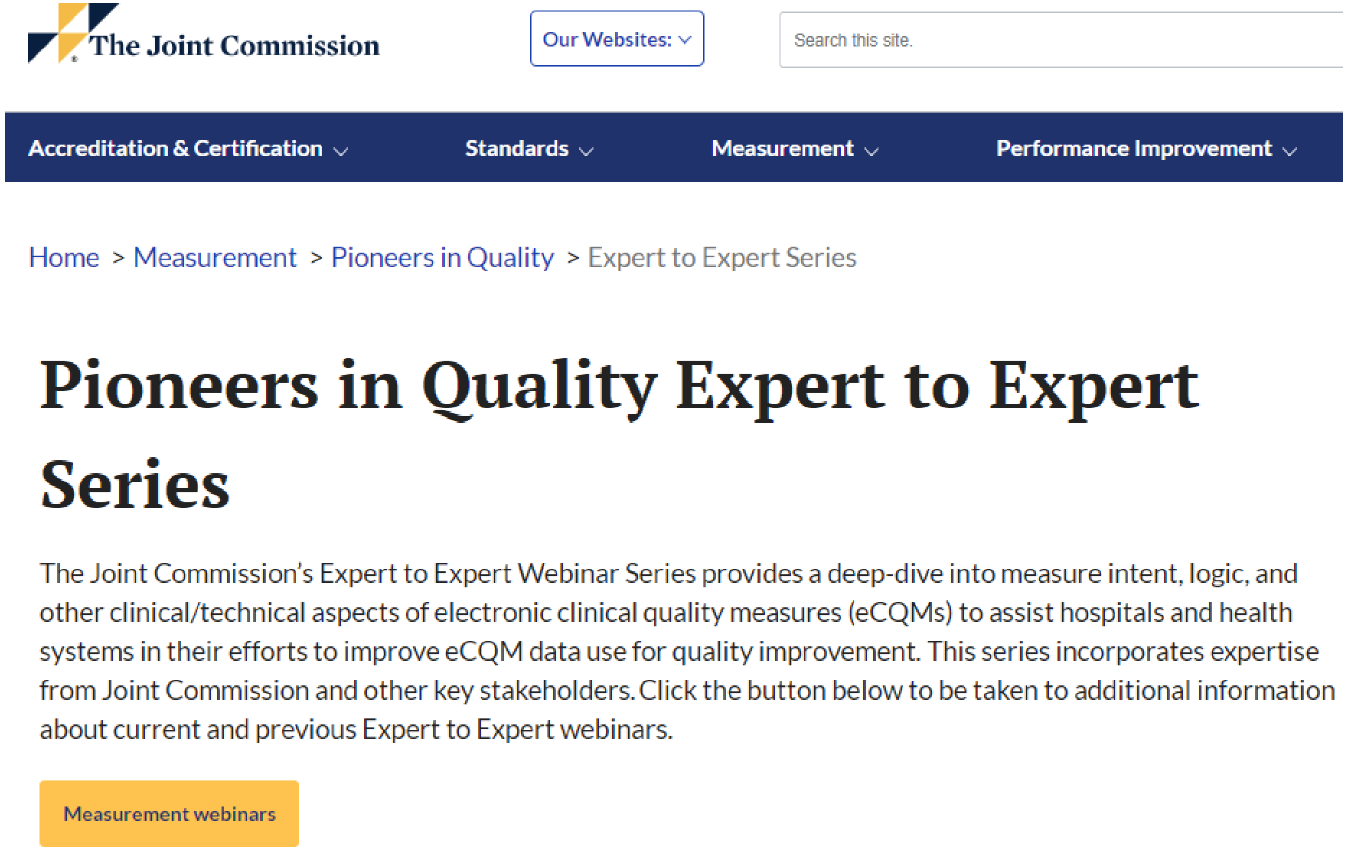
- Please submit questions via the question pane
- Click the Question mark icon in the audience toolbar
- A panel will open for you to type and submit your question
- Include slide reference number when possible
- All questions not answered verbally during the live event will be addressed in a written follow-up Q&A document
- The follow-up document will be posted to the Joint Commission website several weeks after the live event

Joint Commission Pioneers in Quality eCQM Expert to Expert Webinar New Measure Review

# Webinar recording

All Expert to Expert webinar recording links, slides, transcripts, and Q&A documents can be accessed within several weeks of the live event on the Joint Commission's webpage via this link:

https://www.jointcommission.org/measurement/pioneers-in-quality/pioneers-in-quality-expert-to-expert-series/



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Measurement
Performance Improvement
Home > Measurement > Pioneers in Quality > Expert to Expert Series

## Pioneers in Quality Expert to Expert Series

The Joint Commission's Expert to Expert Webinar Series provides a deep-dive into measure intent, logic, and other clinical/technical aspects of electronic clinical quality measures (eCQMs) to assist hospitals and health systems in their efforts to improve eCQM data use for quality improvement. This series incorporates expertise from Joint Commission and other key stakeholders. Click the button below to be taken to additional information about current and previous Expert to Expert webinars.

Measurement webinars

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# Coming Soon – Expert to Expert Webinars

- Webinar series began Dec 9 that incorporates expertise from The Joint Commission, Centers for Medicare & Medicaid Services, Mathematica, and Lantana to address the 2022 eCQM Annual Updates for: VTE, STK, PC, ED, and Safe Opioid Use measures.
- A new measure review webinar is also planned in February for new Hypoglycemia and Hyperglycemia eCQMs.
- Additional information will be available at this link as each webinar is offered: https://www.jointcommission.org/measurement/pioneers-in-quality/pioneers-in-quality-expert-to-expert-series/

# Webinar CE Evaluation Survey and Certificate

You will receive an automated email tomorrow that will direct you to the evaluation survey.

We use your feedback to inform future content and assess the quality of our educational programs.  The evaluation closes in 2 weeks.

## CE Certificate Distribution

When you complete the online evaluation survey, after you click *SUBMIT*, you will be redirected to a URL from which you can print or download/save a PDF CE Certificate.

The Joint Commission

# Thank you for attending!

pioneersinquality@jointcommission.org

https://www.jointcommission.org/measurement/pioneers-in-quality/pioneers-in-quality-expert-to-expert-series/