Proposed New Measure for HEDIS®[1] Measurement Year (MY) 2023: Emergency Department Visits for Hypoglycemia in Older Adults With Diabetes (EDH)

NCQA seeks comments on a proposed new measure for inclusion in HEDIS MY 2023:

- *Emergency Department Visits for Hypoglycemia in Older Adults With Diabetes:* For members 65 years of age and older with diabetes (types 1 and 2), the risk-adjusted ratio of observed-to-expected emergency department (ED) visits for hypoglycemia during the MY.

The measure reports a total rate and a rate among members receiving basal insulin; both rates are stratified by dual eligibility status. Lower rates indicate better performance on this measure.

Although the focus of diabetes treatment in younger adults is to prevent hyperglycemia (elevated blood glucose), as adults age, they become more susceptible to adverse effects of glucose-lowering treatment. Older adults are more likely to experience severe hypoglycemia (low blood sugar), leading to fall-related events and fractures, increased risk of cardiovascular events and cognitive decline. Given these potentially devastating consequences, clinical practice guidelines for the treatment of older adults with diabetes emphasize that prevention of hypoglycemia is paramount to patient safety, and encourages avoidance of intensive glycemic control. Health plans have an opportunity to identify their older patients with diabetes who are at highest risk of hypoglycemia and to implement appropriate interventions to prevent it.

To address the harms associated with hypoglycemia, NCQA developed the proposed measure and tested the concept using 2018–2019 claims data, including 42 health plans and 777,913 members. Testing demonstrated that the measure can be feasibly reported by health-plans with a sufficient denominator size for HEDIS reporting. The average observed rate of ED visits for hypoglycemia was 2.1 visits per 100 members with diabetes. Advisory panels expressed overall support for this measure and agreed that hypoglycemia is a high-priority health issue in older adults with diabetes.

Based on initial testing results and expert feedback, NCQA developed and tested a two-part risk adjustment model for this measure. The model uses predictor variables such as end stage renal disease, congestive heart failure and dementia to predict how many members are expected to have at least one ED visit for hypoglycemia, and then how many ED visits those members are expected to have. Testing demonstrated that the risk adjustment model performed adequately and was calibrated well. The mean plan-level observed-to-expected (O/E) ratio was 0.97, with variation between the 90th percentile (worst-performing plans) demonstrating an O/E of 1.48, and the 10th percentile (best-performing plans) demonstrating an O/E of 0.58.

O/E rates of ED visits for hypoglycemia were higher among members on insulin (O/E of 2.4), prompting the decision to report a separate rate for these members. The separate insulin rate will have a corresponding risk adjustment model that accounts for excess risk tied to insulin use and is uniquely calibrated to predict the expected number of ED visits for hypoglycemia among members who fall into the rate. NCQA has restricted the insulin rate to members on basal insulin, given that exclusively short-acting regimens are considered inappropriate for older adults (we would therefore not want to account for this avoidable excess risk when calculating expected ED visits).

Higher O/E rates were also observed among dual eligible beneficiaries (O/E of 3.7), an indication that the measure should speak to this variation in performance. NCQA advisory panels raised the option of stratification by dual eligibility, alone or in combination with risk adjustment for dual eligibility. Historically, NCQA does not risk adjust for social factors like socioeconomic status (for which dual eligibility may be a proxy), given concerns about masking disparities in care and setting lower expectations for communities facing barriers, but NCQA did explore dual eligibility risk adjustment in testing and discussed the topic extensively with expert panels.

Testing revealed that dual eligibility does appear to have an effect on plan performance, showing that on average, plans with a small number of dual eligible beneficiaries perform better and plans with a large

number of dual eligible beneficiaries perform worse. This raises concerns about potential unearned performance advantages and disadvantages tied to the size of a plan's dual eligible population. However, results also demonstrated variation in plan performance by dual eligibility. Some plans with large populations of dual eligible beneficiaries achieved high performance on this measure, and vice versa, suggesting that plans have the ability to influence performance for this population.

In light of these results, NCQA considered several potential approaches to specifying dual eligibility in this measure, to find the best method of promoting accountability for addressing hypoglycemia in dual eligible beneficiaries and reducing disparities in care:

1. Specify the measure with dual eligible-stratified rates and a total rate, with no risk adjustment for dual eligibility in any rate. This option enables transparency in disparities in care but would not address the effect that dual-eligible population size has on performance on the total rate (which groups dual eligible beneficiaries and non-dual eligible beneficiaries together).
2. Specify the measure with *only* stratified rates (no total rate reported) and no risk adjustment for dual eligibility in any rate. This option addresses concerns about grouping dual eligible and non-dual eligible beneficiaries, while providing transparency into performance differences between groups.
3. Specify risk adjustment for dual eligibility in the total rate and no adjustment for dual eligibility in the stratified rates. This would similarly address concerns about grouping dual members and non-dual members together in the total rate, while also identifying disparities through unadjusted stratified rates; however, this option triggers NCQA's concerns about setting lower expectations for dual eligible beneficiaries through risk adjustment.

Advisory panels ultimately recommended that NCQA pursue the second option. Experts were concerned that such risk adjustment would set a lower performance bar for dual eligible beneficiaries and eclipse disparities in care. Panels expressed that the option without a total rate best supports accountability for addressing disparities in care for dual eligible beneficiaries. Based on this feedback, NCQA recommends moving forward with option 2.

NCQA seeks general feedback on the measure and specific feedback on the following questions:

1. Do you support reporting a separate rate among members receiving basal insulin?
2. Do you support specifying the measure with stratification by dual eligibility and no total rate reported?
    a. Do you think a total rate should be reported for this measure? If so, do you see any potential unintended consequences of not risk adjusting the total rate?
3. Do you support the decision not to risk adjust this measure by dual eligibility? If not, what are your concerns?

Supporting documents include the draft measure specification and evidence workup.

NCQA acknowledges the contributions of the Diabetes, Geriatric, Utilization and Technical Measurement Advisory Panels.

Emergency Department Visits for Hypoglycemia in Older Adults With Diabetes (EDH)

SUMMARY OF CHANGES TO HEDIS MY 2023

- First-year measure.

Description

For members 67 years of age and older with diabetes (type 1 and type 2), the risk-adjusted ratio of observed-to-expected (O/E) emergency department (ED) visits for hypoglycemia during the measurement year:

- For all members 67 years of age and older with diabetes (type 1 and type 2), the risk-adjusted ratio of O/E ED visits for hypoglycemia during the measurement year, stratified by dual eligibility.
- For a subset of members 67 years of age and older with diabetes (type 1 and type 2) who had at least one dispensing event of basal insulin every 180 days from July 1 of the year prior to the measurement year through December 31 of the measurement year, the risk-adjusted ratio of O/E ED visits for hypoglycemia, stratified by dual eligibility.

Definitions

Classification period	The year prior to the measurement year.
PPV	Predicted probability of a visit. The predicted probability of a member having an ED visit for hypoglycemia in the measurement year.
PUCV	Predicted unconditional count of visits. The unconditional count of ED visits for hypoglycemia for members during the measurement year.
Basal insulin	Long- or intermediate-acting insulin.

Eligible Population: Rate 1—All Members With Diabetes

Refer to General Guideline 10: Reporting for small denominator limits.

Product lines Medicare.

Stratification Report the following dual-eligibility stratifications:

- Dual eligible.
- Not dual eligible.

Follow the *SES Stratification* instructions in the *Guidelines for Risk Adjusted Utilization Measures* to categorize members into SES strata. Map members from their SES strata to the corresponding dual eligible strata according to the table below.

SES Strata	Dual Eligible Strata
LIS/DE	Dual Eligible
LIS/DE and Disability	Dual Eligible
Non-LIS/DE, Non-disability	Not Dual Eligible
Disability	Not Dual Eligible
Other	Not Dual Eligible
Unknown	Not Dual Eligible

Ages Members 67 years and older as of December 31 of the measurement year.

Continuous enrollment The measurement year and the year prior to the measurement year.

Allowable gap No more than one gap in enrollment of up to 45 days during each year of continuous enrollment.

Anchor date December 31 of the measurement year.

Benefit Medical and pharmacy.

Event/diagnosis There are two ways to identify members with diabetes: by claim/encounter data and by pharmacy data. The organization must use both methods to identify the eligible population, but a member only needs to be identified by one method to be included in the measure. Members may be identified as having diabetes during the measurement year or the year prior to the measurement year.

Claim/encounter data. Members who met any of the following criteria during the measurement year or the year prior to the measurement year (count services that occur over both years):

- At least one acute inpatient encounter (Acute Inpatient Value Set) with a diagnosis of diabetes (Diabetes Value Set) ***without*** telehealth (Telehealth Modifier Value Set; Telehealth POS Value Set).
- At least one acute inpatient discharge with a diagnosis of diabetes (Diabetes Value Set) on the discharge claim. To identify an acute inpatient discharge:
  1. Identify all acute and nonacute inpatient stays (Inpatient Stay Value Set).
  2. Exclude nonacute inpatient stays (Nonacute Inpatient Stay Value Set).
  3. Identify the discharge date for the stay.
- At least two outpatient visits (Outpatient Value Set), observation visits (Observation Value Set), telephone visits (Telephone Visits Value Set), e-visits or virtual check-ins (Online Assessments Value Set), ED visits (ED Value Set), nonacute inpatient encounters (Nonacute Inpatient Value Set) or nonacute inpatient discharges (instructions below; the diagnosis must be on the discharge claim), on different dates of service, with a diagnosis of diabetes (Diabetes Value Set). Visit type need not be the same for the two encounters. To identify a nonacute inpatient discharge:
  1. Identify all acute and nonacute inpatient stays (Inpatient Stay Value Set).

2. Confirm the stay was for nonacute care based on the presence of a nonacute code (Nonacute Inpatient Stay Value Set) on the claim.
3. Identify the discharge date for the stay.

Only include nonacute inpatient encounters (Nonacute Inpatient Value Set) ***without*** telehealth (Telehealth Modifier Value Set; Telehealth POS Value Set).

Pharmacy data. Members who were dispensed insulin or hypoglycemics/ antihyperglycemics on an ambulatory basis during the measurement year or the year prior to the measurement year (Diabetes Medications List).

Diabetes Medications

Description	Prescription		
Alpha-glucosidase inhibitors	• Acarbose	• Miglitol	
Amylin analogs	• Pramlintide		
Antidiabetic combinations	• Alogliptin-metformin • Alogliptin-pioglitazone • Canagliflozin-metformin • Dapagliflozin-metformin • Empagliflozin-linagliptin	• Empagliflozin-metformin • Glimepiride-pioglitazone • Glipizide-metformin • Glyburide-metformin • Linagliptin-metformin	• Metformin-pioglitazone • Metformin-repaglinide • Metformin-rosiglitazone • Metformin-saxagliptin • Metformin-sitagliptin
Insulin	• Insulin aspart • Insulin aspart-insulin aspart protamine • Insulin degludec • Insulin detemir • Insulin glargine • Insulin glulisine	• Insulin isophane human • Insulin isophane-insulin regular • Insulin lispro • Insulin lispro-insulin lispro protamine • Insulin regular human • Insulin human inhaled	
Meglitinides	• Nateglinide	• Repaglinide	
Glucagon-like peptide-1 (GLP1) agonists	• Albiglutide • Dulaglutide • Exenatide	• Liraglutide (excluding *Saxenda*®) • Semaglutide	
Sodium glucose cotransporter 2 (SGLT2) inhibitor	• Canagliflozin	• Dapagliflozin (excluding Farxiga®)	• Empagliflozin
Sulfonylureas	• Chlorpropamide • Glimepiride	• Glipizide • Glyburide	• Tolazamide • Tolbutamide
Thiazolidinediones	• Pioglitazone	• Rosiglitazone	
Dipeptidyl peptidase-4 (DDP-4) inhibitors	• Alogliptin • Linagliptin	• Saxagliptin • Sitagliptin	

Note: *Glucophage/metformin as a solo agent is not included because it is used to treat conditions other than diabetes; members with diabetes on these medications are identified through diagnosis codes only.*

Required exclusions

Exclude members who meet either of the following criteria:

- Members who did not have a diagnosis of diabetes (Diabetes Value Set), in any setting, during the measurement year or the year prior to the measurement year ***and*** who had a diagnosis of polycystic ovarian syndrome, gestational diabetes or steroid-induced diabetes (Diabetes Exclusions Value Set), in any setting, during the measurement year or the year prior to the measurement year.
- Members in hospice or using hospice services any time during the measurement year. Refer to *General Guideline 17: Members in Hospice*.

Eligible Population: Rate 2—Members Receiving Basal Insulin

Product lines

Medicare.

Stratification

Report the following dual-eligibility stratifications:

- Dual eligible.
- Not dual eligible.

Follow the *SES Stratification* instructions in the *Guidelines for Risk Adjusted Utilization Measures* to categorize members into SES strata. Map members from their SES strata to the corresponding dual eligible strata according to the table below.

SES Strata	Dual Eligible Strata
LIS/DE	Dual Eligible
LIS/DE and Disability	Dual Eligible
Non-LIS/DE, Non-disability	Not Dual Eligible
Disability	Not Dual Eligible
Other	Not Dual Eligible
Unknown	Not Dual Eligible

Ages

Members 67 years and older as of December 31 of the measurement year.

Continuous enrollment

The measurement year and the year prior to the measurement year.

Allowable gap

No more than one gap in enrollment of up to 45 days during each year of continuous enrollment.

Anchor date

December 31 of the measurement year.

Benefit

Medical and pharmacy.

Event/diagnosis

All members who meet eligible population criteria for rate 1 and received basal insulin. Identify members in the eligible population who received at least one dispensing event of basal insulin (Basal Insulin Medications List) every 180 days from July 1 of the year prior to the measurement year through December 31 of the measurement year.

Basal Insulin Medications

Description	Prescription	
Basal insulin	• Insulin aspart-insulin aspart protamine • Insulin degludec • Insulin detemir • Insulin glargine	• Insulin isophane human • Insulin isophane-insulin regular • Insulin lispro-insulin lispro protamine • Insulin regular human

Required exclusions

Exclude members who meet either of the following criteria:

- Members who did not have a diagnosis of diabetes (Diabetes Value Set), in any setting, during the measurement year or the year prior to the measurement year ***and*** who had a diagnosis of polycystic ovarian syndrome, gestational diabetes or steroid-induced diabetes (Diabetes Exclusions Value Set), in any setting, during the measurement year or the year prior to the measurement year.
- Members in hospice or using hospice services any time during the measurement year. Refer to *General Guideline 17: Members in Hospice*.

Calculation of Observed Events

Step 1 Count each visit to an ED for hypoglycemia once, regardless of the intensity or duration of the visit. Count multiple ED visits for hypoglycemia on the same date of service as one visit. Identify all ED visits for hypoglycemia during the measurement year using:

- An ED visit (ED Value Set) with a diagnosis of hypoglycemia (Hypoglycemia Value Set).

Step 2 Calculate the number of visits per member. For members with more than one visit, retain only the first five. Do not report visits beyond the first five.

Step 3 Calculate the total using all ED visits identified after completing steps 1–2. Assign each remaining ED visit to an age and stratification category using the reporting instructions below.

Risk Adjustment Determination

For each member in the eligible population, use the steps in the *Risk Adjustment Comorbidity Category Determination* in the *Guidelines for Risk Adjusted Utilization Measures* to identify risk adjustment categories based on presence of comorbidities.

Risk Adjustment Weighting and Calculation of Expected Events

Calculation of risk-adjusted outcomes (counts of ED visits for hypoglycemia) uses predetermined risk weights generated by two separate regression models to predict how many ED visits for hypoglycemia each member might have during the measurement year. Refer to the reporting indicator column in the risk adjustment tables to ensure that weights are linked appropriately

For each member in the eligible population, assign predicted probability of a visit (PPV) risk weights.

Step 1 Link the PPV weights for each member with a comorbidity HCC category.

Step 2 Link the age-gender PPV weights for each member.

Step 3 Sum all PPV weights associated with the member (HCC, age and gender).

Step 4 Use the formula below to calculate the predicted probability of each member having at least one visit, based on the sum of the weights for each member.

$$\text{PPV} = \frac{e^{(\sum \text{PPV WeightsForEachMember})}}{1+e^{(\sum \text{PPV WeightsForEachMember})}}$$

Note: *Truncate intermediate calculations to 10 decimal places.*

Assign predicted unconditional count of visits (PUCV) risk weights for each member in the eligible population.

Step 1 Link the PUCV weights for each member with a comorbidity HCC category. Assign a weight of 1 if a member does not have comorbidities to which weights can be linked.

Step 2 Link the age-gender PUCV weights for each member.

Step 3 Use the formula below to calculate the predicted unconditional count of visits in the measurement year.

PUCV = Age/gender Weight * HCC Weight

Note: *Multiply by each HCC associated with the member. For example, assume a member with HCC-51, HCC-85, HCC-134. The formula would be:*

*PUCV = Age/gender Weight * HCC-51 * HCC-85 * HCC-134*

Note: *Truncate intermediate calculations to 10 decimal places.*

Expected count of ED visits Use the formula below to report the final member-level expected count of ED visits for hypoglycemia for each category. Round to four decimal places using the .5 rule and enter these values into the reporting table.

Expected Count of ED Visits = PPV x PUCV

Step 4 Use the formula below to calculate the covariance of the predicted outcomes for each category (i.e., metric and dual-eligibility stratification). For categories with a single member (n_c=1), set the covariance to zero. Do not round the covariance before using it in step 5.

$$COV_c = \frac{\sum_{m=1}^{n_c}(PPV_m - mean(PPV)_c) \times (PUCV_m - mean(PUCV)_c)}{n_c - 1}$$

Where:

c	denotes an individual category
n_c	is the number of members in the category indicated by c
m	is an individual member within the category indicated by c
PPV_m	is the unrounded PPV for the member denoted by m
$mean(PPV)_c$	is the unrounded mean PPV in the category indicated by c
$PUCV_m$	is the unrounded PUCV for the member denoted by m
$mean(PUCV)_c$	is the unrounded mean PUCV in the category indicated by c

Step 5 After the covariance between the PPV and PUCV is calculated for a given category, follow the formula below to calculate the variance for the category.

$$Variance_c = \sum_{m=1}^{n_c} (PPV_m \times PUCV_m)^2 \times \left(1 + (1 - PPV_m)^2 + \left(\frac{2 \times COV_c}{PPV_m \times PUCV_m}\right)\right)$$

Where:

c denotes an individual category

n_c is the number of members in the category indicated by c

m is an individual member within the category indicated by c

PPV_m is the unrounded PPV for the member denoted by m

$PUCV_m$ is the unrounded PUCV for the member denoted by m

n_c is the number of members in the category indicated by c

Round the variance for reporting to four decimal places using the .5 rule.

Reporting: Number of Members in the Eligible Population

The number of members in the eligible population for each metric and dual-eligibility stratification, reported as the MemberCount.

Reporting: Number of Observed Events Among Members in the Eligible Population

The number of observed ED visits with a diagnosis of hypoglycemia for each metric and dual-eligibility stratification, reported as the ObservedCount.

Calculated: Observed Events per 1,000 Members in the Eligible Population

The number of observed ED visits (ObservedCount) divided by the number of members in the eligible population (MemberCount), multiplied by 1,000 within each metric and dual-eligibility stratification. Calculated by IDSS as the ObservedRate.

Reporting: Number of Expected Events Among Members in the Eligible Population

The number of expected ED visits with a diagnosis of hypoglycemia within each metric and dual-eligibility stratification, reported as the ExpectedCount.

Calculated: Expected Visits per 1,000 Members in the Eligible Population

The number of expected ED (ExpectedCount) divided by the number of members in the eligible population (MemberCount), multiplied by 1,000 within each metric and dual-eligibility stratification. Calculated by IDSS as the ExpectedRate.

Reporting: Variance Among Members in the Eligible Population

The variance (from Risk Adjustment Weighting and Calculation of Expected Events) within each metric and dual-eligibility stratification, reported as the CountVariance.

Calculated: O/E Ratio Among Members in the Eligible Population

The Number of Observed Events Among Members in the Eligible Population (ObservedCount) divided by Number of Expected Events Among Members in the Eligible Population (ExpectedCount) within each metric and dual-eligibility stratification. Calculated by IDSS as the OE.

Note

- *Supplemental data may not be used for this measure.*

Table EDH-A-3: Data Elements for Emergency Department Visits for Hypoglycemia in Older Adults With Diabetes

Metric	Dual Eligibility	Data Element	Reporting Instructions
Diabetes	DualEligible	Benefit	Metadata
BasalInsulin	NotDualEligible	MemberCount	For each Metric and Stratification
		ObservedCount	For each Metric and Stratification
		ObservedRate	1000 * ObservedCount / MemberCount
		ExpectedCount	For each Metric and Stratification
		ExpectedRate	1000 * ExpectedCount / MemberCount
		CountVariance	For each Metric and Stratification
		OE	ObservedCount / ExpectedCount

Emergency Department Visits for Hypoglycemia in Older Adults With Diabetes (EDH)
Measure Workup

Topic Overview

Measure Description

Emergency Department Visits for Hypoglycemia in Older Adults With Diabetes assesses the risk-adjusted ratio of observed-to-expected emergency department (ED) visits for hypoglycemia during the measurement year among members 67 years of age and older with diabetes (type 1 and type 2).

Background and Importance

According to the most recent National Diabetes Statistics Report, 26.8% of adults 65 and older in the U.S. have diabetes; 90%–95% have type 2 diabetes (Centers for Disease Control and Prevention (CDC), 2020). The prevalence of type 2 diabetes in older adults is expected to double in the next two decades because the size of the older population is expanding (American Diabetes Association (ADA, 2018a).

In younger, healthy adults, the focus of diabetes treatment is to prevent hyperglycemia and diabetic complications with strict glycemic control and intensive treatment; however, in older adults, avoidance of hypoglycemia (in addition to hyperglycemia) is considered crucial to safe and effective diabetes treatment. Older adults, many of whom have comorbidities, frailty, or limited life expectancy, are both less likely to realize the benefits of intensive treatment and more likely to experience dangerous adverse events of such treatment, most notably hypoglycemia (American Geriatrics Society Choosing Wisely Workgroup, 2013).

According to analysis by the National Electronic Injury Surveillance System–Cooperative Adverse Drug Event Surveillance, between 2007 and 2011 there were an estimated 97,648 potentially preventable ED visits resulting from insulin-related hypoglycemia and errors annually (Geller et al., 2014). Although evidence suggests the risk of hypoglycemia may be reduced through appropriate treatment, older adults continue to experience hypoglycemia, potentially due to overtreatment and intense glycemic control.

Health importance

Older adults with diabetes are at higher risk of hypoglycemia resulting from diabetes treatment than younger adults (Abdelhafiz et al., 2015). Common adverse events resulting from hypoglycemia include cardiovascular disease, falls and fractures, dementia, low health-related quality of life, potential risk of strokes and increased mortality (Hart et al., 2018; Mattishent et al., 2016; Zheng et al., 2021).

Patients with diabetes who experience a hypoglycemic event are at significantly higher risk of repeat severe hypoglycemic episodes, as well as other negative outcomes such as cardiovascular events (O'Reilly et al., 2021). Hypoglycemia may be influenced by a variety of factors, including malnutrition or food insecurity (Abdelhafiz et al., 2015; Seligman et al., 2010), tight glycemic control (Yu et al., 2016) and use of intensive antihyperglycemic medications (Bodmer et al., 2008).

While the consequences of hypoglycemia can be devastating in older adults, it may be possible to reduce hypoglycemia risk through effective treatment management. Multiple clinical practice guidelines recommend adjusting treatment regimens in older adults to minimize hypoglycemia risk. For example, the American Diabetes Association (ADA) recommends routine monitoring of hypoglycemic episodes and adjusting glycemic targets and pharmacologic regimens to avoid hypoglycemia in older adults (ADA, 2021). The Endocrine Society recommends that clinicians design outpatient diabetes regimens

specifically to minimize hypoglycemia (Endocrine Society, 2019). The AACE/ACE cites minimizing hypoglycemia as a guiding principle in its diabetes treatment algorithm and emphasizes that reducing risk of hypoglycemia should be a key consideration when selecting antihyperglycemic agents (Garber et al., 2020).

Risk factors

A number of factors influence whether an individual with diabetes is likely to experience severe hypoglycemia: increased age, race, annual household income, diabetes type, prior hypoglycemia, and number and type of comorbidities (McCoy et al., 2020, Schroeder et al., 2017, Chow et al, 2018). A recent study of approximately 200,000 adults with diabetes in the U.S. found that having type 1 diabetes was associated with a 34% increase in the risk of experiencing a hypoglycemia-related ED visit or hospitalization (McCoy et al., 2020). The same study found that the risk for individuals 75 and older was 56% higher than for those 18–44. The study examined 16 comorbidities; the risk of hypoglycemia increased with the number of comorbidities and was highest for individuals with end stage renal disease (ESRD), chronic kidney disease stages 3 and 4, myocardial infarction and falls.

Research also suggests an association between increased risk of hypoglycemia-related ED visits or hospitalizations and intense glycemic control using high-risk agents, such as insulin or sulfonylureas, and potential overtreatment in older adults (Lega et al., 2021). One study found that basal insulin use was associated with a 12.5-fold increase in risk of hypoglycemia-related ED visits and hospitalizations, compared to patients treated with medications other than sulfonylurea and insulin (e.g., metformin). Risk increased significantly when the patient used short-acting insulin (23.2-fold higher) or a combination of basal and short-acting insulin (27.7-fold higher) (McCoy et al., 2020).

Hypoglycemia occurrence

Hypoglycemia is a common occurrence in older adults with diabetes. A systematic review and meta-analysis of studies examining hypoglycemia prevalence among patients with type 2 diabetes found that across over 500,000 total participants, the pooled prevalence of mild or moderate hypoglycemia was 45% and the pooled prevalence of severe hypoglycemia (defined as episodes requiring third-party assistance) was 6%. Prevalence rates were even higher among individuals on insulin, with a rate of 52% for mild or moderate and 21% for severe (Edridge et al., 2015). A study of hypoglycemia frequency among patients with type 1 diabetes and patients with insulin-treated type 2 diabetes in Scotland found that 45% of patients reported experiencing at least one episode of hypoglycemia during the study period (Donnelly et al., 2005).

While both of these studies included patients of all ages, additional evidence indicates that rates of hypoglycemia increase with age. A retrospective cohort study of over 160,000 patients with type 2 diabetes found the incidence rate of hypoglycemia among individuals 65–74 was almost twice as high as for those 20–64 and over four times as high among those 75 and older (Ikeda et al., 2018). Another study found the incidence rate of severe hypoglycemic events among patients 65 and older (193.2 per 10,000 person years) was higher than the overall incidence rate of the study population (153.8 per 10,000 person years), although older adults made up a small portion of the study sample (Quilliam et al., 2011). The phase 3 trial of the Glycemia Reduction Approaches in Diabetes: A Comparative Effectiveness Study (GRADE) study found that severe hypoglycemia occurred more commonly among participants treated with glimepiride than with sitagliptin, liraglutide and insulin glargine (Barnard, 2021).

Instances of severe hypoglycemia in older adults can result in loss of consciousness, sometimes requiring an ED visit or hospitalization. According to

the National Diabetes Statistics Report, in 2016 there were 235,000 ED visits for hypoglycemia in the U.S. (CDC, 2020). A retrospective cohort study of 536,581 adults with type 2 diabetes between 2004 and 2008 found that 3.5% of patients included in the study experienced at least one hypoglycemic event requiring an ED visit, hospitalization, or outpatient encounter (Quilliam et al., 2011).

An analysis of the National Hospital Ambulatory Medical Care Survey from 1993–2005 found that overall, there were 34 ED visits for hypoglycemia per 1,000 persons with diabetes (3.4%) (Ginde et al., 2008). The same analysis showed that hypoglycemia accounted for 3.7 of every 1,000 ED visits due to any cause, a rate that increased with age—almost twice as high among persons 65–74 (12 per 1,000) as for those 45–64 (5.5 per 1,000). A separate analysis of the Nationwide Emergency Department Sample found that in 2011, 2.2% of all ED visits experienced by adults with diabetes were related to hypoglycemia. Notably, adults 65 and older accounted for 49.5% of all hypoglycemia-related ED visits. Adults 45–64 experienced a hypoglycemia-related ED visit rate of one ED visit per 100 adults with diabetes, while adults 75 and older experienced a rate of 2.4 per 100 (Wang et al., 2015).

Financial importance and cost-effectiveness

Hypoglycemia-related expenditures contribute substantially to health care system costs. An analysis of the National Electronic Injury Surveillance System—Cooperative Adverse Drug Event Surveillance and National Health Interview Survey from 2007–2011 estimated that ED visits for insulin-related hypoglycemia and errors cost over $600 million, with adults 65 and older accounting for over 40% of ED visits (Geller et al., 2014).

A more recent study using claims data from approximately 9,500 patients who experienced a severe hypoglycemia event between 2016 and 2017 found that the median cost of an ED visit was $678. This significantly increased to over $9,600 if the ED visit resulted in hospitalization (Bajpai et al., 2021). Another study that tracked adults with type 2 diabetes on oral anti-diabetes medications initiating basal insulin demonstrated that the mean total cost per hypoglycemia episode was $986. Over half of the studied population was 65 and older. Hypoglycemia-related medical expenses accounted for 12.6% of total health care expenditures for patients in the study (Fonseca et al., 2017).

Opportunity to improve care

Available evidence suggests that reducing risk of severe hypoglycemia in older adults is possible with appropriate interventions, including, but not limited to, relaxation of glycemic targets, avoidance of overtreatment, simplification of treatment regimens and continuous glucose monitoring (CGM). In one study of a hypoglycemia risk reduction project for older veterans with diabetes and renal impairment, pharmacists recommended terminating glyburide prescriptions. The rate of serious hypoglycemic events, defined as an ED visit or hospitalization for hypoglycemia, decreased substantially for patients with severe renal impairment included in the intervention group. The incidence rate among that group declined from 0.169 per 1,000 person-days to 0.039 per 1,000 person-days following the intervention. In comparison, the incidence rate in the non-targeted cohort declined from 0.133 to just 0.088 (Aspinall et al., 2011).

A recent study in the U.K. that examined use of information booklets by ambulance clinicians saw a decrease in repeat ambulance attendances for hypoglycemia, suggesting that patient education is an important and low-cost intervention to reduce risk (Botan et al., 2021). A health educational program with coaching from trained nurses at Kaiser Foundation Health Plan of Washington was found to greatly reduce severe hypoglycemia in patients with type 1 diabetes and will be tested with patients with type 2 diabetes (Ralston, 2021). Canary Health, a digital health company, observed reduced hypoglycemic

symptoms, in addition to other improved health outcomes, in individuals with diabetes using Canary Health's online self-management program, Better Choices, Better Health® (Lorig et al., 2016).

A study exploring simplification of insulin regimens for older adults with type 2 diabetes found that the mean duration of time spent in a hypoglycemic state reduced steadily in 8 months after simplification. Simplification was achieved by switching multiple-dose insulin regimens to once-a-day glargine, with or without noninsulin agents, over 5 months (Munshi et al., 2016). In addition to treatment deintensification efforts, CGM permits greater personalization of anti-hyperglycemic treatment and has also been found to contribute to reduced hypoglycemia incidence. A recently published randomized clinical trial of older adults with type 1 diabetes found that CGM resulted in reduced time spent in a hypoglycemic state, compared to standard intermittent blood glucose monitoring, including a reduction in severe hypoglycemic events, defined as those involving seizure or loss of consciousness (Pratley et al., 2020).

Health plans and clinicians can use risk stratification tools to identify members with higher risk of severe hypoglycemic events and/or ED utilization. Karter and colleagues (2017) previously developed and validated such a tool to identify the 12-month risk of hypoglycemia-related ED or hospital utilization among patients with type 2 diabetes. The model included 6 variables, including age, presence of severe kidney disease or ESRD and prior hypoglycemia-related utilization. Individuals identified as high risk for hypoglycemia were up to 34.6 times more likely to experience a hypoglycemia-related ED visit or hospitalization than those classified as low risk. Schroeder and colleagues (2017) developed and validated a 16-variable risk prediction model to predict an individual's 6-month risk of severe hypoglycemic event. The model included age, race, diabetes type, BMI, hypoglycemia history and relevant comorbidities. The observed rate of severe hypoglycemia in individuals classified as highest risk was 50 times higher than that of those classified as lowest risk.

Incorporating these risk assessments into clinical workflows can help plans and clinicians focus hypoglycemia prevention efforts on patients at highest risk. Health plans can also identify patients at higher risk by tracking glucose levels over time or ED utilization. Researchers validated a hypoglycemia-related ED visit algorithm in ICD-9 by comparing visits identified by claims against medical chart review to confirm hypoglycemia. The algorithm looked for hypoglycemia in any diagnosis position (up to 10 available in the dataset) on the claim. Of the 68 ED visits identified using codes that map to ICD-10 codes in the value set for this measure, 59 were confirmed via chart review, for a positive predictive value of 86.7%.

One study proposing solutions to address hypoglycemia suggested health care settings that manage low-income populations identify patients with diabetes who experience food insecurity and establish protocols for referring such patients to food pantries, soup kitchens and federal nutrition programs such as the Supplemental Nutrition Assistance Program. This can help beneficiaries avoid food shortages at the end of each month, thus leading to a reduction in hypoglycemia (Seligman et al., 2014). The Endocrine Society's "Hypoglycemia Quality Collaborative Strategic Blueprint" recommends health plan education on reimbursement and benefit design to influence provider and patient behavior and improve hypoglycemia prevention and management.

Health care disparities

There is robust evidence of persistent disparities in care by race, ethnicity, and other sociodemographic factors among individuals with diabetes. According to

the National Diabetes Statistics Report, the overall prevalence of diabetes among Black, non-Hispanic adults is 16.3%, as compared to 11.9% among White, non-Hispanic adults (CDC, 2020). Analysis of national survey data from sources including the National Vital Statistics System and the American Community Survey show that diabetes mortality is at least 60% higher among the American Indian and Alaska Native populations than the White population (Gopal et al., 2017). Rates of ED visits for hypoglycemia among adults have been found to be almost twice as high for Black and Hispanic individuals than for White, non-Hispanic individuals (Ginde et al, 2008).

Growing evidence has linked SDOH such as socioeconomic status and geographic location to disparities in diabetes prevalence and outcomes, including hypoglycemia risk. Long-term trend data from 1935–2016 show diabetes prevalence is higher among lower socioeconomic groups and individuals living in the southern and midwestern states (Gopal et al., 2017). Findings from a recent study comparing older adults with diabetes enrolled in Medicare Advantage (MA) with those insured by commercial plans from 2016–2019 suggest that MA enrollees may be less likely to be treated with newer medications to manage glucose levels, which may contribute to greater disparities among patients with lower income (McCoy et al., 2021).

One study using claims data on almost 600,000 commercially insured Americans 19–64 concluded that individuals experiencing food insecurity (without reliable access to a sufficient quantity of affordable, nutritious food) are at higher risk for hypoglycemia in the last week of the month, due to the exhaustion of food budgets (Basu et al., 2017). This study observed that in the last 7 days of each month, lower-income patients had increased risk of ER visits or inpatient hospitalizations for hypoglycemia. The risk of end-of-month hypoglycemia was mitigated when nutritional support was provided to low-income populations. The authors estimated that addressing monthly episodes of hypoglycemia could save $54.1 million per year in ER and inpatient hospitalization costs (Basu et al., 2017).

Another study of inpatient admissions in California for individuals 18 and older from 2000–2008 demonstrated that admissions for hypoglycemia were 27% higher among those with lower-median incomes than higher-median incomes in the last week of the month. The study noted that social factors such as inadequate access to primary care services among Medicaid patients could have contributed to such high numbers. Demand for food sources at the end of the month, coupled with an increasing rate of diabetes among low-income Americans, is likely to lead to increased rates of hypoglycemic episodes in this population (Seligman et al, 2014).

Although these studies did not focus specifically on older adults, it is a fact that food insecurity is a growing problem among older adults. According to *The State of Senior Hunger,* a 2020 annual report released by Feeding America, 7.3% of seniors reported being food insecure in 2018. This number was as high as 29.3% among those living below the federal poverty line. The rates of food insecurity among Black seniors were over twice as high as that of White seniors (Ziliak & Gunderson, 2020). It is reasonable to infer that older adults with low income may also experience the monthly cycle of hypoglycemia, leading to increased risk at month’s end as food budgets exhaust.

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