DSME for Preventable Hypoglycemia

Linda Gottfredson, PhD

Kathy Stroh, MS, RD, LDN, CDE

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JAZZ IT UP

WITH INNOVATION

AND ENGAGEMENT

AADE15 | AUGUST 5 - 8, 2015

NEW ORLEANS, LOUISIANA

AADE American Association of Diabetes Educators

Linda Gottfredson

PhD

Co-Author of AADE Practice Advisory “Special Considerations in the Management and Education of Older Persons with Diabetes”

Professor Emeritus
University of Delaware
Newark, DE

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Kathy Stroh

MS, RN, LD, CDE

- AADE Public Health Community of Interest Co-Leader
- Co-Author of AADE Practice Advisory “Special Considerations in the Management and Education of Older Persons with Diabetes”
- NDEP Practice Transformation Task Group

Diabetes Educator
Westside Family Healthcare
Wilmington, DE

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Outline

1. **Hypoglycemia: A national problem**

2. **Hypoglycemia: Definitions**

3. ***National Action Plan for ADE* Prevention***

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

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Hyperglycemia-related hospitalizations fell 39% overall in the Medicare population from 1999 to 2010.

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Lipska KJ, et al. (2013, June 24). National trends in hospital admissions for hyperglycemia and hypoglycemia among Medicare beneficiaries, 1999-2010. Webcast at the annual meeting of the American Diabetes Association.

Hyperglycemia hospitalizations fell further in *older age groups*

Ages	1999	2010
65-74	97*	67
75-84	132	75
85+	136	68

*Per 100,000 patient-years

Lipska KJ, et al. (2013, June 24). National trends in hospital admissions for hyperglycemia and hypoglycemia among Medicare beneficiaries, 1999-2010. Webcast at the annual meeting of the American Diabetes Association.

While glucose control has been improving nationally,

serious hypoglycemia has not

and insulin mistakes resulting in emergency care

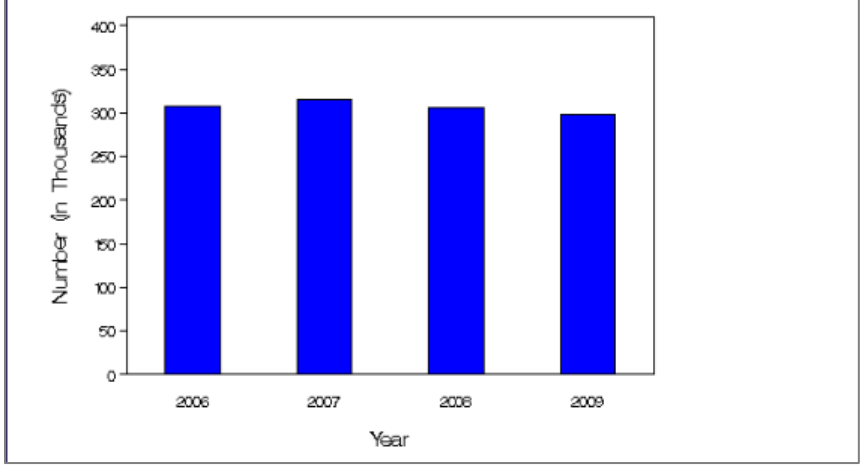
aren't rare, two recent studies showed.

Lipska KJ, et al. (2013, June 24). National trends in hospital admissions for hyperglycemia and hypoglycemia among Medicare beneficiaries, 1999-2010. Webcast at the annual meeting of the American Diabetes Association.

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



Centers for Disease Control and Prevention. "Hypoglycemia." <http://www.cdc.gov/diabetes/statistics/hypoglycemia> Accessed 5/22/2015.

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)

Age	Number going to ED for IHE/yr	% of insulin-only patients each year	% of insulin + oral patients each year
18-44	21,189	3.5	0.3
45-64	34,173	2.7	0.4
65-79	24,720	2.7	0.7
>80	15,479	5.0	1.6

Geller KI, Shehab N, Lovegrove MC, Kegler SR, Weidenbach KN, Ryan GJ, & Budnitz DS. (2014). National estimates of insulin-related hypoglycemia and errors leading to emergency department visits and hospitalizations. *JAMA Intern Med*, *174*(5):678-686.

Hypoglycemia hospitalizations *rose* among older adults (ages 65+)

1999	2007	2010
94*	130	105

*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)

pska KJ, et al. (2013, June 24). National trends in hospital admissions for hyperglycemia and hypoglycemia among Medicare beneficiaries, 1999-2010. Webcast at the annual meeting of the American Diabetes Association.

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

Ages	2010
65-74	72
75-84	141
85+	152

*Per 100,000 patient-years

Lipska KJ, et al. (2013, June 24). National trends in hospital admissions for hyperglycemia and hypoglycemia among Medicare beneficiaries, 1999-2010. Webcast at the annual meeting of the American Diabetes Association.

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).

Geller KI, Shehab N, Lovegrove MC, Kegler SR, Weidenbach KN, Ryan GJ, & Budnitz DS. (2014). National estimates of insulin-related hypoglycemia and errors leading to emergency department visits and hospitalizations. *JAMA Intern Med, 174*(5):678-686.

2. HYPOGLYCEMIA: DEFINITIONS

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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.”

Young B. (2013, June 25). Discussant video: Hypoglycemia still poorly controlled. *Medpage Today*, Meeting Coverage, American Diabetes Association meeting, Chicago.

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

Elizabeth R. Seaquist, MD[1]
John Anderson, MD[2]
Belinda Childs, ARNP, MN, BC-ADM, CDE[3]
Philip Cryer, MD[4]
Samuel Dagogo-Jack, MD, MBBS, MSC[5]
Lisa Fish, MD[6]
Simon R. Heller, MD[7]
Henry Rodriguez, MD[8]
James Rosenzweig, MD[9]
Robert Vigersky, MD[10]

OBJECTIVE—To review the evidence about the impact of hypoglycemia on patients with diabetes that has become available since the past reviews of this subject by the American 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 concen-

the classification of 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 carbohydrates, glucagon, or take other corrective actions. Plasma glucose concentrations may not be available during

of Directors in November 2012 and was reviewed and approved by The Endocrine Society's Clinical Affairs Core Committee in October 2012 and by Council in November 2012.

CONCLUSIONS—The workgroup reconfirmed the previous definitions of hypoglycemia in diabetes, reviewed the implications of hypoglycemia on both short- and long-term outcomes, considered the implications of hypoglycemia on treatment outcomes, presented strategies to prevent hypoglycemia, and identified knowledge gaps that should be addressed by future research. In addition, tools for patients to report hypoglycemia at each visit and for clinicians to document counseling are provided.

Diabetes Care 36:1384–1395, 2013

In 2005, the American Diabetes Association Workgroup on Hypoglycemia released a report entitled "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 di-

years a Endocrine Society

ards of actice guideline enti-

range, 2 d Management of

were ca Disorders," which

The nicians should man-

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treated , new evidence has

tients o links hypoglycemia

in those es in older patients

tions th (3–6) and in children

s (7,8). To provide

this new information

ed into clinical prac-

Diabetes Association

Society assembled a

n Hypoglycemia in

s the following ques-

tions:

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 patients at risk for hypoglycemia (i.e., those treated with a sulfonylurea, glinide, or insulin) should be alert to the possibility of developing hypoglycemia at a self-monitored plasma glucose—or continuous glucose monitoring subcutaneous 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 level reported to reduce counterregulatory re-

the classification of 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 carbohydrates, glucagon, 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 not accompanied by a plasma glucose determination but that was presumably caused by a plasma glucose concentration ≤70 mg/dL (≤3.9 mmol/L).

5) Pseudo-hypoglycemia. Pseudohypoglycemia is an event during which the person with diabetes reports any of the typical symptoms of hypoglycemia with a measured plasma glucose concentration >70 mg/dL (>3.9 mmol/L) but approaching that level.

Definitions of Hypoglycemia

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

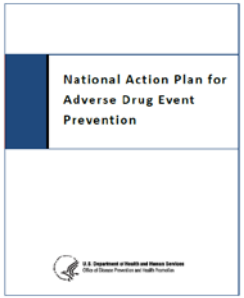
Rather than refer to a specific blood glucose concentration for all individuals, hypoglycemia in patients with diabetes can be defined as:

An abnormally low plasma glucose concentration that exposes the individual to potential or actual harm.

Office of Disease Prevention and Health Promotion and the Centers for Disease Control and Prevention. (2014, September). Slides for Preventing Adverse Drug Events: Individualizing Glycemic Targets Using Health Literacy Strategies. (Continuing Education Course) CDC Training and Continuing Education Online. Chapter 2.

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



U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion. (2014). National Action Plan for Adverse Drug Event Prevention. Washington, DC:

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 <=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.

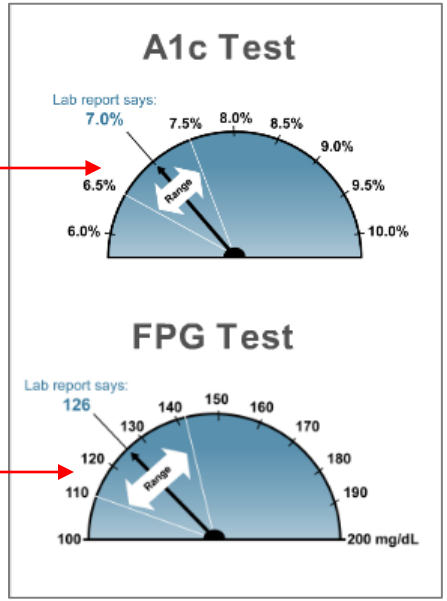
BG monitor accuracy

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 Institute of Diabetes and Digestive and Kidney Diseases. (2014, March). The A1C test and diabetes. NIH Publication No. 14–7816. Bethesda, MD: National Diabetes Information Clearinghouse, p. 5.

3. *National Action Plan*

for

ADE Prevention

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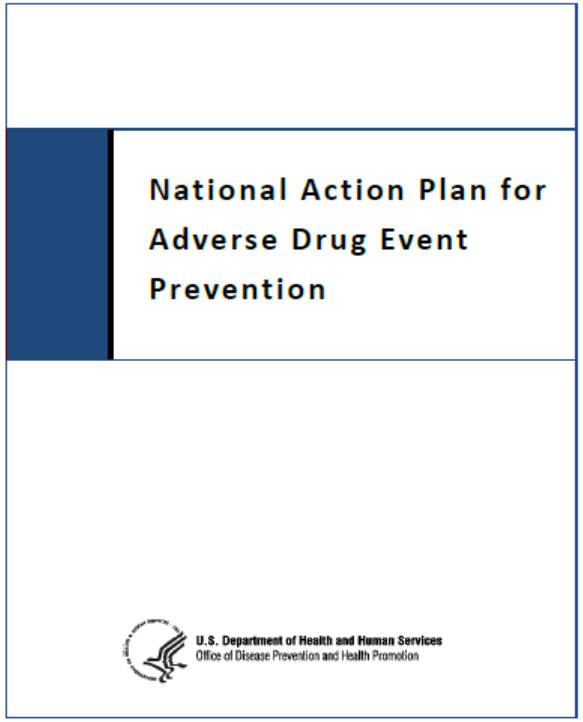
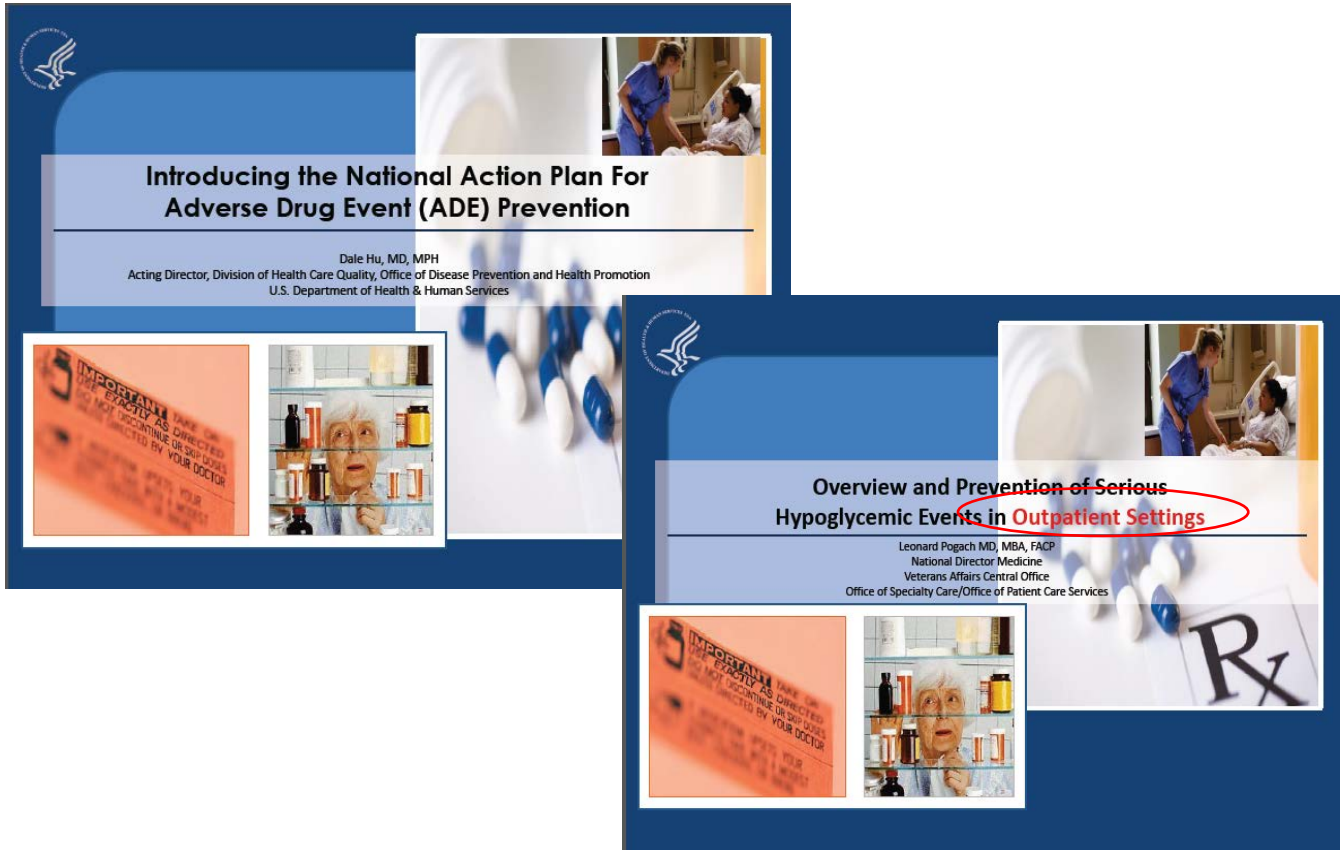
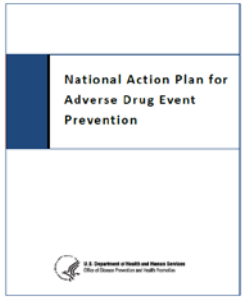


U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion. (2014). National Action Plan for Adverse Drug Event Prevention. Washington, DC:

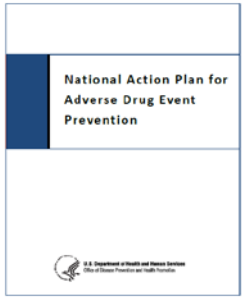


Office of Disease Prevention and Health Promotion. (2014, October 23). ADE Prevention: 2014 Action Plan Conference (Slides).



The Action Plan highlights 3 classes of drugs

- Opioids
- Anti-coagulants
- Diabetes agents



Considerations in Targeting Drug Classes

Medication Class	Nature of Harms		
	Common	Clinically Significant	Preventable
Antibiotics	✓	?	?
Antineoplastics	✓	✓	?
Corticosteroids	✓	?	?
Anticoagulants	✓	✓	✓
Insulin/oral hypoglycemics	✓	✓	✓
Opioids/ benzodiazepines	✓	✓	✓

Office of Disease Prevention and Health Promotion. (2014, October 23). ADE Prevention: 2014 Action Plan Conference (Slides).

National Action Plan for Adverse Drug Event Prevention

Emergency Hospitalizations for Adverse Drug Events in Older Americans

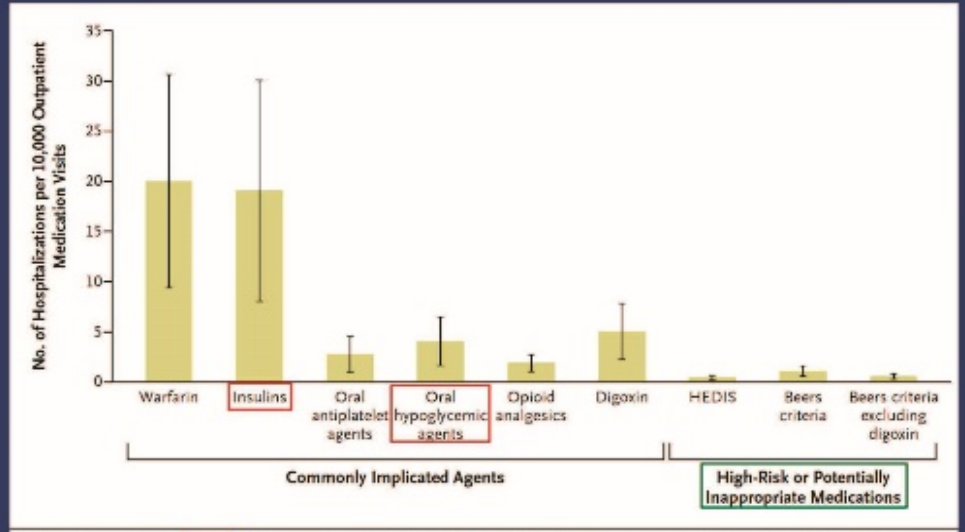
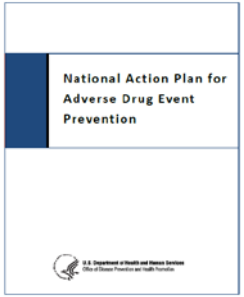


Figure 1. Estimated Rates of Emergency Hospitalizations for Adverse Drug Events in Older U.S. Adults, 2007–2009.

New Engl J Med 2011;365:2002-12



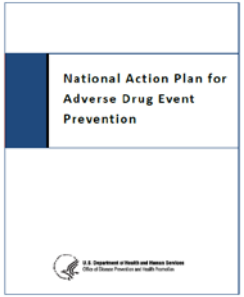
Adverse Drug Events (ADEs)*

*"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

*U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion. (2014). *National action plan for adverse drug event prevention*. Washington, DC.

**Kohn LT, Corrigan JM, & Donaldson MS. (2000). *To err is human: Building a safer health system*. Washington, DC: National Academy Press.



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)

ED and return to Primary Care

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

U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion. (2014). National Action Plan for Adverse Drug Event Prevention. Washington, DC.

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:

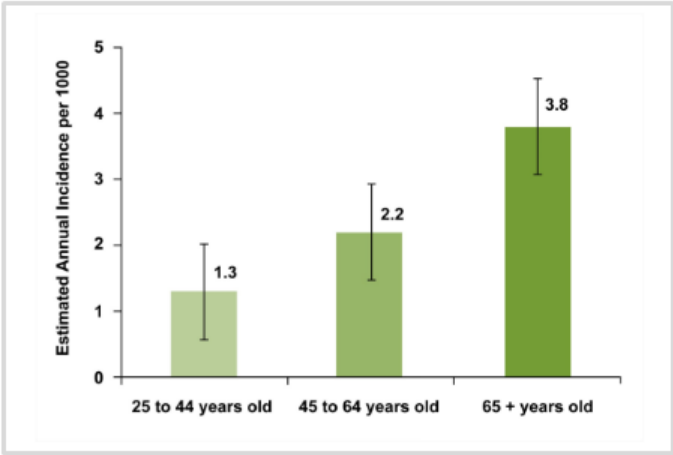
- Depression
- Cognitive impairment
- Epilepsy
- Cardiovascular disease
- Advanced diabetes complications, such as hypoglycemia unawareness and impaired renal function

Office of Disease Prevention and Health Promotion and the Centers for Disease Control and Prevention. (2014, September). Slides for Preventing Adverse Drug Events: Individualizing Glycemic Targets Using Health Literacy Strategies. (Continuing Education Course) CDC Training and Continuing Education Online.

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)



CDC, unpublished data. Updated numbers for: Budnitz DS, Pollock DA, Weidenbach KN, et al. (2006). National surveillance of emergency department visits for outpatient adverse drug events. *JAMA, 296*(15):1858-66. doi: 10.1001/jama.296.15.1858

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.

CDC, unpublished data. Updated numbers for: Budnitz DS, Pollock DA, Weidenbach KN, et al. (2006). National surveillance of emergency department visits for outpatient adverse drug events. *JAMA, 296*(15):1858-66. doi: 10.1001/jama.296.15.1858

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

Office of Disease Prevention and Health Promotion and the Centers for Disease Control and Prevention. (2014, September). Transcript of Preventing Adverse Drug Events: Individualizing Glycemic Targets Using Health Literacy Strategies (Continuing Education Course). CDC Training and Continuing Education Online. <http://health.gov/hcq/trainings/preventhypoglycemicades/pdf/Diabetes-ADEs-Transcript.pdf>

4. ADEs WITH DIABETES DRUGS

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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)

Budnitz D, Lovegrove M, Shehab N, et al. (2011). Emergency hospitalizations for adverse drug events in older Americans. *N Engl J Med*, *365*:2002-2012. doi: 10.1056/NEJMsa1103053.

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.

Office of Disease Prevention and Health Promotion and the Centers for Disease Control and Prevention. (2014, September). Slides for Preventing Adverse Drug Events: Individualizing Glycemic Targets Using Health Literacy Strategies. (Continuing Education Course) CDC Training and Continuing Education Online.

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

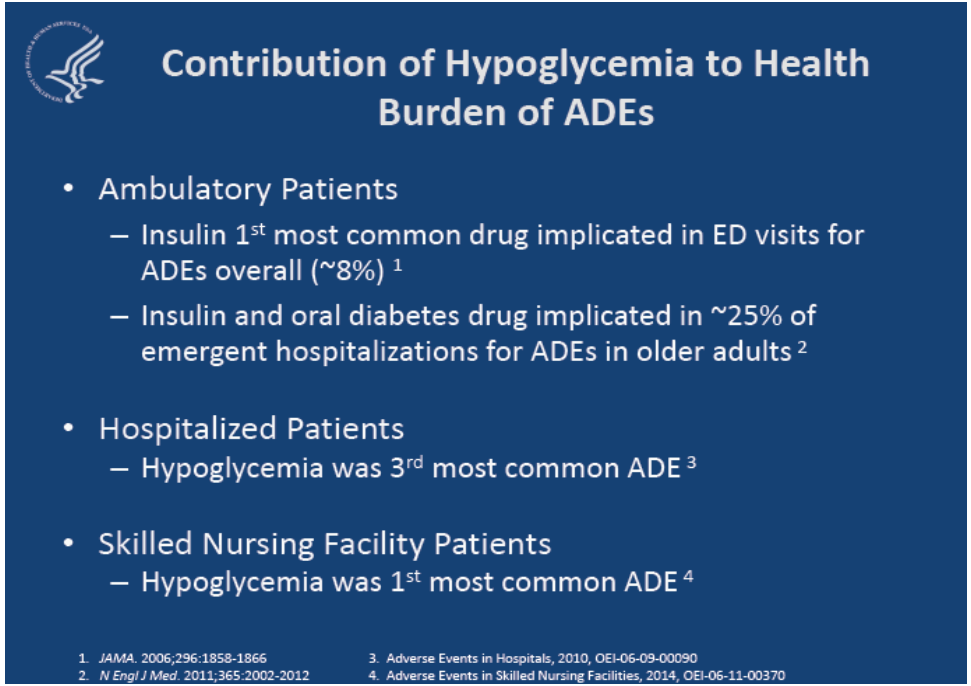
Office of Disease Prevention and Health Promotion and the Centers for Disease Control and Prevention. (2014, September). Slides for Preventing Adverse Drug Events: Individualizing Glycemic Targets Using Health Literacy Strategies. (Continuing Education Course) CDC Training and Continuing Education Online.

National Estimates of Medications Commonly Implicated in Emergency Hospitalizations for Adverse Drug Events in Older U.S. Adults, 2007–2009.*

Medication	Annual National Estimate of Hospitalizations (N=99,628)		Proportion of Emergency Department Visits Resulting in Hospitalization
	no.	*% (95% CI)*	%
Most commonly implicated medications†			
Warfarin	33,171	33.3 (28.0–38.5)	46.2
Insulins	13,854	13.9 (9.8–18.0)	40.6
Oral antiplatelet agents	13,263‡	13.3 (7.5–19.1)	41.5
Oral hypoglycemic agents	10,656	10.7 (8.1–13.3)	51.8
Opioid analgesics	4,778	4.8 (3.5–6.1)	32.4
Antibiotics	4,205	4.2 (2.9–5.5)	18.3
Digoxin	3,465	3.5 (1.9–5.0)	80.5
Antineoplastic agents	3,329‡	3.3 (0.9–5.8)‡	51.5
Antiadrenergic agents	2,899	2.9 (2.1–3.7)	35.7
Renin–angiotensin inhibitors	2,870	2.9 (1.7–4.1)	32.6
Sedative or hypnotic agents	2,469	2.5 (1.6–3.3)	35.2
Anticonvulsants	1,653	1.7 (0.9–2.4)	40.0
Diuretics	1,071‡	1.1 (0.4–1.8)‡	42.4
High-risk or potentially inappropriate medications§			
HEDIS high-risk medications	1,207	1.2 (0.7–1.7)	20.7
Beers-criteria potentially inappropriate medications	6,607	6.6 (4.4–8.9)	42.0
Beers-criteria potentially inappropriate medications, excluding digoxin	3,170	3.2 (2.3–4.1)	27.6

¼ of ADE hospitalizations

Budnitz D, Lovegrove M, Shehab N, et al. (2011). Emergency hospitalizations for adverse drug events in older Americans. *N Engl J Med*, *365*:2002-2012. doi: 10.1056/NEJMsa1103053.



Office of Disease Prevention and Health Promotion. (2014, October 23). ADE Prevention: 2014 Action Plan Conference (Slides).

What patient actions precipitated these IHEs?

Table 4. Number of Cases and Estimates of Precipitating Factors Identified in ED Visits for IHEs (United States, 2007-2011)[a]

Precipitating Factor	ED Visits for IHEs: Cases, No.	ED Visits for IHEs: Annual National Estimate, % (95% CI)	Illustrative Cases[b]
Meal-related misadventure	952	45.9 (38.2-53.6)	• Unrestrained 19-year-old female driver hit tree and brick wall. Blood glucose was 24. Took insulin 2 hours ago, but no time to eat. Diagnosis: scalp abrasion, hypoglycemia. • 75-year-old male is an insulin-dependent diabetic, had a syncopal episode at home, found with blood glucose in the 20s by paramedics. EMS gave patient an ampule of D50 [dextrose 50%] intravenously. Per wife, patient has been having low blood glucose and it has been difficult to keep elevated. She feels it is due to chemotherapy, possibly not eating enough. Diagnosis: hypoglycemia.
Unintentionally took wrong insulin product	332	22.1 (17.2-26.9)	• 51-year-old male, per spouse she injected patient with 50 units of NovoLog instead of 50 units of Lantus, blood glucose 33 at time of arrival. Diagnosis: hypoglycemia. • 67-year-old male accidentally took wrong medication. Confused Humalog insulin with Humulin insulin, blood glucose 36. Diagnosis: hypoglycemia.
Unintentionally took wrong dose/ confused units	205	12.2 (9.2-15.2)	• Patient started new insulin regimen, 30-35 units of Lantus, 3-6 units of NovoLog; patient took 35 units of NovoLog accidentally; blood glucose 40. Diagnosis: insulin overdose. • 62-year-old male given 40 units of regular insulin instead of 4, finger-stick blood glucose 47. Diagnosis: insulin overdose, hypoglycemia.
Intentionally took "additional" dose	113	6.0 (4.4-7.6)	• 69-year-old male hypoglycemic—patient's blood glucose was over 400; took 12 units insulin in addition to his insulin pump; blood glucose dropped to 38; found unresponsive by wife. Diagnosis: insulin shock.
Pump-related misadventure	38	1.5 (0.7-2.2)	• 33-year-old female accidentally gave self bolus of 36 units regular insulin while changing insulin pump. Diagnosis: overdose, accidental. • 27-year-old male is an insulin-dependent diabetic on insulin pump, had a witnessed tonic-clonic seizure, EMS found blood glucose of 20. Patient admitted that he had eaten dinner but his pump had run out so he gave himself an injection and feels he may have overcompensated. Diagnosis: hypoglycemia, seizure.
Other misadventure[c]	211	13.4 (10.4-16.4)	• 76-year-old male with syncopal episode after mowing lawn for 3 hours; took usual insulin at noon rather than in the morning—passed out. Diagnosis: hypoglycemic reaction.

Eating behavior

Insulin behavior

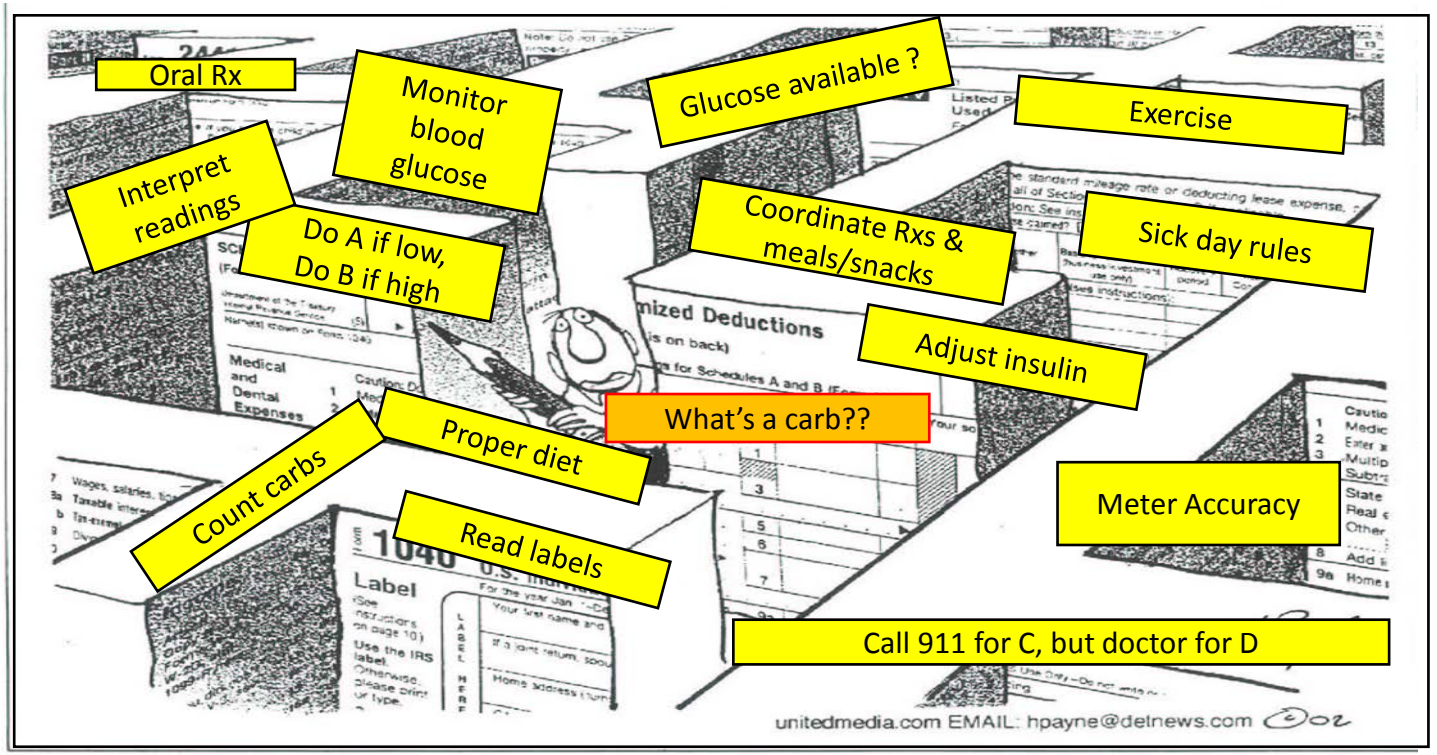
Pump behavior

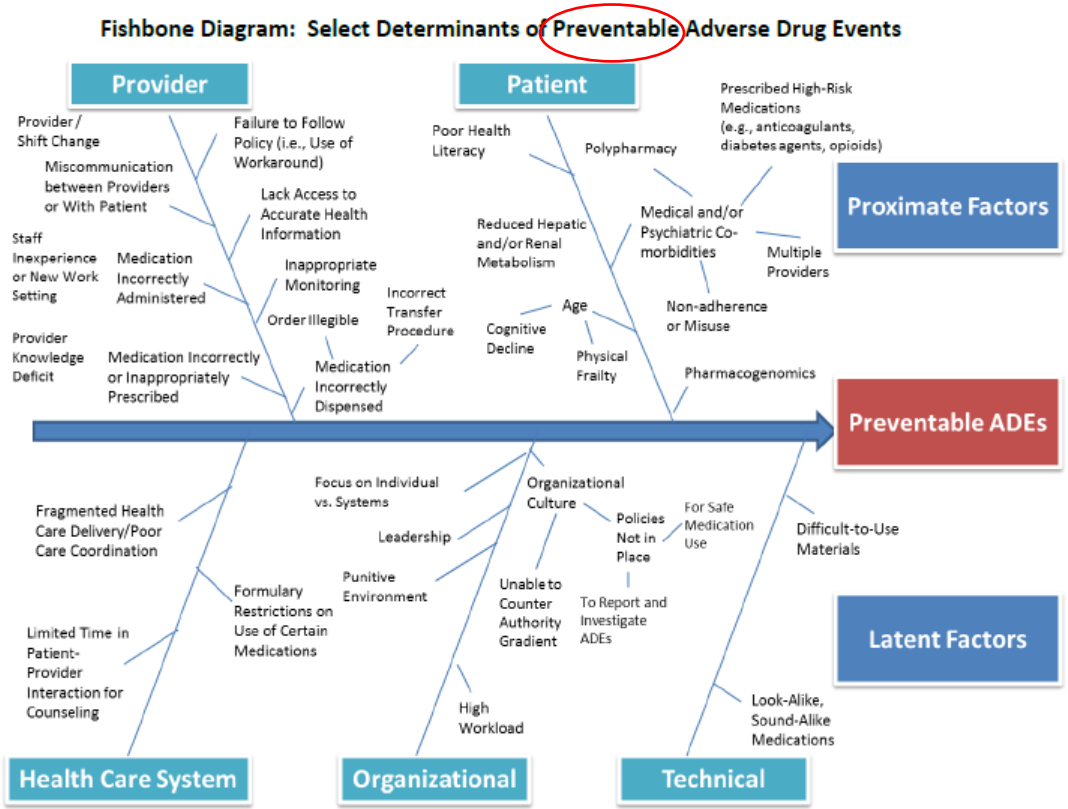
Geller KI, Shehab N, Lovegrove MC, Kegler SR, Weidenbach KN, Ryan GJ, & Budnitz DS. (2014). National estimates of insulin-related hypoglycemia and errors leading to emergency department visits and hospitalizations. *JAMA Intern Med*, *174*(5):678-686.

5. SOURCES OF PATIENT ERROR

- COMPLEXITY OF PATIENT'S DSM JOB
- PATIENT'S COGNITIVE ABILITY

Preventing hypoglycemia - from a patient's perspective





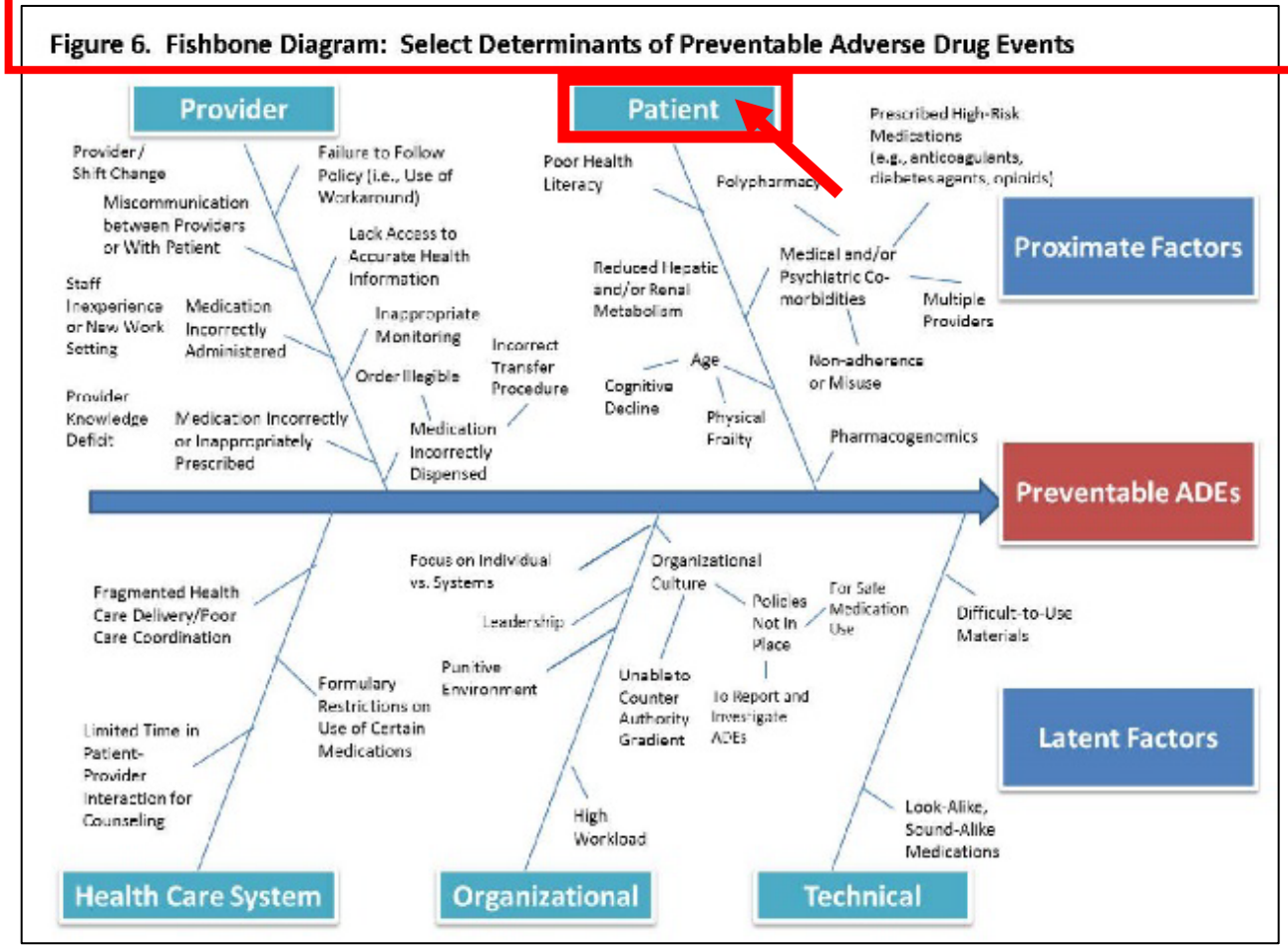
U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion. (2014). *National Action Plan for Adverse Drug Event Prevention.* Washington, DC.

What can CDEs do?

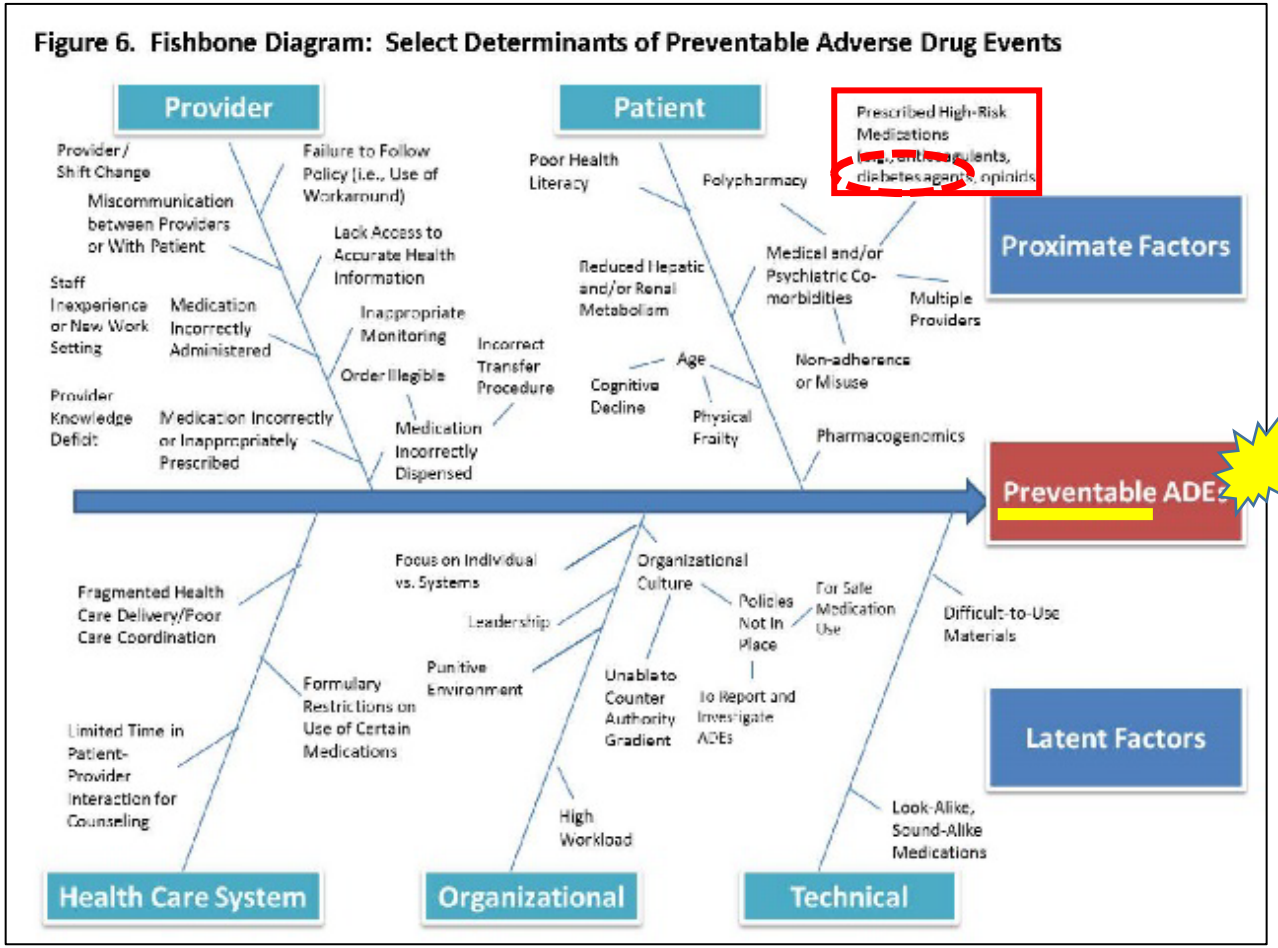
Personalize DSME
to prevent hypoglycemia

National Workgroup

Figure 6. Fishbone Diagram: Select Determinants of Preventable Adverse Drug Events

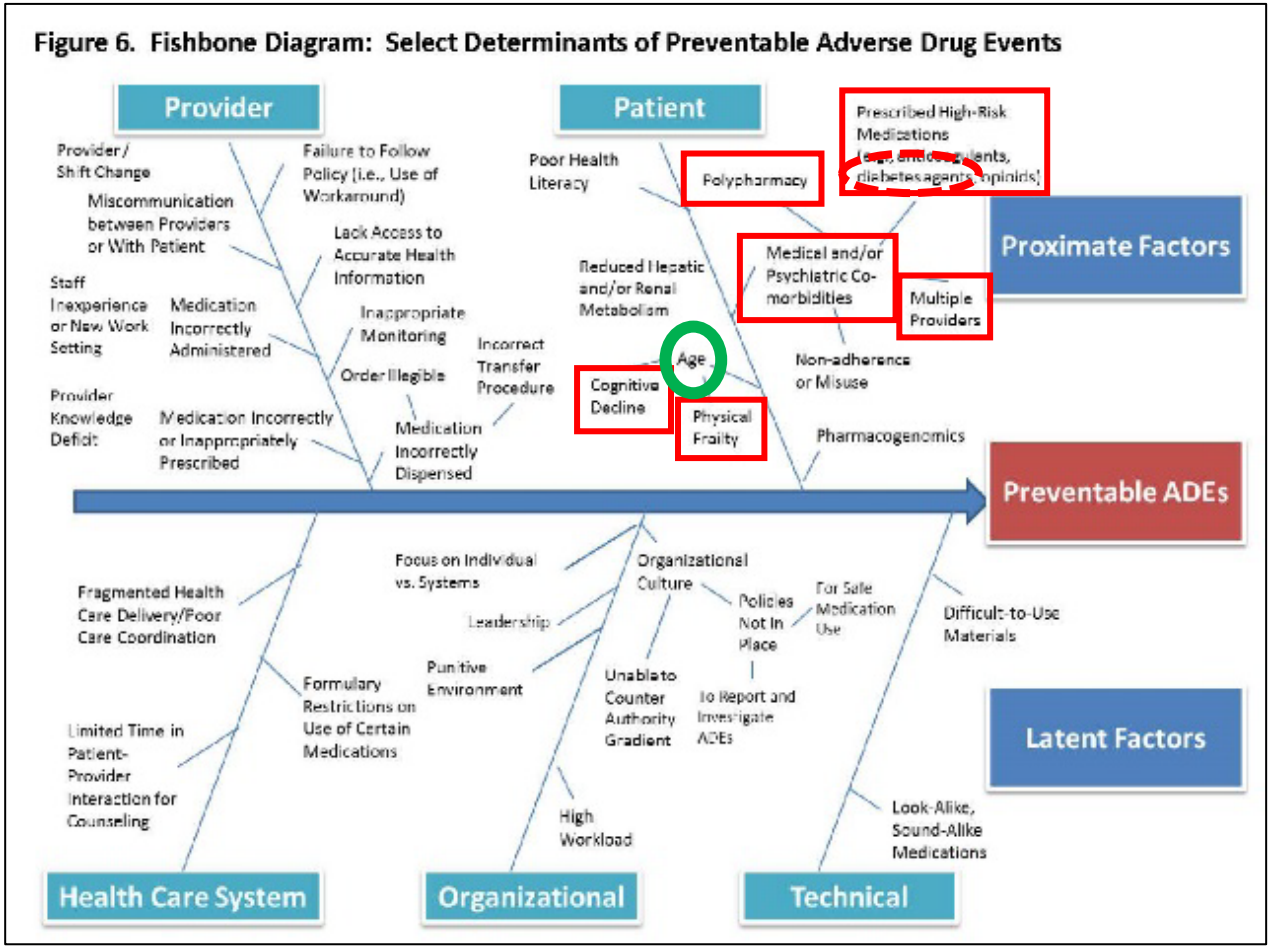


U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion. (2014). *National Action Plan for Adverse Drug Event Prevention*. Washington, DC



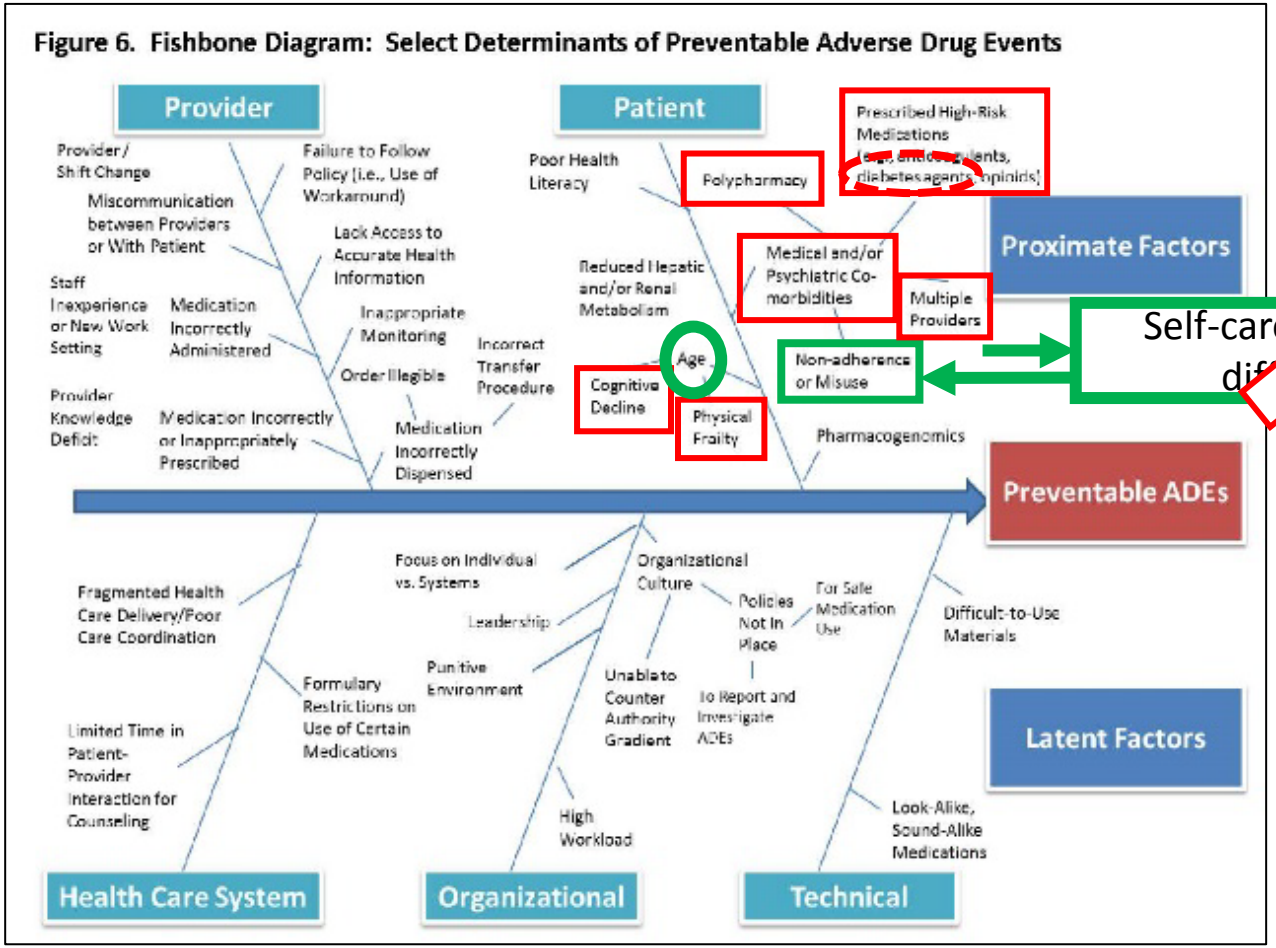
Prevention critical when risk is high

U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion. (2014). *National Action Plan for Adverse Drug Event Prevention.* Washington, DC.



Risk of ADEs rises with age

U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion. (2014). *National Action Plan for Adverse Drug Event Prevention.* Washington, DC.



Because complexity of self-care increases

Self-care is more difficult

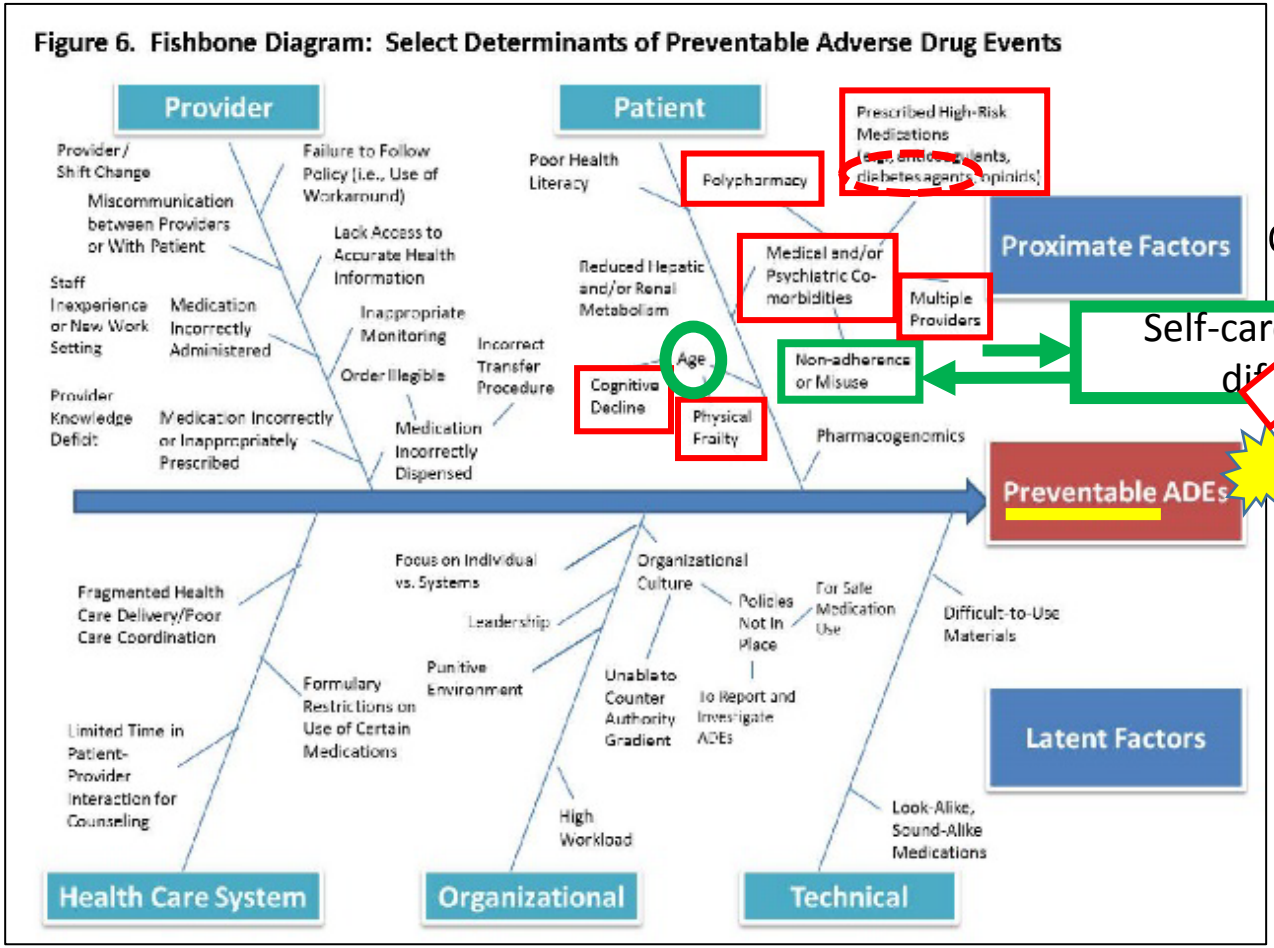
too

And abilities decline

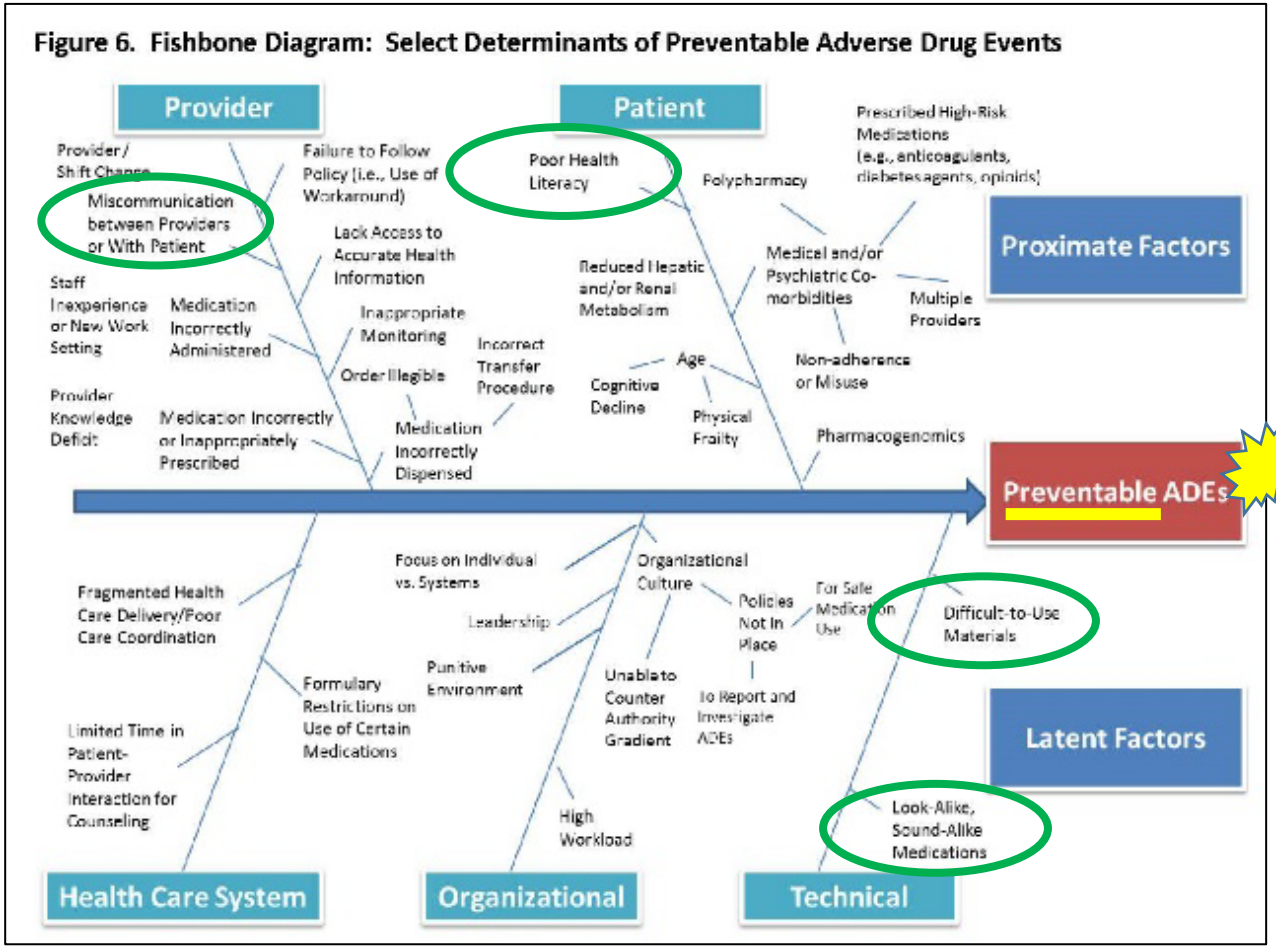
U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion. (2014). *National Action Plan for Adverse Drug Event Prevention.* Washington, DC.

How can CDEs help patients avoid critical errors?

Figure 6. Fishbone Diagram: Select Determinants of Preventable Adverse Drug Events

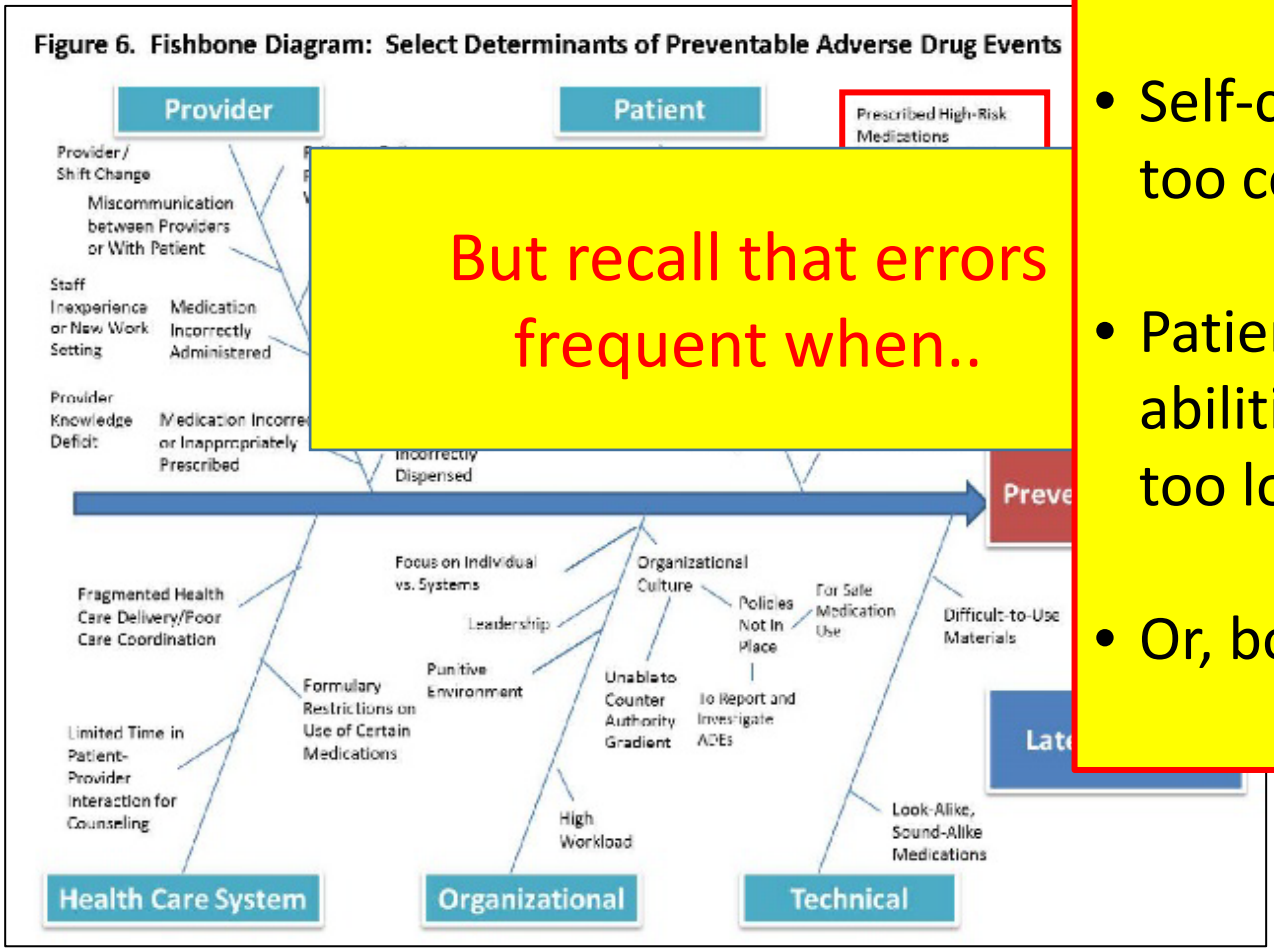


U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion. (2014). *National Action Plan for Adverse Drug Event Prevention.* Washington, DC.



Common guidance for reducing patient error

U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion. (2014). *National Action Plan for Adverse Drug Event Prevention.* Washington, DC.



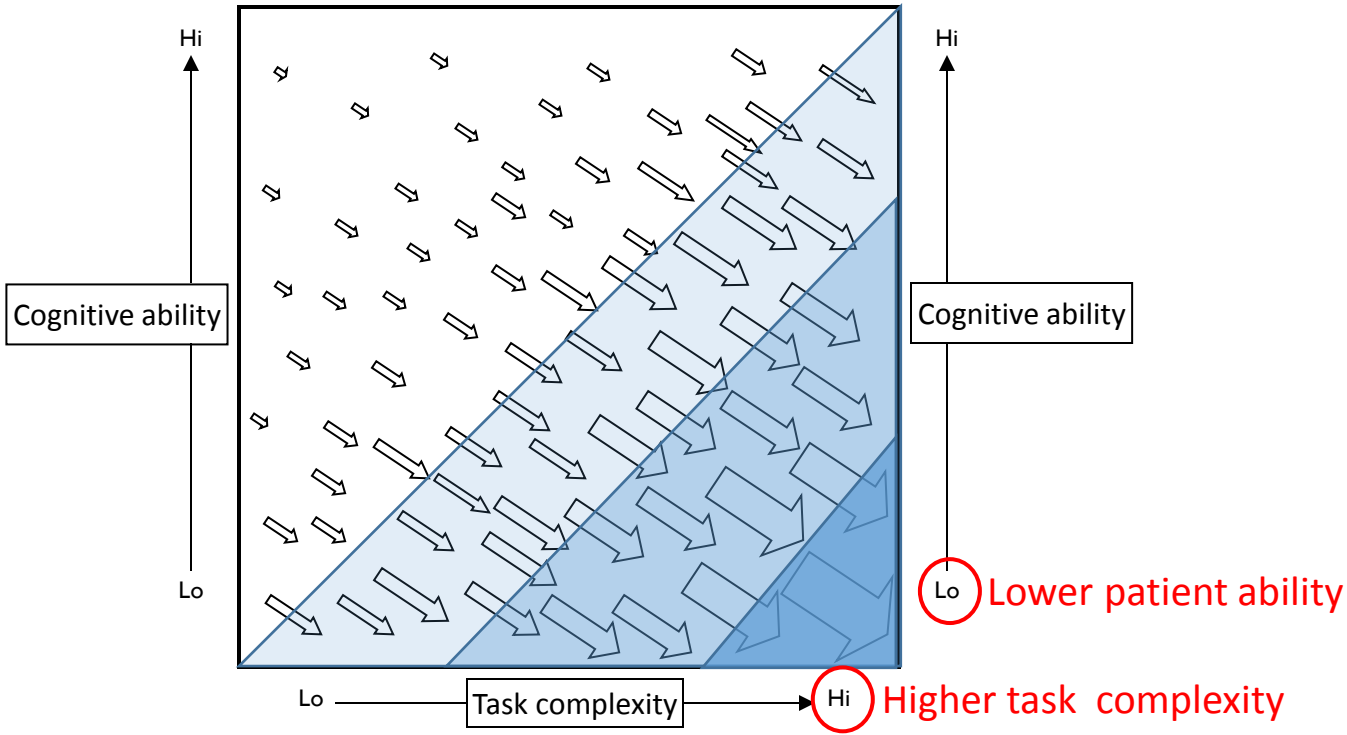
But recall that errors frequent when..

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

U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion. (2014). *National Action Plan for Adverse Drug Event Prevention.* Washington, DC.

Risk of patient error increases when:

(⟹ = error rate on specific tasks)



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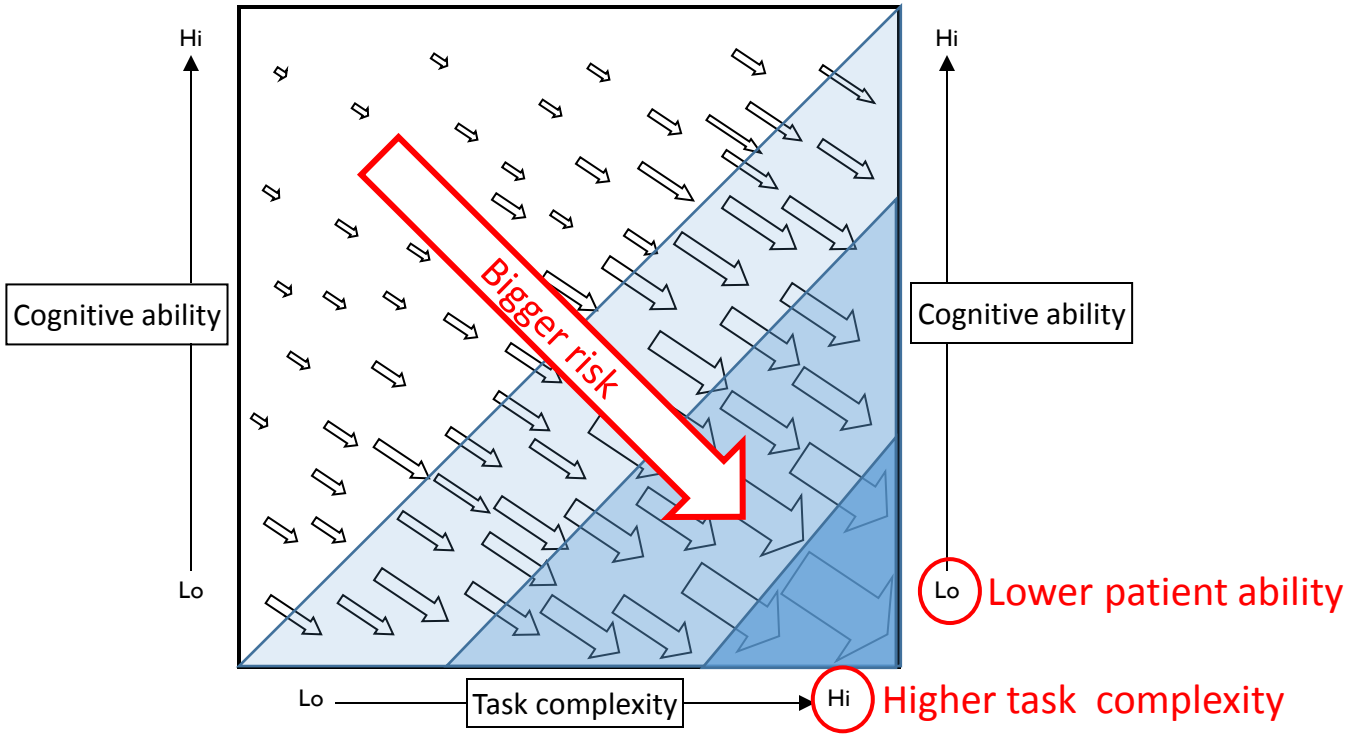
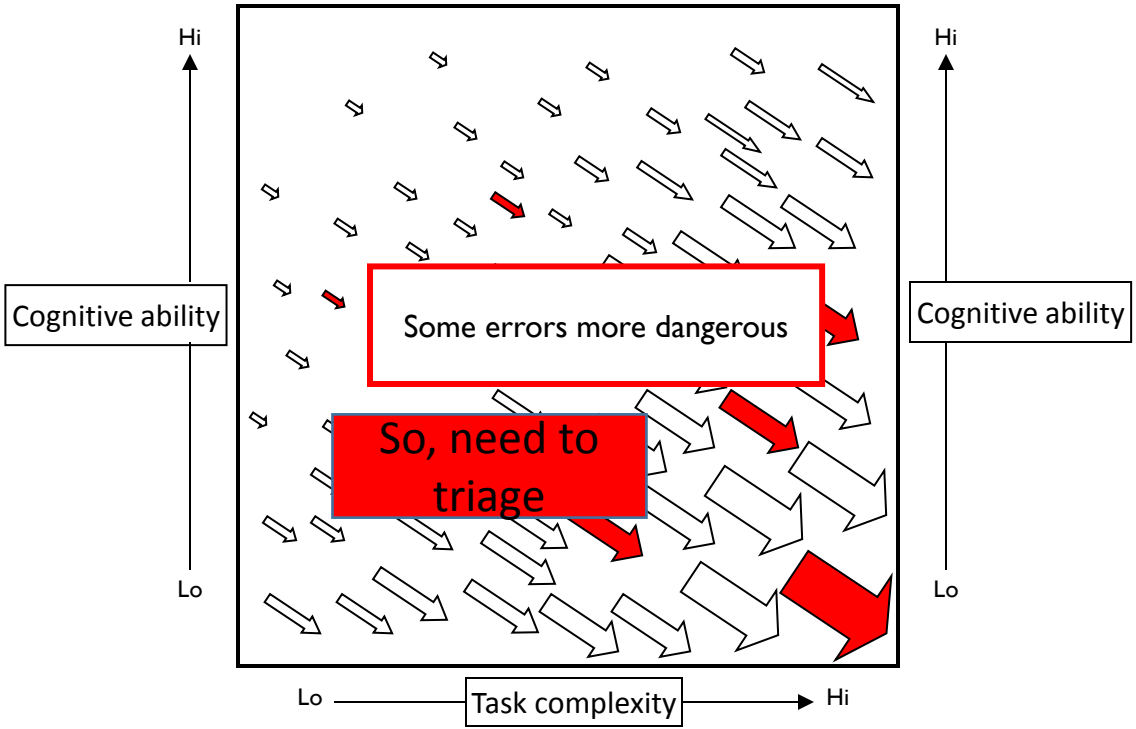


Critical errors



Common critical errors

Recall top 3 “precipitating factors”

	% of ED visits for IHE
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%

Geller KI, Shehab N, Lovegrove MC, Kegler SR, Weidenbach KN, Ryan GJ, & Budnitz DS. (2014). National estimates of insulin-related hypoglycemia and errors leading to emergency department visits and hospitalizations. *JAMA Intern Med*, *174*(5):678-686.

Common critical errors

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

What went wrong?

Insights from “near misses”

Geller KI, Shehab N, Lovegrove MC, Kegler SR, Weidenbach KN, Ryan GJ, & Budnitz DS. (2014). National estimates of insulin-related hypoglycemia and errors leading to emergency department visits and hospitalizations. *JAMA Intern Med*, *174*(5):678-686.

1. Meal-related misadventures

- Took insulin, but:
  - did not eat

Diabetes Disaster Averted #51: Careful Listening Saves Lives

I reviewed her recent episode with her again, stating "so you ate your dinner, and then you passed out..." at which point she interrupted with "no, I did not eat my dinner, I HAD it, it was right in front of me on the table, and then I passed out...." The conclusion was that she had a severe hypoglycemic reaction because she delayed her dinner.

  - did not eat enough carbs (only a salad)
  - did not count carbs

Basal/Bolus or is it Bolus/Basal or just Bolus/Bolus?

during her visit, I asked her to demonstrate how to calculate basal and bolus insulin, how to draw up her insulin. and how to inject using her own supplies. I was completely surprised when.. she based her dose upon her prevailing blood glucose without regard to her food.

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

Diabetes Disaster Averted #11: Label Literacy The patient had erroneously calculated a higher insulin dose based on weight grams not carb grams. Luckily, he experienced no hypoglycemia.

Diabetes Disaster Averted #60: Helping Patients Decipher Nutrition Labels

I asked him where he got the amount of carbohydrate in a particular food. It turns out he was using the weight of the food in grams listed at the top of the food label (e.g., 56 grams), rather than the amount listed next to Total Carbohydrates (24 g).

Source for case studies: Diabetes in Control. "Diabetes Disasters Averted." <http://www.diabetesincontrol.com/articles/practicum?series=Mastery-Series> Accessed May 22, 2015.

2. Unintentionally took wrong insulin

- Used up “leftover” insulin

Educating Elderly Patients

she had been using the short-acting analog that was prescribed. However, the previous week she had come across an unopened bottle of a Humulin mix which she did not want to waste so decided to use it in her pump.

All Insulins Not the Same

The patient's wife had not filled the new prescription for the regular insulin home. She had the Lantus insulin which he was on prior to his hospitalization, and she wanted to use that insulin before purchasing any more. She was using Lantus for the sliding scale dosage

- Mixed up bottles for bolus and basal insulins

What's Hiding in that Insulin Box?

The patient had been using the two insulins together for about two years… When she brought them in everything seemed okay until our intern noticed that the bottles were switched in the boxes…The patient told us that it was easier for her to hold onto the bottles for dosing if she left then in the box and did not notice that she had switched then when she had taken them out to pop off the safety tops.

- Used bolus <u>at times when</u> should use basal insulin

- Failed to stop old insulin when changed to new one

Changing Medications

At a recent support group meeting, a patient raised his hand and told me that he had been prescribed both Lantus and Levemir, and was taking them both at night.

patients had been switched from Lantus to Levemir due to issues with weight, and it was assumed he understood that he would no longer be taking Lantus. The

Source for case studies: Diabetes in Control. “Diabetes Disasters Averted.” <http://www.diabetesincontrol.com/articles/practicum?series=Mastery-Series> Accessed May 22, 2015.

3. Unintentionally took wrong dose

- Split or chewed time release pills

"Do Not Crush, Chew or Cut"

In one case an elderly patient was prescribed Glucotrol XL 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....

- Based dose on wrong factor

Patient's Method of Figuring Meal-time Insulin Doesn't Quite Work

. In reporting his dosing he stated that after he checked his glucose before each meal he took the "first two numbers of the result," and made that his dosage for meal-time insulin. For example, if the glucose reading was 240, he would take 24 units of Humalog.

was the only thing that made sense to me that I could remember."...

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.

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.

- Administered dose improperly

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!

Source for case studies: Diabetes in Control. "Diabetes Disasters Averted." <http://www.diabetesincontrol.com/articles/practicum?series=Mastery-Series> Accessed May 22, 2015.

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

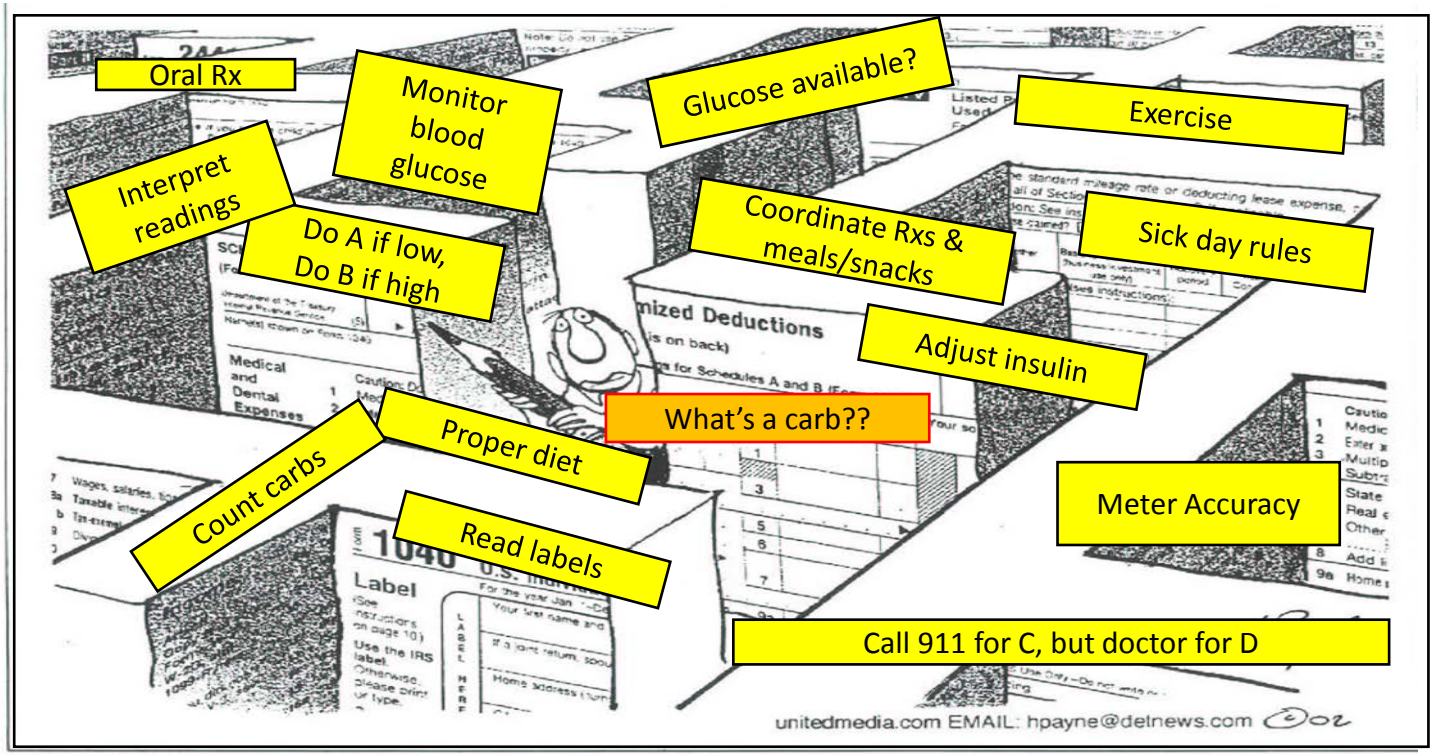
Elemental cognitive errors

6. DIFFERENTIATED INSTRUCTION:

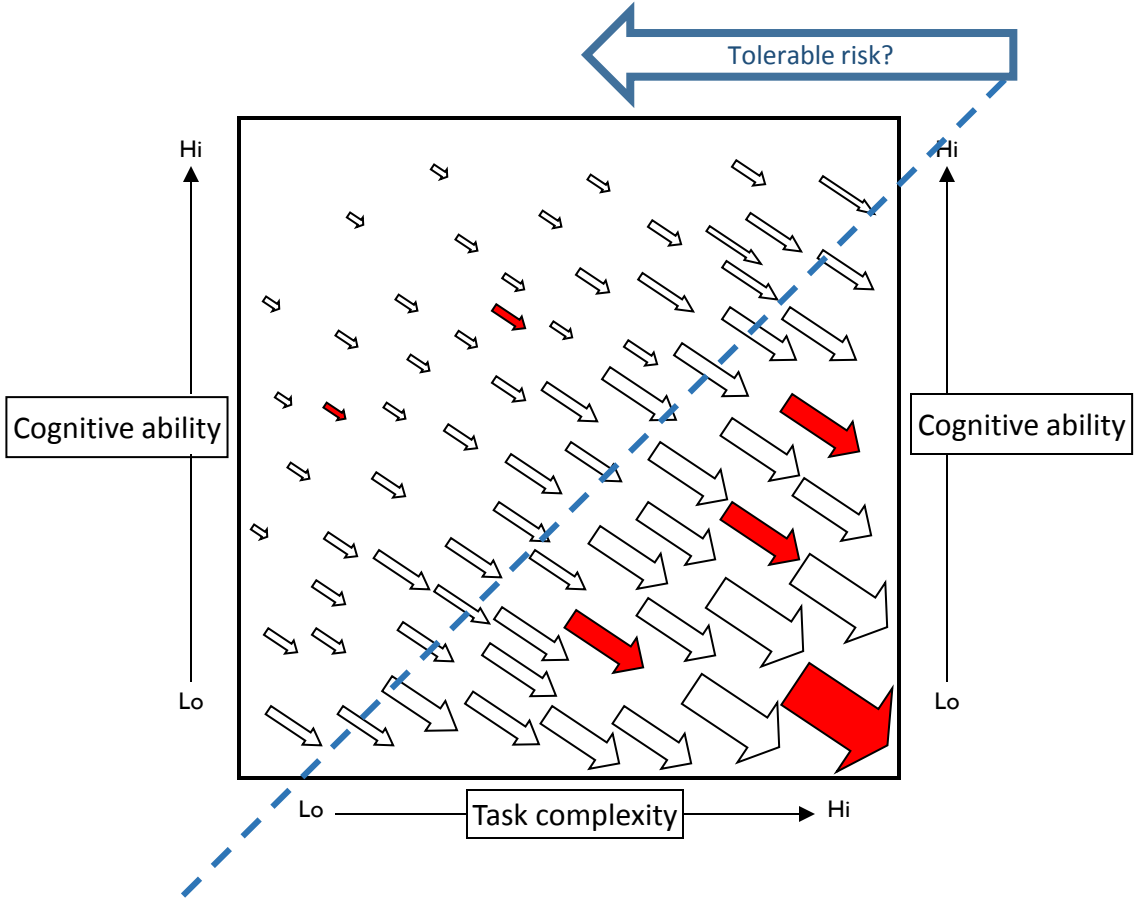
STRATEGY TO PREVENT HYPOGLYCEMIA

AADE15

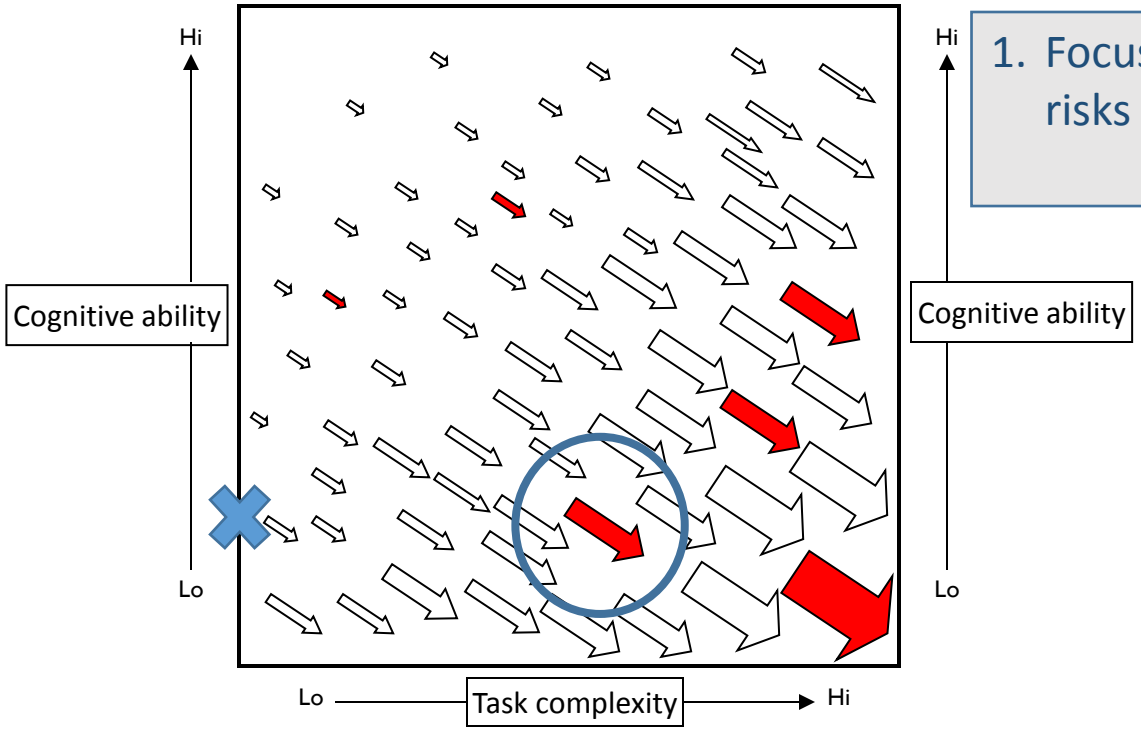
How can CDEs help patients navigate their maze?
By **personalizing** DSME to **prevent** hypoglycemia



Need personalized, *differentiated* DSME

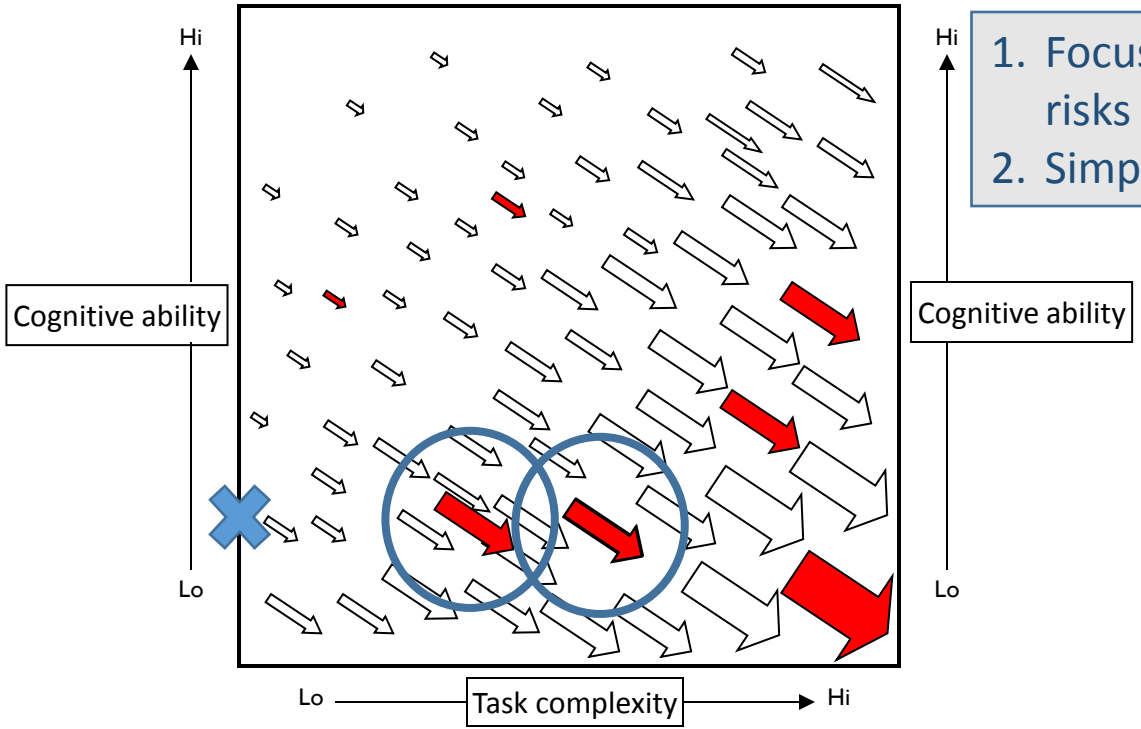


Strategy



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.

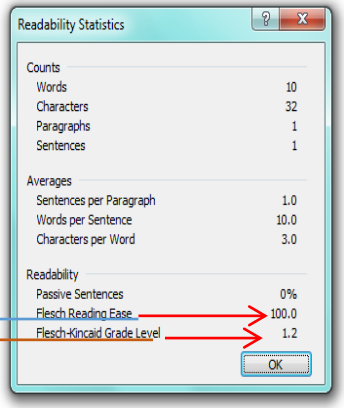
Ingredients of readability:

ASW: Average syllables per word

ASL: Average words per sentence

206.835- (84.6 * ASW) - (1.015 * ASL)

(0.39 * ASL) + (11.8 * ASW) - 15.59



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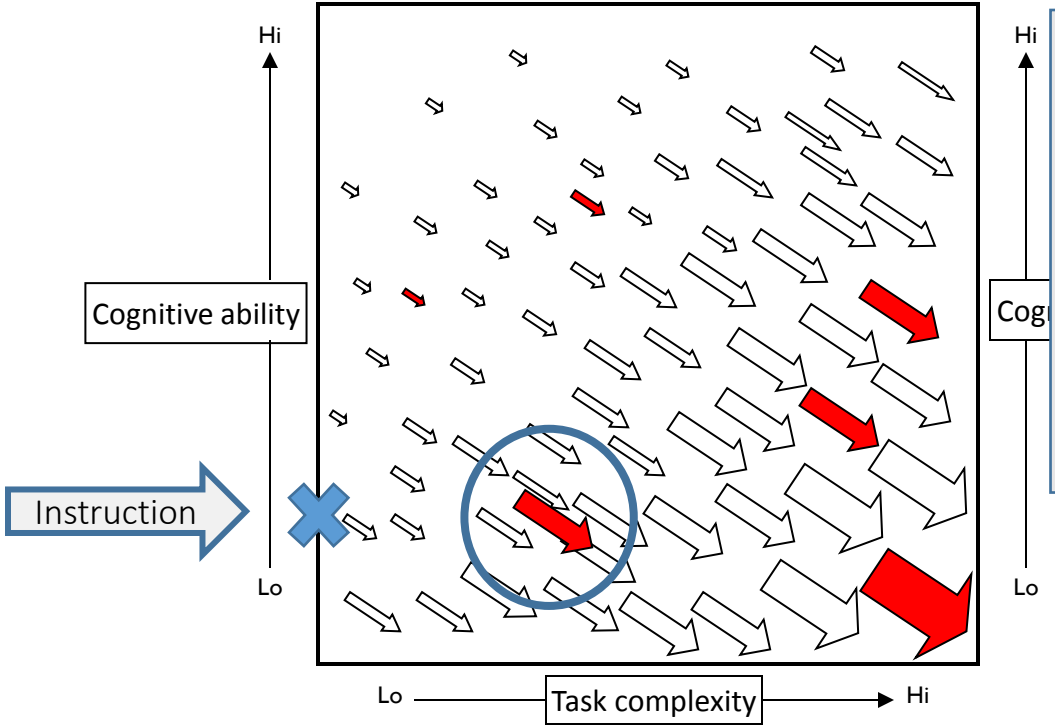
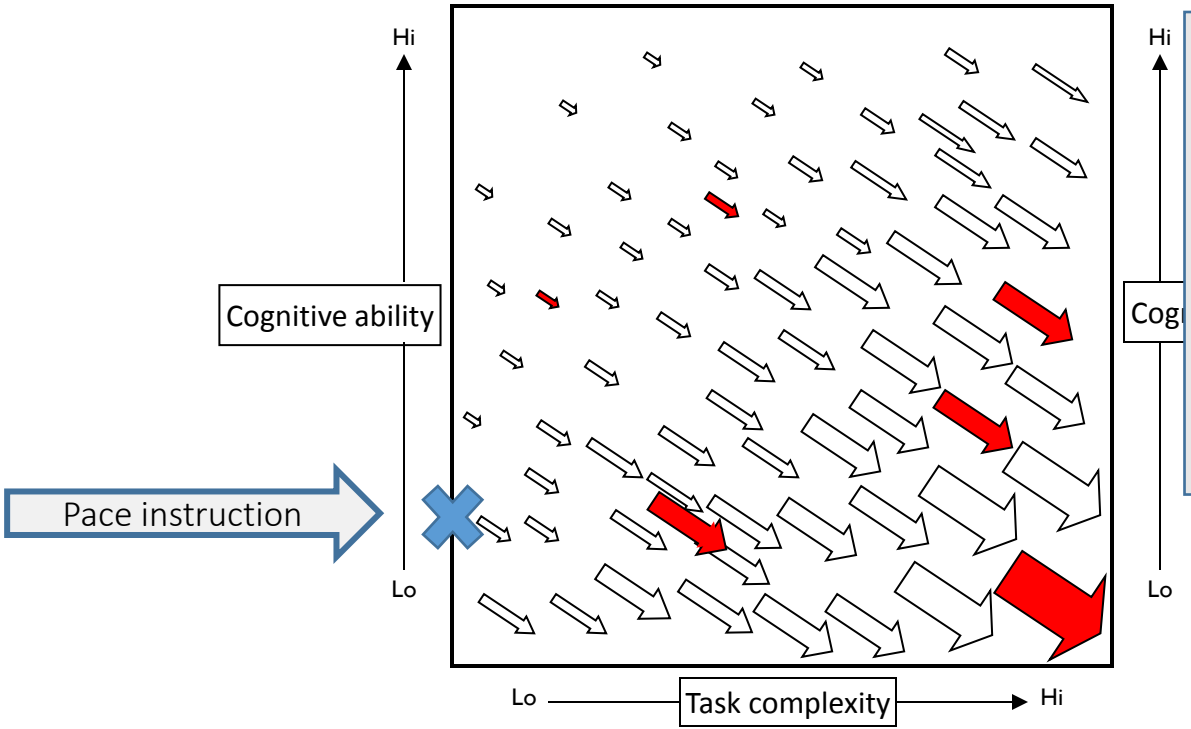


1. Focus on patient's biggest risks
2. Simplify task, if possible
3. Target instruction to ability level

Strategy



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

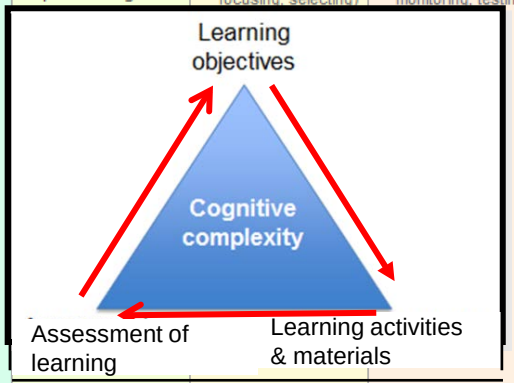
(2001 revision)

Bloom's levels = continuum of cognitive complexity

Table 1. The cognitive processes dimension — categories, cognitive processes (and alternative names)

lower order thinking skills → higher order thinking skills

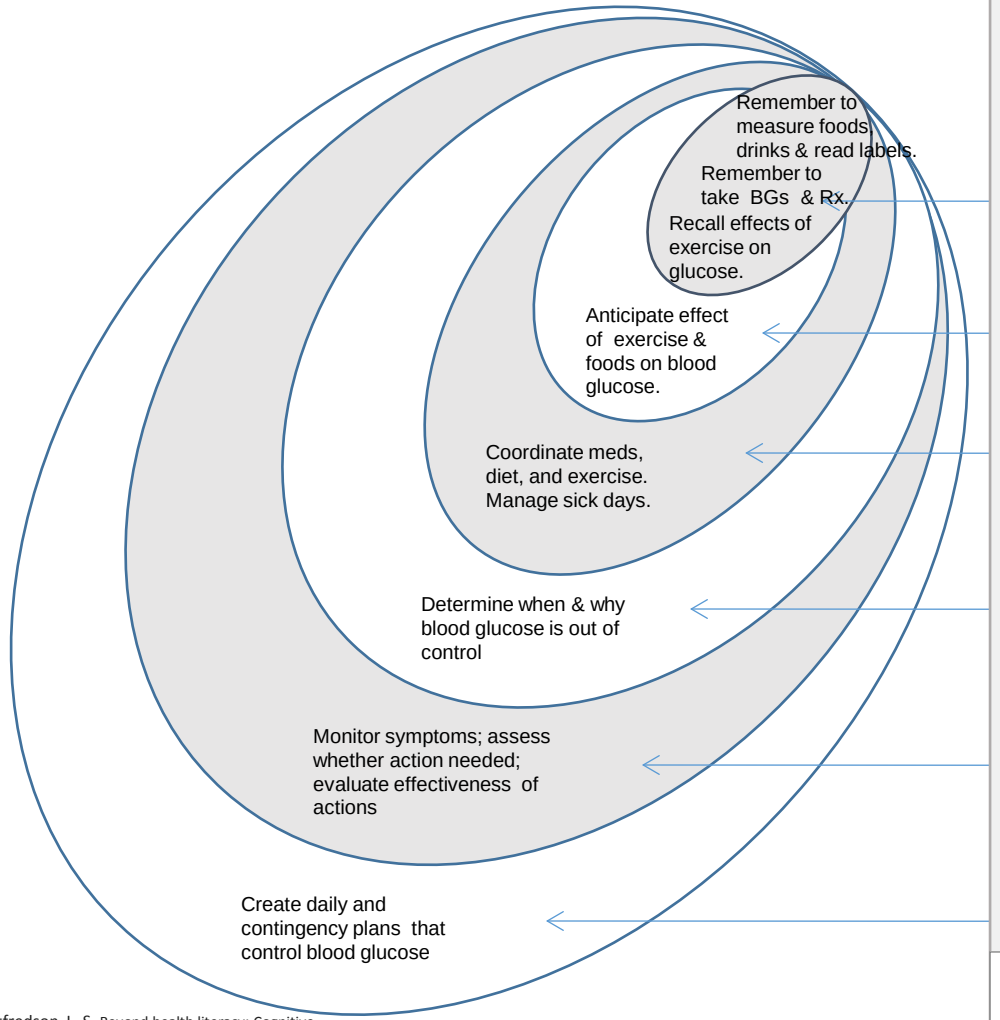
remember	understand	apply	analyze	evaluate	create
recognizing (identifying) recalling (retrieving)	interpreting (clarifying, paraphrasing, representing, translating) exemplifying (illustrating, instantiating) classifying (categorizing, subsuming) summarizing (abstracting, generalizing) inferring (concluding, extrapolating, interpolating, predicting) comparing (contrasting, mapping, matching) explaining (constructing models)	executing (carrying out) implementing	differentiating (discriminating, distinguishing, focusing, selecting)	checking (coordinating, detecting, monitoring, testing)	generating (hypothesizing) planning (designing) producing (construct)



(Table 1 adapted from Anderson and Krathwohl, 2001, pp. 67–68.)

Anderson LW & Krathwohl DR. (2001). *A taxonomy for learning, teaching, and assessing: A revision of Bloom's Taxonomy of Educational Objectives*. NY: Addison Wesley Longman.

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

Most complex tasks

*Revised 2001: Anderson, L. W., & Krathwohl,D. R. *A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives.* NY: Addison

Good instruction minimizes *unnecessary* cognitive load on student

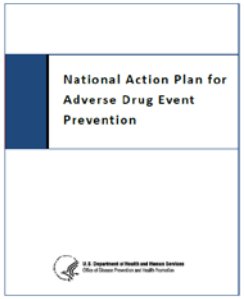
- Teach essential DSM tasks first, one at a time
- Sequence instruction from simple to complex ideas & skills
- Adjust speed and abstractness of instruction to accommodate individual's learning needs
- **Never** assume that something is "simple" or obvious
- Confirm mastery before moving on
- Don't squander individual's cognitive resources by teaching non-essential skills and content, using too-complex materials, etc.

7. OTHER STRATEGIES TO PREVENT HYPOGLYCEMIA

AADE15

Other strategies include:

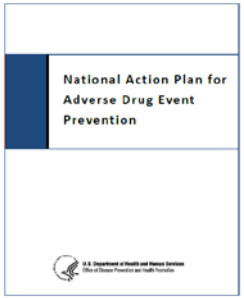
- Technology: CGMS, Apps
- National Call to Action to Prevent ADEs
- Individualizing BG goals
- ADA/ES Strategies cited in “Hypoglycemia and Diabetes: A Report of a Workgroup”



Opportunities for prevention in outpatient settings

	Examples
Safety	Patient adjusts meds to changes in oral intake
	Patient coordinates meals and BG testing
	Provider doesn't prescribe sliding scale insulin when risk of hypoglycemia is high
Engagement & communication	Use teach-back when educating patient
	Establish patient's goals
	Understand daily barriers to adherence

U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion. (2014). National Action Plan for Adverse Drug Event Prevention. Washington, DC:



Opportunities for prevention in outpatient settings—cont.

More examples	
Education	Importance of consistent eating patterns
	Guidance on sick day management
	How to treat low blood sugar
	Accuracy of self-monitoring equipment
	Check expiration dates of meds
	Test blood glucose at home

U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion. (2014). National Action Plan for Adverse Drug Event Prevention. Washington, DC:

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)

Adapted from : U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion. (2014). National Action Plan for Adverse Drug Event Prevention. Washington, DC:

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,[d] 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,[j] Richard E. Pratley, MD,[k] and Carrie S. Swift, MS, RD, BC-ADM, CDE[l]

More than 25% of the U.S. population aged ≥ 65 years has diabetes mellitus (hereafter referred to as diabetes),[1] 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

American Diabetes Association and the American Geriatrics Society, 2012.

Table 1. A Framework for Considering Treatment Goals for Glycemia, Blood Pressure, and Dyslipidemia in Older Adults with Diabetes

Patient Characteristics/ Health Status	Rationale	Reasonable A1C Goal (A Lower Goal May Be Set for an Individual if Achievable without Recurrent or Severe Hypoglycemia or Undue Treatment Burden)	Fasting or Preprandial Glucose (mg/dL)	Bedtime Glucose (mg/dL)	Blood Pressure (mmHg)	Lipids
Healthy (Few coexisting chronic illnesses, intact cognitive and functional status)	Longer remaining life expectancy	<7.5%	90–130	90–150	<140/80	Statin unless contraindicated or not tolerated
Complex/intermediate (Multiple coexisting chronic illnesses[a] or 2+ instrumental ADL impairments or mild to moderate cognitive impairment)	Intermediate remaining life expectancy, high treatment burden, hypoglycemia vulnerability, fall risk	<8.0%	90–150	100–180	<140/80	Statin unless contraindicated or not tolerated
Very complex/poor health (Long-term care or end-stage chronic illnesses[b] or moderate to severe cognitive impairment or 2+ ADL dependencies)	Limited remaining life expectancy makes benefit uncertain	<8.5%[c]	100–180	110–200	<150/90	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.

American Diabetes Association and the American Geriatrics Society, 2012.

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

Elizabeth R. Seaquist, MD[1]
John Anderson, MD[2]
Belinda Childs, ARNP, MN, BC-ADM, CDE[3]
Philip Cryer, MD[4]
Samuel Dagogo-Jack, MD, MBBS, MSC[5]
Lisa Fish, MD[6]
Simon R. Heller, MD[7]
Henry Rodriguez, MD[8]
James Rosenzweig, MD[9]
Robert Vigersky, MD[10]

OBJECTIVE—To review the evidence about the impact of hypoglycemia on patients with diabetes that has become available since the past reviews 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—Five members of the American Diabetes Association and five members of The Endocrine Society with expertise in different aspects of hypoglycemia were invited by the Chair, who is a member of both, to participate in a planning conference call and a 2-day meeting that was also attended by staff from both organizations. Subsequent communications took place via e-mail and phone calls. The writing group consisted of those invitees who participated in the writing of the manuscript. The workgroup meeting was supported by educational grants to the American Diabetes Association from Lilly USA, LLC and Novo Nordisk and sponsorship to the American Diabetes Association from Sanofi. The sponsors had no input into the development of or content of the report.

EVIDENCE—The writing group considered data from recent clinical trials and other studies to update the prior workgroup report. Unpublished data were not used. Expert opinion was used to develop some conclusions.

CONSENSUS PROCESS—Consensus was achieved by group discussion during conference calls and face-to-face meetings, as well as by iterative revisions of the written document. The document was reviewed and approved by the American Diabetes Association's Professional Practice Committee in October 2012 and approved by the Executive Committee of the Board of Directors in November 2012 and was reviewed and approved by The Endocrine Society's Clinical Affairs Core Committee in October 2012 and by Council in November 2012.

CONCLUSIONS—The workgroup reconfirmed the previous definitions of hypoglycemia in diabetes, reviewed the implications of hypoglycemia on both short- and long-term outcomes, considered the implications of hypoglycemia on treatment outcomes, presented strategies to prevent hypoglycemia, and identified knowledge gaps that should be addressed by future research. In addition, tools for patients to report hypoglycemia at each visit and for clinicians to document counseling are provided.

Diabetes Care 36:1384–1395, 2013

In 2005, the American Diabetes Association Workgroup on Hypoglycemia released a report entitled "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. In 2009, The Endocrine Society released a clinical practice guideline entitled "Evaluation and Management of Adult Hypoglycemic 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 2012 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 people 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

Seaquist ER, et al. (2013). Hypoglycemia and diabetes: A report of a Workgroup of the American Diabetes Association and The Endocrine Society. *Diabetes Care, 36*:1 384-1 395.

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?"

Seaquist E, Anderson J, Childs B, et al. Hypoglycemia and Diabetes: A Report of a Workgroup of the American Diabetes Association and the Endocrine Society. *Diabetes Care May*. 2013;36(5)1384-1395. doi: 10.2337/dc12-2480

Table 2—*Hypoglycemia Patient Questionnaire*

Name _____
First Middle Last
Today's date _____

1. To what extent can you tell by your symptoms that your blood glucose is LOW?
____ Never ____ Rarely ____ Sometimes ____ Often ____ Always

2. In a typical week, how many times will your blood glucose go below 70 mg/dL?
_____ a week

3. When your blood glucose goes below 70 mg/dL, what is the usual reason for this?
_____

4. How many times have you had a severe hypoglycemic episode (where you needed someone's help and were unable to treat yourself)?
Since the last visit ____ times
In the last year ____ times

5. How many times have you had a moderate hypoglycemic episode (where you could not think clearly, properly control your body, had to stop what you were doing, but you were still able to treat yourself)?
Since the last visit ____ times
In the last year _____ times

6. How often do you carry a snack or glucose tablets (or gel) with you to treat low blood glucose? Check one of the following:
Never ___ Rarely ___ Sometimes___ Often___ Almost always___

7. How LOW does your blood glucose need to go before you think you should treat it?
Less than ____mg/dL

8. What and how much food or drink do you usually treat low blood glucose with?
_____

9. Do you check your blood glucose before driving? Check one of the following:
Yes, always___ Yes, sometimes ___ No___

10. How LOW does your blood glucose need to go before you think you should not drive?
____mg/dL

11. How many times have you had your blood glucose below 70 mg/dL while driving?
Since the last visit ____ times
In the last year _____ times

12. If you take insulin, do you have a glucagon emergency kit?
Yes___/ No ___

13. Does a spouse, relative, or other person close to you know how to administer glucagon?
Yes___/ No ___

Seaquist ER, et al. (2013). Hypoglycemia and diabetes: A report of a Workgroup of the American Diabetes Association and The Endocrine Society. *Diabetes Care, 36*:1 384-1 395.


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

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).

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 di-

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

Seaquist ER, et al. (2013). Hypoglycemia and diabetes: A report of a Workgroup of the American Diabetes Association and The Endocrine Society. *Diabetes Care, 36*:1 384-1 395.

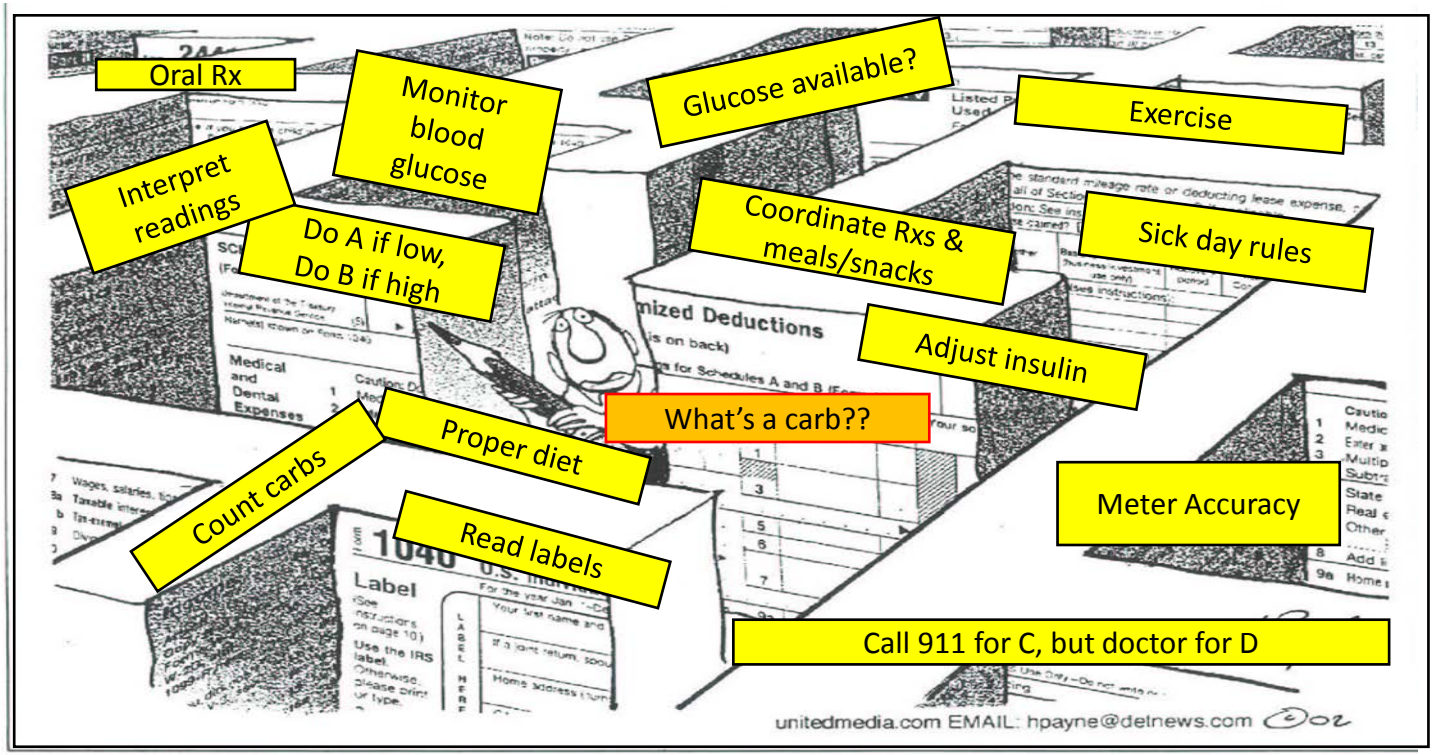
Differentiated Instruction

~~Or~~

And

Existing Strategies

How can CDEs help patients navigate their maze?
By **personalizing** DSME to **prevent** hypoglycemia



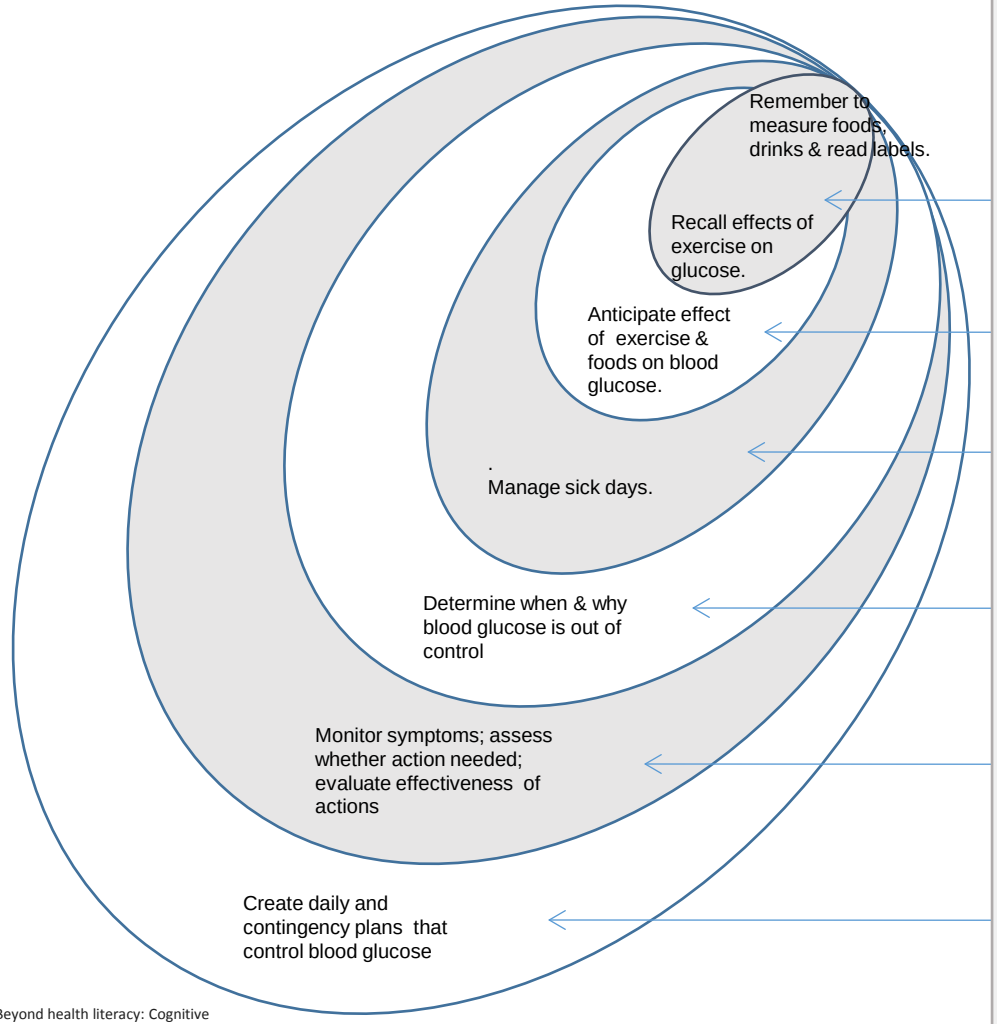
DSME to prevent critical patient errors

- 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



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

Most complex tasks

Thank you

Kathy.stroh@westsidehealth.org

gottfred@udel.edu

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