DSME for Preventable Hypoglycemia

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JAZZ IT UP
WITH INNOVATION
AND ENGAGEMENT

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NEW ORLEANS, LOUISIANA
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Disclosure to Participants

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  – Learners must attend the full activity and complete the evaluation in order to claim continuing education credit/hours

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• Off-Label Use:
  – Participants will be notified by speakers to any product used for a purpose other than for which it was approved by the Food and Drug Administration.
1. Hypoglycemia: A national problem

2. Hypoglycemia: Definitions


4. ADEs with diabetes drugs

5. Sources of patient error
   - complexity of patient’s DSM job
   - patient’s cognitive reach

6. Differentiated instruction: Strategy to prevent hypoglycemia

7. Other strategies to prevent hypoglycemia

*ADE = adverse drug event
1. HYPOGLYCEMIA: A NATIONAL PROBLEM
Hyperglycemia-related hospitalizations fell 39% overall in the Medicare population from 1999 to 2010.
Hyperglycemia hospitalizations fell further in older age groups

<table>
<thead>
<tr>
<th>Ages</th>
<th>1999</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>65-74</td>
<td>97*</td>
<td>67</td>
</tr>
<tr>
<td>75-84</td>
<td>132</td>
<td>75</td>
</tr>
<tr>
<td>85+</td>
<td>136</td>
<td>68</td>
</tr>
</tbody>
</table>

*Per 100,000 patient-years

While glucose control has been improving nationally,

serious hypoglycemia has not

and insulin mistakes resulting in emergency care

aren't rare, two recent studies showed.

Emergency department visits, with hypoglycemia as first-listed diagnosis

DM patients 18 years or older, 2006-2009, USA

Number remained stable, about 300,000/yr

How many insulin-treated DM patients go to ED each year for insulin-related hypoglycemia and errors (IHEs)?

(Based on national data for 2007-2011, USA)

<table>
<thead>
<tr>
<th>Age</th>
<th>Number going to ED for IHE/yr</th>
<th>% of insulin-only patients each year</th>
<th>% of insulin + oral patients each year</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-44</td>
<td>21,189</td>
<td>3.5</td>
<td>0.3</td>
</tr>
<tr>
<td>45-64</td>
<td>34,173</td>
<td>2.7</td>
<td>0.4</td>
</tr>
<tr>
<td>65-79</td>
<td>24,720</td>
<td>2.7</td>
<td>0.7</td>
</tr>
<tr>
<td>&gt;80</td>
<td>15,479</td>
<td>5.0</td>
<td>1.6</td>
</tr>
</tbody>
</table>
Hypoglycemia hospitalizations *rose* among older adults (ages 65+)

<table>
<thead>
<tr>
<th>Year</th>
<th>1999</th>
<th>2007</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>94*</td>
<td>130</td>
<td>105</td>
</tr>
</tbody>
</table>

*Per 100,000 patient-years

Peaked in 2007 in wake of ACCORD trial—Which showed higher mortality with intensive therapy (A1c target of 6.5)

And—hospitalizations for hypoglycemia remained twice as high among oldest seniors

<table>
<thead>
<tr>
<th>Ages</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>65-74</td>
<td>72</td>
</tr>
<tr>
<td>75-84</td>
<td>141</td>
</tr>
<tr>
<td>85+</td>
<td>152</td>
</tr>
</tbody>
</table>

*Per 100,000 patient-years

Cost of these IHEs?

Based on prior cost estimates for hypoglycemia and

Nearly 100,000 ED visits

and

30,000 hospitalizations annually

Well over $600 million

Was spent during the 5-year study period (2007-2011).

2. HYPOGLYCEMIA: DEFINITIONS
Hospitalizations for hypoglycemia just “tip of the iceberg”

“These numbers include only the most severe events and vastly underestimate the day-to-day hypoglycemia and insulin events sustained in the community.

People may be seen by paramedics and receive glucose and they're fine and then never make it to the hospital.

So it's really the tip of the iceberg because so many more patients have hypoglycemic episodes that we don't even have a clue as to the numbers.”

Hypoglycemia and Diabetes: A Report of a Workgroup of the American Diabetes Association and The Endocrine Society

Elizabeth R. Seiquer, MD
John Anderson, MD
Brenda Cancer, MD, PhD, RN, CDE
Philip Cressna, MD
Samuel D’Addeo, MD, PhD, MS, MD, PhD

OBJECTIVE—To review the evidence about the impact of hypoglycemia on patients with diabetes that has become available in the past reviews of this subject by the American Diabetes Association and the Endocrine Society.

In 2003, the American Diabetes Association Workgroup on Hypoglycemia published a report titled "Defining and Reporting Hypoglycemia in Diabetes" (1). In that report, recommendations were primarily made to advise the U.S. Food and Drug Administration (FDA) on how hypoglycemia should be used as an end point in studies of new treatments for diabetes. The Endocrine Society practice guideline entitled "Management of Hypoglycemia," which indicates that hypoglycemia is a common clinical problem, was subsequently published (2).

This evidence has now been updated with new data on the incidence and prevalence of hypoglycemia in patients with diabetes and the impact of hypoglycemia on quality of life, health care utilization, and outcomes.

How should hypoglycemia be defined and reported?—Hypoglycemia puts patients at risk for injury and death. Consequently, the workgroup defines hypoglycemia in patients with diabetes as all episodes of an abnormally low plasma glucose concentration that expose the individual to potential harm. A single threshold value for plasma glucose concentrations is not sufficient to define hypoglycemia in diabetes.

Consistent with past recommendations (1), the workgroup suggests the following classification of hypoglycemia in diabetes:

1. Severe hypoglycemia. Severe hypoglycemia is an event requiring assistance of another person to actively administer carbohydrate, gluconate, or take other corrective actions. Plasma glucose concentrations may not be available during these episodes.

2. Moderate hypoglycemia. Moderate hypoglycemia is an episode that occurs without assistance of another person and is later treated with carbohydrates or glucose. Plasma glucose concentrations are usually available during these episodes.

3. Mild hypoglycemia. Mild hypoglycemia is an episode that occurs without assistance of another person and is treated with carbohydrates or glucose. Plasma glucose concentrations are usually available during these episodes.

4. Symptomatic hypoglycemia. Symptomatic hypoglycemia is an episode that occurs without assistance of another person and is treated with carbohydrates or glucose. Plasma glucose concentrations are usually available during these episodes.

5. Non-symptomatic hypoglycemia. Non-symptomatic hypoglycemia is an episode that occurs without assistance of another person and is treated with carbohydrates or glucose. Plasma glucose concentrations are usually available during these episodes.

6. Unclassified hypoglycemia. Unclassified hypoglycemia is an episode that occurs without assistance of another person and is treated with carbohydrates or glucose. Plasma glucose concentrations are usually available during these episodes.

The workgroup recommends that the following questions be answered:

1. How should hypoglycemia in diabetes be defined and reported?
2. What are the implications of hypoglycemia on both short- and long-term outcomes in people with diabetes?
3. What are the implications of hypoglycemia on treatment targets for patients with diabetes?
How should hypoglycemia in diabetes be defined and reported?—Hypoglycemia puts patients at risk for injury and death. Consequently, the workgroup defines iatrogenic hypoglycemia in patients with diabetes as all episodes of an abnormally low plasma glucose concentration that expose the individual to potential harm. A single threshold value for plasma glucose concentration that defines hypoglycemia in diabetes cannot be assigned because glycemic thresholds for symptoms of hypoglycemia (among other responses) shift to lower plasma glucose concentrations after recent antecedent hypoglycemia (9–12) and to higher plasma glucose concentrations in patients with poorly controlled diabetes and infrequent hypoglycemia (13).

Nonetheless, an alert value can be defined that draws the attention of both patients and caregivers to the potential harm associated with hypoglycemia. The workgroup (1) suggests that a person at risk for hypoglycemia (i.e., those treated with a sulfonylurea, glitazone, or insulin) should be alert to the possibility of developing hypoglycemia at a self-monitored plasma glucose—or continuous glucose monitoring-substrate glucose concentration of ≤70 mg/dL (≤3.9 mmol/L). This alert value is data driven and pragmatic (14). Given the limited accuracy of the monitoring devices, it approximates the lower limit of the normal postabsorptive plasma glucose concentration (15), the glycemic thresholds for activation of glucose counterregulatory systems in nondiabetic individuals (15), and the upper limit of plasma glucose levels reported to reduce counterregulatory re-

1. Severe hypoglycemia. Severe hypoglycemia is an event requiring assistance of another person to actively administer carbohydrates, glucose, or take other corrective actions. Plasma glucose concentrations may not be available during an event, but neurological recovery following the return of plasma glucose to normal is considered sufficient evidence that the event was induced by a low plasma glucose concentration.

2. Documented symptomatic hypoglycemia. Documented symptomatic hypoglycemia is an event during which typical symptoms of hypoglycemia are accompanied by a measured plasma glucose concentration ≤70 mg/dL (≤3.9 mmol/L).

3. Asymptomatic hypoglycemia. Asymptomatic hypoglycemia is an event not accompanied by typical symptoms of hypoglycemia but with a measured plasma glucose concentration ≤70 mg/dL (≤3.9 mmol/L).

4. Probable symptomatic hypoglycemia. Probable symptomatic hypoglycemia is an event during which symptoms typical of hypoglycemia are accompanied by a plasma glucose concentration ≤70 mg/dL (≤3.9 mmol/L).

5. Pseudo-hypoglycemia. Pseudo-

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Definitions of Hypoglycemia

Definitions for hypoglycemia are variable, which complicates both the study and tracking of hypoglycemic events.

Rather than refer to a specific blood glucose concentration for all individuals, hypoglycemia in patients with diabetes can be defined as:

An abnormally low plasma glucose concentration that exposes the individual to potential or actual harm.
Definition of “serious hypoglycemia”

Because of inconsistent definitions in the literature, the FIW for Diabetes Agents ADEs has chosen to use the term “serious hypoglycemia,” recognizing that this terminology does not represent Federal or agency perspectives. For the purpose of this Action Plan, “serious hypoglycemia” is defined as requiring third-party assistance (e.g., from a family member and/or medical personnel, or leading to an emergency department visit or hospital admissions) or blood glucose lower than 40 mg/dL, recognizing that there is a gradient of severity in these episodes.
Using an “Alert” Value

While it’s not possible to define a single threshold glucose value that defines hypoglycemia in all individuals, a glucose value of $\leq 70$ mg/dL is commonly recommended for generating concern (an “alert”).

An “alert” value may give patients and caregivers time to prevent a serious clinical hypoglycemic episode. It also accounts for the limited accuracy of some monitoring devices.

Glucose measurements generally vary depending on the sample source (e.g., capillary blood from fingerstick, venous blood draw), sample type (e.g., plasma, whole blood), and method of measurement. These variables may change the glucose alert thresholds.
BG monitor accuracy

A1c Test

- Average blood glucose for last 3 months
- Fringe of error often ± .5%

Fasting plasma glucose (FPG) test

- Current but less accurate
- Fringe of error may be ± 16 mg/dl
National Action Plan for Adverse Drug Event Prevention

Introducing the National Action Plan For Adverse Drug Event (ADE) Prevention

Dai Hu, MD, MPH
Acting Director, Division of Health Care Quality, Office of Disease Prevention and Health Promotion
U.S. Department of Health & Human Services

Overview and Prevention of Serious Hypoglycemic Events in Outpatient Settings

Leonard Pagano MD, MBA, FACP
National Director Medicine
Veterans Affairs Central Office
Office of Specialty Care/Office of Patient Care Services
The Action Plan highlights 3 classes of drugs

- Opioids
- Anti-coagulants
- Diabetes agents
# Considerations in Targeting Drug Classes

<table>
<thead>
<tr>
<th>Medication Class</th>
<th>Nature of Harms</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Common</td>
</tr>
<tr>
<td>Antibiotics</td>
<td>✓</td>
</tr>
<tr>
<td>Antineoplastics</td>
<td>✓</td>
</tr>
<tr>
<td>Corticosteroids</td>
<td>✓</td>
</tr>
<tr>
<td>Anticoagulants</td>
<td>✓</td>
</tr>
<tr>
<td>Insulin/oral hypoglycemics</td>
<td>✓</td>
</tr>
<tr>
<td>Opioids/ benzodiazepines</td>
<td>✓</td>
</tr>
</tbody>
</table>
Emergency Hospitalizations for Adverse Drug Events in Older Americans

Figure 1. Estimated Rates of Emergency Hospitalizations for Adverse Drug Events in Older U.S. Adults, 2007–2009.
Adverse Drug Events (ADEs)*

“Harms directly caused by a drug during medical care.”**

- Medication errors
  - Errors in prescribing, transcribing, dispensing, administering, adherence, or monitoring of a drug
- Adverse drug reactions
  - Harms directly caused by a drug at normal doses
- Allergic reactions
- Overdoses


ADEs occur...

In any health care setting

- Inpatient (e.g., acute care hospitals)
- Outpatient
- Long-term care (LTC) (e.g., nursing homes, group homes)

But more often during transitions of care
(e.g., hospital to nursing home, between health care providers)

- Inadequate transfer of info between providers
- Patients don’t understand how to manage their medications

Individual Risk Factors: Comorbid Conditions

Certain comorbid conditions are risk factors for ADEs, regardless of a patient’s age. These include, but are not limited to:

- Depression
- Cognitive impairment
- Epilepsy
- Cardiovascular disease
- Advanced diabetes complications, such as hypoglycemia unawareness and impaired renal function
ADEs and Older Adults

Age is a principal underlying risk factor for ADEs, and older adults (age 65 and older) are particularly vulnerable.

ADEs Treated in U.S. Emergency Departments (2004 - 2005)

ADEs and Older Adults (Continued)

National surveillance data indicate that older adults are 2 to 3 times more likely than younger people to have an ADE requiring a physician office or ED visit.

Older adults are also 7 times more likely to have an ADE requiring hospital admission.

Many adverse drug events are not reported or measured. These numbers are likely an underestimate of the true numbers.

Other populations also especially vulnerable to ADEs

- Very young children
- People with low socioeconomic status
- People with limited health literacy
- People with limited access to health care services
- Certain minority racial or ethnic groups
4. ADEs WITH DIABETES DRUGS
ADEs with Diabetes Drugs

Common contributing factors
- Intensive treatment
- Misunderstanding or errors in administration

Medications commonly associated ED visits, ages 65+
- Insulin
- Oral agents (esp. sulfonylureas)

Medication Adherence

Taking medication as prescribed is an important aspect of what patients do to self-manage their diabetes.

Diabetes treatment regimens are very complex, and this complexity can have an impact on medication adherence.
Medication Adherence

Other factors that can affect medication adherence include:

- Not being able to afford medication
- Distrust of provider or treatment plan
- Longer duration of disease
- Personal challenges such as depression or stress
<table>
<thead>
<tr>
<th>Medication</th>
<th>Annual National Estimate of Hospitalizations (N = 99,628)</th>
<th>Proportion of Emergency Department Visits Resulting in Hospitalization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Most commonly implicated medications†</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Warfarin</td>
<td>33,171</td>
<td>46.2</td>
</tr>
<tr>
<td>Insulins</td>
<td>13,854</td>
<td>40.6</td>
</tr>
<tr>
<td>Oral antplatelet agents</td>
<td>13,263†</td>
<td>41.5</td>
</tr>
<tr>
<td>Oral hypoglycemic agents</td>
<td>10,656</td>
<td>51.8</td>
</tr>
<tr>
<td>Opioid analgesics</td>
<td>4,778</td>
<td>32.4</td>
</tr>
<tr>
<td>Antibiotics</td>
<td>4,205</td>
<td>18.3</td>
</tr>
<tr>
<td>Digoxin</td>
<td>3,465</td>
<td>80.5</td>
</tr>
<tr>
<td>Antineoplastic agents</td>
<td>3,329†</td>
<td>51.5</td>
</tr>
<tr>
<td>Antiadrenergic agents</td>
<td>2,899</td>
<td>35.7</td>
</tr>
<tr>
<td>Renin–angiotensin inhibitors</td>
<td>2,870</td>
<td>32.6</td>
</tr>
<tr>
<td>Sedative or hypnotic agents</td>
<td>2,469</td>
<td>35.2</td>
</tr>
<tr>
<td>Anticonvulsants</td>
<td>1,653</td>
<td>40.0</td>
</tr>
<tr>
<td>Diuretics</td>
<td>1,071†</td>
<td>42.4</td>
</tr>
<tr>
<td>High-risk or potentially inappropriate medications§</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HEDIS high-risk medications</td>
<td>1,207</td>
<td>20.7</td>
</tr>
<tr>
<td>Beers-criteria potentially inappropriate medications</td>
<td>6,607</td>
<td>42.0</td>
</tr>
<tr>
<td>Beers-criteria potentially inappropriate medications, excluding digoxin</td>
<td>3,170</td>
<td>27.6</td>
</tr>
</tbody>
</table>

\[ \frac{3}{4} \text{ of ADE hospitalizations} \]
Contribution of Hypoglycemia to Health Burden of ADEs

- **Ambulatory Patients**
  - Insulin 1st most common drug implicated in ED visits for ADEs overall (~8%) ¹
  - Insulin and oral diabetes drug implicated in ~25% of emergent hospitalizations for ADEs in older adults ²

- **Hospitalized Patients**
  - Hypoglycemia was 3rd most common ADE ³

- **Skilled Nursing Facility Patients**
  - Hypoglycemia was 1st most common ADE ⁴

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¹ *JAMA. 2006;296:1555-1566*  
³ *Adverse Events in Hospitals. 2010, OSH 06-00-0099*  
⁴ *Adverse Events in Skilled Nursing Facilities. 2014, OSH 06-11-00770*
What patient actions precipitated these IHEs?

<table>
<thead>
<tr>
<th>Precipitating Factor</th>
<th>Cases, No.</th>
<th>Annual National Estimate, % (95% CI)</th>
<th>Illustrative Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meal-related misadventure</td>
<td>952</td>
<td>45.9 (38.2-53.6)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unintentionally took wrong insulin product</td>
<td>332</td>
<td>22.1 (17.2-26.9)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unintentionally took wrong dose/</td>
<td>205</td>
<td>12.2 (9.3-15.2)</td>
<td></td>
</tr>
<tr>
<td>confirmed units</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intentionally took &quot;additional&quot; dose</td>
<td>113</td>
<td>6.0 (4.4-7.6)</td>
<td></td>
</tr>
<tr>
<td>Pump-related misadventure</td>
<td>38</td>
<td>1.5 (0.7-2.2)</td>
<td></td>
</tr>
<tr>
<td>Other misadventure</td>
<td>211</td>
<td>13.4 (10.4-16.4)</td>
<td></td>
</tr>
</tbody>
</table>

**Eating behavior**

- Unintentionally took wrong insulin product: A 33-year-old male accidentally gave herself 38 units of regular insulin while changing insulin pump. Diagnosis: insulin overdose, accidental.

**Insulin behavior**

- Unintentionally took wrong dose/confirmed units: A 51-year-old man, prior spouse injected patient with 50 units of Novolog instead of 50 units of Lantus, blood glucose 33 at time of arrival. Diagnosis: hypoglycemia.

**Pump behavior**

- Pump-related misadventure: A 76-year-old with syncopal episode after reeling lown for 3 hours; took usual insulin at noon rather than in the morning—passed out. Diagnosis: hypoglycemic reaction.

5. SOURCES OF PATIENT ERROR

• COMPLEXITY OF PATIENT’S DSM JOB

• PATIENT’S COGNITIVE ABILITY
Preventing hypoglycemia - from a patient’s perspective
Fishbone Diagram: Select Determinants of Preventable Adverse Drug Events

Provider
- Failure to follow policy (i.e., use of workround)
- Lack of accurate health information
- Inappropriate monitoring
- Medication incorrectly administered
- Medication incorrectly or inappropriately prescribed
- Poor health literacy

Patient
- Polypharmacy
- Reduced hepatic and/or renal metabolism
- Age
- Cognitive decline
- Physical frailty
- Non-adherence or misuse
- Psychiatric comorbidities

Proximate Factors
- Name
- Prescribed high-risk medications
- Multiple providers
- Pharmocogenomics

Preventable ADEs

Health Care System
- Fragmented health care delivery/poor care coordination
- Limited time in patient-provider interaction for counseling
- Limited time in patient-provider interaction for counseling

Organizational
- Focus on individual vs. system
- Leadership
- Punitive environment
- Unreliable authority for authority gradient
- High workload

Technical
- Policies not in place
- For $250 medication use
- Look-alike, sound-alike medications

Latent Factors
- Difficult-to-use materials
- Formulary restrictions on use of certain medications

What can CDEs do?

**Personalize DSME**

to **prevent** hypoglycemia
Figure 6. Fishbone Diagram: Select Determinants of Preventable Adverse Drug Event Events

- **Provider**
  - Provider/Shift Change
  - Miscommunication between Providers or With Patient
  - Staff Inexperience or New Work Setting
  - Provider Knowledge Deficit

- **Patient**
  - Failure to Follow Policy (i.e., Use of Workarounds)
  - Lack of Access to Accurate Health Information
  - Incorrect Medicine or/unappropriately Administered
  - Order Illegible
  - Medication Incorrectly or Inappropriately Prescribed

- **Proximate Factors**
  - Prescribed High-Risk Medications (e.g., anticoagulants, diabetes agents, opioids)
  - Medical and/or Psychiatric Co-morbidities
  - Multiple Providers
  - Non-adherence or Misuse
  - Pharmacogenomics

- **Preventable ADEs**
  - Fragmented Health Care Delivery/Poor Care Coordination
  - Focus on Individual vs. Systems
  - Leadership
  - Formulary Restrictions on Use of Certain Medications
  - Punitive Environment
  - Unbiased Counter Authority/Gradient
  - High Workload
  - Policies Not In Place
  - To Report and Investigate ADEs

- **Latent Factors**
  - Look Alike, Sound-Alike Medications

Prevention critical when risk is high
Risk of ADEs rises with age.
Because complexity of self-care increases and abilities decline.
How can CDEs help patients avoid critical errors?

Common guidance for reducing patient error

But recall that errors frequent when...

- Self-care is too complex
- Patient’s abilities are too low
- Or, both

Risk of patient error increases when:

\[ \iff = \text{error rate on specific tasks} \]

- Lower patient ability
- Higher task complexity
Risk of patient error increases when:

\( \implies \text{error rate on specific tasks} \)

- Lower patient ability
- Higher task complexity

Cognitive ability and task complexity interact to increase the risk of error.
Critical errors

Some errors more dangerous

So, need to triage

Cognitive ability

Task complexity

Critical errors
Common critical errors

Recall top 3 “precipitating factors”

1. Meal-related misadventure 46%
2. Unintentionally took wrong insulin product 22%
   • usually took short-acting in place of long-acting insulin
3. Unintentionally took wrong dose/confused units 12%

Common critical errors

Recall top 3 “precipitating factors”

1. Meal-related misadventure 46%
2. Unintentionally took wrong insulin product 22%
3. Unintentionally took wrong dose/confused units 12%

What went wrong?

Insights from “near misses”

1. Meal-related misadventures

- Took insulin, but:
  - did not eat
  - did not eat enough carbs (only a salad)
  - did not count carbs

- counted carbs incorrectly—e.g., used weight grams rather than carb grams

2. Unintentionally took wrong insulin

- Used up “leftover” insulin

- Mixed up bottles for bolus and basal insulins

- Used bolus at times when should use basal insulin

- Failed to stop old insulin when changed to new one

3. Unintentionally took wrong dose

• Split or chewed time release pills

• Based dose on wrong factor

• Administered dose improperly

"Do Not Crush, Chew or Cut"

In one case an elderly patient was prescribed Glucotrol AL to treat elevated blood sugars. This is a specially formulated medication that releases an entire day’s supply of the medication slowly over a 24-hour period. The pill was too large for the woman to swallow, so she chewed it. She soon complained of feeling dizzy, weak, listless, and lethargic. Chewing the drug caused it to be released all at once, causing dangerously low blood glucose levels, which could have been fatal....

Medication Safety Alert

A second patient also had mysteriously low blood glucose levels while using her pump. The pump has a bolus dosing "wizard" that allows patients to enter their blood glucose and the amount of carbohydrate grams they’ve eaten.

The patient was entering the measured blood glucose into the carbohydrate field instead of the number of carbohydrates eaten. For example, 220 was entered in the carbohydrate field instead of 60 grams.

New FlexTouch Pens Not the Same as the Old

She was administering Levemir, 60 units, with a FlexPen. She said that she just dialed the dose to the maximum it would allow her as she knew it would only dial to 60 units. She did not confirm the dose visually... I knew that her next refill would probably be the FlexTouch pen, which dials to 80 units. I reiterated the importance of a visual confirmation.

CDE prevented a likely ADE!

Commonalities in patient errors

- Treated unlikes (e.g., different insulins) as interchangeable
- Did not grasp relevance of key distinctions
- Performed only one step of multi-step task
- Performed one or more steps incorrectly
- Did not coordinate timing of essential tasks
- Did not notice when things amiss
- Lacked basic skills and knowledge we often take for granted
6. DIFFERENTIATED INSTRUCTION:

STRATEGY TO PREVENT HYPOGLYCEMIA
How can CDEs help patients navigate their maze?
By personalizing DSME to prevent hypoglycemia
Need personalized, differentiated DSME
Strategy

1. Focus on patient’s biggest risks
Strategy

1. Focus on patient’s biggest risks
2. Simplify task, if possible
Readability doesn’t make a complex task easy

To be or not to be, that is the question.

Ingredients of readability:
ASW: Average syllables per word
ASL: Average words per sentence

\[
206.835 - (84.6 \times ASW) - (1.015 \times ASL)
\]

\[
(0.39 \times ASL) + (11.8 \times ASW) - 15.59
\]
Strategy

1. Focus on patient’s biggest risks
2. Simplify task, if possible
3. Target instruction to ability level
1. Focus on patient’s biggest risks
2. Simplify task, if possible
3. Target instruction to ability level
4. Sequence learning objectives by complexity of cognitive processes
Bloom’s Taxonomy of Learning Objectives
(2001 revision)

Bloom’s levels = continuum of cognitive complexity

Anticipate effect of exercise & foods on blood glucose.
Coordinate meds, diet, and exercise.
Manage sick days.
Determine when & why blood glucose is out of control
Monitor symptoms; assess whether action needed; evaluate effectiveness of actions
Create daily and contingency plans that control blood glucose.

Recall effects of exercise on glucose.
Remember to measure foods, drinks & read labels.
Remember to take BGs & Rx.

DSM tasks differ in complexity

Bloom's taxonomy of educational objectives (cognitive domain)*

**Simplest tasks**
1. **Remember**
   - recognize, recall, identify, retrieve

2. **Understand**
   - paraphrase, summarize, compare, predict, infer

3. **Apply**
   - execute familiar task, apply procedure to unfamiliar task

4. **Analyze**
   - distinguish, focus, select, integrate, coordinate

5. **Evaluate**
   - check, monitor, detect inconsistencies, judge effectiveness

6. **Create**
   - hypothesize, plan, invent, devise, design

Good instruction minimizes *unnecessary* cognitive load on student

- Teach essential DSM tasks first, one at a time
- Sequence instruction from simple to complex ideas & skills
- Adjust speed and abstractness of instruction to accommodate individual’s learning needs
- *Never* assume that something is “simple” or obvious
- Confirm mastery before moving on
- Don’t squander individual’s cognitive resources by teaching non-essential skills and content, using too-complex materials, etc.
7. OTHER STRATEGIES TO PREVENT HYPOGLYCEMIA
Other strategies include:

- Technology: CGMS, Apps
- National Call to Action to Prevent ADEs
- Individualizing BG goals
Opportunities for prevention in outpatient settings

<table>
<thead>
<tr>
<th>Examples</th>
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</thead>
<tbody>
<tr>
<td><strong>Safety</strong></td>
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<tr>
<td></td>
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<tr>
<td><strong>Engagement &amp; communication</strong></td>
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</tbody>
</table>
Opportunities for prevention in outpatient settings—cont.

<table>
<thead>
<tr>
<th>More examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education</td>
</tr>
<tr>
<td>Importance of consistent eating patterns</td>
</tr>
<tr>
<td>Guidance on sick day management</td>
</tr>
<tr>
<td>How to treat low blood sugar</td>
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<tr>
<td>Accuracy of self-monitoring equipment</td>
</tr>
<tr>
<td>Check expiration dates of meds</td>
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<tr>
<td>Test blood glucose at home</td>
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</table>
ADE Prevention Strategies/Tools: Outpatient Settings

- Awareness and education of patients/families on how to treat low blood glucose, including availability of products such as glucose tablets for home use

- Explain risks of nocturnal hypoglycemia with patients and caregivers

- Address cultural competency (literacy, language, cultural acceptability)
Diabetes in Older Adults: A Consensus Report

M. Sue Kirkman, MD, a Vanessa Jones Briscoe, PhD, NP, CDE, b Nathaniel Clark, MD, MS, RD, c Hermes Florez, MD, MPH, PhD, a Linda B. Haas, PHC, RN, CDE, e Jeffrey B. Halter, MD, f Elbert S. Huang, MD, MPH, g Mary T. Korytkowski, MD, h Medha N. Munshi, MD, i Peggy Soule Odegard, BS, PharmD, CDE, h Richard E. Pratley, MD, h and Carrie S. Swift, MS, RD, BC-ADM, CDE i

More than 25% of the U.S. population aged ≥ 65 years has diabetes mellitus (hereafter referred to as diabetes), and the aging of the overall population is a significant driver of the diabetes epidemic. Although the Consensus Development Conference on Diabetes and Older Adults (defined as those aged ≥ 65 years) in February 2012. Following a series of scientific presentations by experts in the field, the writing group independently
Table 1. A Framework for Considering Treatment Goals for Glycemia, Blood Pressure, and Dyslipidemia in Older Adults with Diabetes

<table>
<thead>
<tr>
<th>Patient Characteristics/Health Status</th>
<th>Rationale</th>
<th>Reasonable A1C Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Healthy (Few coexisting chronic illnesses, intact cognitive and functional status)</td>
<td>Longer remaining life expectancy</td>
<td>&lt;7.5%</td>
</tr>
<tr>
<td>Complex/Intermediate (Multiple coexisting chronic illnesses, or 2+ instrumental ADL impairments or mild to moderate cognitive impairment)</td>
<td>Intermediate remaining life expectancy, high treatment burden, hypoglycemia vulnerability, fall risk</td>
<td>&lt;8.0%</td>
</tr>
<tr>
<td>Very complex/poor health (Long-term care or end-stage chronic illnesses, or moderate to severe cognitive impairment or 2+ ADL dependencies)</td>
<td>Limited remaining life expectancy makes benefit uncertain</td>
<td>&lt;8.5%</td>
</tr>
</tbody>
</table>

- **Preprandial Glucose** (mg/dL)  
- **Bedtime Glucose** (mg/dL)  
- **Blood Pressure** (mmHg)  
- **Lipids**

- **Healthy (Few coexisting chronic illnesses, intact cognitive and functional status)**
  - Preprandial Glucose: 90-130
  - Bedtime Glucose: 90-150
  - Blood Pressure: <140/80
  - Lipids: Statin unless contraindicated or not tolerated

- **Complex/Intermediate (Multiple coexisting chronic illnesses, or 2+ instrumental ADL impairments or mild to moderate cognitive impairment)**
  - Preprandial Glucose: 90-150
  - Bedtime Glucose: 100-160
  - Blood Pressure: <140/80
  - Lipids: Statin unless contraindicated or not tolerated

- **Very complex/poor health (Long-term care or end-stage chronic illnesses, or moderate to severe cognitive impairment or 2+ ADL dependencies)**
  - Preprandial Glucose: 100-180
  - Bedtime Glucose: 110-200
  - Blood Pressure: <150/90
  - Lipids: Consider likelihood of benefit with statin (secondary prevention more so than primary)

This represents a consensus framework for considering treatment goals for glycemia, blood pressure, and dyslipidemia in older adults with diabetes. The patient characteristic categories are general concepts. Not every patient will clearly fall into a particular category. Consideration of patient/caregiver preferences is an important aspect of treatment individualization. Additionally, a patient’s health status and preferences may change over time. ADL = activities of daily living.
Hypoglycemia and Diabetes: A Report of a Workgroup of the American Diabetes Association and The Endocrine Society

Elizabeth R. Seiquer, MD, PhD
John Anderson, MD
Bethesda Centers, Inc., Bethesda, MD, USA
Philipe Ceyte, MD
Samuel Eaker, MD, PhD

Objective—To review the evidence about the impact of hypoglycemia on patients with diabetes that has become available since the last review of this subject by the American Diabetes Association and The Endocrine Society and to provide guidance about how this new information should be incorporated into clinical practice.

Participants—Members of the American Diabetes Association and the members of The Endocrine Society with expertise in the different aspects of hypoglycemia were invited to the meeting, which was a two-day meeting that was also attended by experts from both organizations. The meeting was held in Washington, DC, USA.

Evidence—The workgroup considered data from recent clinical trials and other studies to update the prior workgroup report. Unpublished data were reviewed. Expert opinion was used to develop some conclusions.

Consensus Process—A consensus was achieved by group discussion during conference calls and face-to-face meetings, as well as through written comments of the written document. The document was reviewed and approved by the American Diabetes Association and The Endocrine Society. The final document was reviewed by the American Diabetes Association and The Endocrine Society in November 2013 and approved by the Executive Committee of the Board of Directors in December 2013.

Conclusions—The workgroup reviewed the evidence on the impact of hypoglycemia in diabetes, the implications of hypoglycemia on both short- and long-term outcomes, considered the implications of hypoglycemia on treatment outcomes, and provided guidance on how to prevent hypoglycemia, and identified knowledge gaps that should be addressed by future research. In addition, tools for patients to report hypoglycemia are included in the document.

Diabetes Care 36:1384–1395, 2013

In 2003, the American Diabetes Association Workgroup on Hypoglycemia and Related Measures in Type 2 Diabetes (1) published a report on the diagnosis and treatment of hypoglycemia. The report recommended that hypoglycemia should be used as an end point in clinical trials of new treatments for diabetes. In 2009, The Endocrine Society released a clinical practice guideline entitled “Evaluation and Management of Adult Hypoglycemia Disorders,” which summarized how clinicians should manage hypoglycemia in patients with diabetes (2). Since then, new evidence has become available that links hypoglycemia with adverse outcomes in older patients with type 2 diabetes (3–6) and in children with type 1 diabetes (7,8). To provide guidance about how this new information should be incorporated into clinical practice, the American Diabetes Association and The Endocrine Society assembled a new Workgroup on Hypoglycemia in April 2013 to address the following questions:

1. How should hypoglycemia in diabetes be defined and reported?
2. What are the implications of hypoglycemia on both short- and long-term outcomes in patients with diabetes?
3. What are the implications of hypoglycemia on treatment targets for patients with diabetes?
ADA/ES Strategies Known to Prevent Hypoglycemia

- Dietary Intervention
- Exercise Management
- Medication Adjustment
- Glucose Monitoring
- Clinical Surveillance

Strategies for Assessing the Risk of Hypoglycemia

1. **Ask questions** to find out how often patients experience symptomatic and asymptomatic hypoglycemia, and what they do to treat it.

   “How do you know when you have low blood sugar?”

   “When your blood glucose goes below 70, what is the usual cause?”

   “How often do you feel badly because of low blood sugar, while still being able to stop and treat yourself?”

What strategies are known to prevent hypoglycemia, and what are the clinical recommendations for those at risk for hypoglycemia?—

Recurrent hypoglycemia increases the risk of severe hypoglycemia and the development of hypoglycemia unawareness and HAAF. Effective approaches known to decrease the risk of iatrogenic hypoglycemia include patient education, dietary and exercise modifications, medication adjustment, careful glucose monitoring by the patient, and conscientious surveillance by the clinician.

Patient education
There is limited research related to the influence of self-management education on the incidence or prevention of hypoglycemia. However, there is clear evidence that diabetes education improves patient outcomes (97–99). As part of the educational plan, the individual with diabetes developed by Mühlhauser and Berger (100) have reported improved glycemic control comparable with DCCT while reducing the rates of severe hypoglycemia (101,102). These programs have been successfully delivered in other settings (103,104) with comparable reductions in hypoglycemic risk (105). Patients with frequent hypoglycemia may also benefit from enrollment in a blood glucose awareness training program. In such a program, patients and their relatives are trained to recognize subtle cues and early neuroglycopenic indicators of evolving hypoglycemia and respond to them before the occurrence of disabling hypoglycemia (106,107).

Dietary intervention
Patients with diabetes need to recognize which foods contain carbohydrates and understand how the carbohydrates in their diet affect blood glucose. To avoid hypoglycemia, patients on long-acting secretagogues and fixed insulin regimens
Differentiated Instruction

Or

And

Existing Strategies
How can CDEs help patients navigate their maze?
By personalizing DSME to prevent hypoglycemia
DSME to prevent critical patient errors

• Deconstruct the error in question. What went wrong? ____________

• How might you simplify the mis-performed task (e.g., fewer steps)? ____________

• How would you use Bloom’s taxonomy of learning objectives to teach an at-risk patient to perform it with less risk.
Meal-related misadventures: A closer look

• *Took insulin, but*

  • did not eat
  • did not eat enough carbs (only a salad)
  • did not count carbs
  • counted carbs incorrectly—e.g., used weight grams rather than carb grams

Source for Case Studies: Diabetes In Control, "Diabetes Disasters Averted"  
[www.diabetesincontrol.com](http://www.diabetesincontrol.com)
Anticipate effect of exercise & foods on blood glucose.

Manage sick days.

Determine when & why blood glucose is out of control.

Monitor symptoms; assess whether action needed; evaluate effectiveness of actions.

Create daily and contingency plans that control blood glucose.

Recall effects of exercise on glucose.

Anticipate effect of exercise & foods on blood glucose.

Remember to measure foods, drinks & read labels.

Bloom’s taxonomy of educational objectives (cognitive domain)*

**Simplest tasks**
1. **Remember**
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6. **Create**
   - hypothesize, plan, invent, devise, design

*Most complex tasks*

Thank you

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References


