The Cognitive and Functional Burdens of Diabetes for Older Adults

Kathy Stroh, MS, RD, LDN, CDE

Linda Gottfredson, PhD

PA AADE Annual Meeting
Harrisburg, PA
April 22, 2016

Kathy Stroh

MS, RD, LDN, CDE

Westside Family Healthcare
Wilmington, DE

- 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” (December 13, 2013)
- NDEP Practice Transformation Task Group

Linda Gottfredson

PHD

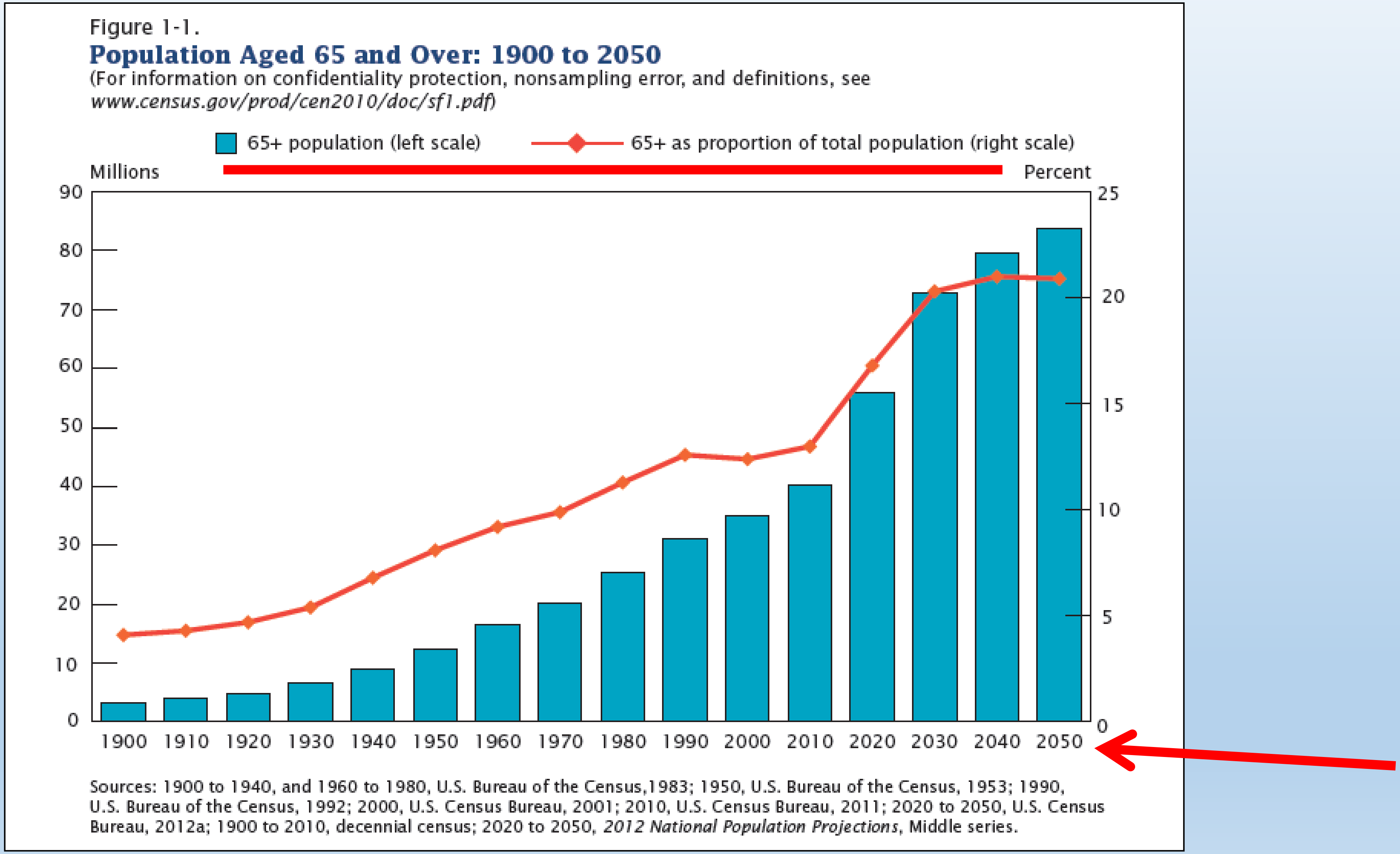
Professor Emeritus
University of Delaware
School of Education

Co-Author of AADE Practice Advisory "Special Considerations in the Management and Education of Older Persons with Diabetes" (December 13, 2013)

Cognitive and Functional Burdens of Diabetes for Older Adults

I. Trends and prevalence of diabetes, by age
II. Age-related cognitive and functional decline
III. Declines that increase the burdens of DSM
IV. DSM errors made by older adults
V. DSME/S that can lighten those burdens

The U.S. population is getting older…..



……..and older

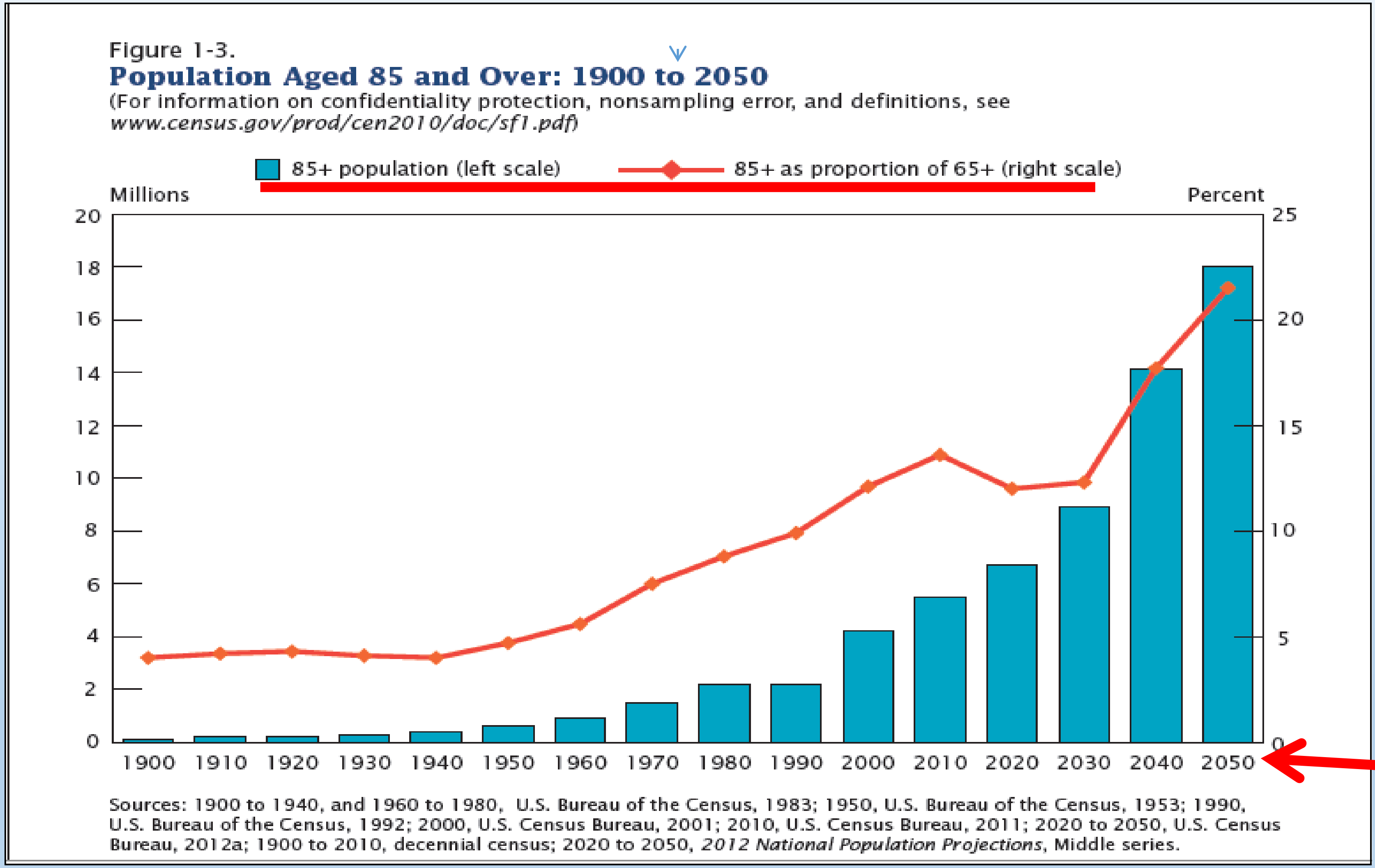


Figure 1-3.
Population Aged 85 and Over: 1900 to 2050
(For information on confidentiality protection, nonsampling error, and definitions, see
www.census.gov/prod/cen2010/doc/sf1.pdf)
85+ population (left scale)
85+ as proportion of 65+ (right scale)
Millions
Percent
20
18
16
14
12
10
8
6
4
2
0
25
20
15
10
5
0
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
2020
2030
2040
2050
Sources: 1900 to 1940, and 1960 to 1980, U.S. Bureau of the Census, 1983; 1950, U.S. Bureau of the Census, 1953; 1990, U.S. Bureau of the Census, 1992; 2000, U.S. Census Bureau, 2001; 2010, U.S. Census Bureau, 2011; 2020 to 2050, U.S. Census Bureau, 2012a; 1900 to 2010, decennial census; 2020 to 2050, 2012 National Population Projections, Middle series.

Increase in population aged 65 and over, by decade

Table 1-1.

Population Aged 65 and Over by Age: 1900 to 2050

(Numbers in thousands. For information on confidentiality protection, nonsampling error, and definitions, see *www.census.gov/prod/cen2010/doc/sf1.pdf*)

Source, year, and reference date	Total population	65 and over		65 to 74		75 to 84		85 and over	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
Census									
1900 (June 1)	75,995	3,080	4.1	2,187	2.9	771	1.0	122	0.2
1910 (April 15)	91,972	3,950	4.3	2,793	3.0	989	1.1	167	0.2
1920 (January 1)	105,711	4,933	4.7	3,464	3.3	1,259	1.2	210	0.2
1930 (April 1)	122,775	6,634	5.4	4,721	3.8	1,641	1.3	272	0.2
1940 (April 1)	131,669	9,019	6.8	6,376	4.8	2,278	1.7	365	0.3
1950 (April 1)	150,697	12,270	8.1	8,415	5.6	3,278	2.2	577	0.4
1960 (April 1)	179,323	16,560	9.2	10,997	6.1	4,633	2.6	929	0.5
1970 (April 1)	203,212	20,066	9.9	12,435	6.1	6,119	3.0	1,511	0.7
1980 (April 1)	226,546	25,549	11.3	15,581	6.9	7,729	3.4	2,240	1.0
1990 (April 1)	248,710	31,242	12.6	18,107	7.3	10,055	4.0	3,080	1.2
2000 (April 1)	281,422	34,992	12.4	18,391	6.5	12,361	4.4	4,240	1.5
2010 (April 1)	308,746	40,268	13.0	21,713	7.0	13,061	4.2	5,493	1.8
Projection									
2020 (July 1)	333,896	55,969	16.8	32,796	9.8	16,480	4.9	6,693	2.0
2030 (July 1)	358,471	72,774	20.3	38,593	10.8	25,236	7.0	8,946	2.5
2040 (July 1)	380,016	79,719	21.0	35,465	9.3	30,140	7.9	14,115	3.7
2050 (July 1)	399,803	83,739	20.9	37,554	9.4	28,206	7.1	17,978	4.5

Note: Data for 1900 to 1950 exclude Alaska and Hawaii.

Sources: 1900 to 1940, and 1960 to 1980, U.S. Bureau of the Census, 1983; 1950, U.S. Bureau of the Census, 1953; 1990, U.S. Bureau of the Census, 1992; 2000, U.S. Census Bureau, 2001; 2010, U.S. Census Bureau, 2011; 2020 to 2050, U.S. Census Bureau, 2012b; 1900 to 2010, decennial census; 2020 to 2050, *2012 National Population Projections*, Middle series.

Older adults are more likely to have diabetes

2 out of 5 adults with diabetes are =>65 years of age

Diagnosed and undiagnosed diabetes among people aged 20 years or older, United States, 2012

	Number with diabetes (millions)	Percentage with diabetes (unadjusted)
Total		
20 years or older	28.9	12.3
By age		
20–44	4.3	4.1
45–64	13.4	16.2
65 years or older	11.2	25.9
By sex		
Men	15.5	13.6
Women	13.4	11.2

Source: 2009–2012 National Health and Nutrition Examination Survey estimates applied to 2012 U.S. Census data.

1 out of 4 people over the age of 65 has diabetes.[1]

Newly diagnosed cases of DM in persons =>65 years of age

New Cases of Diagnosed Diabetes

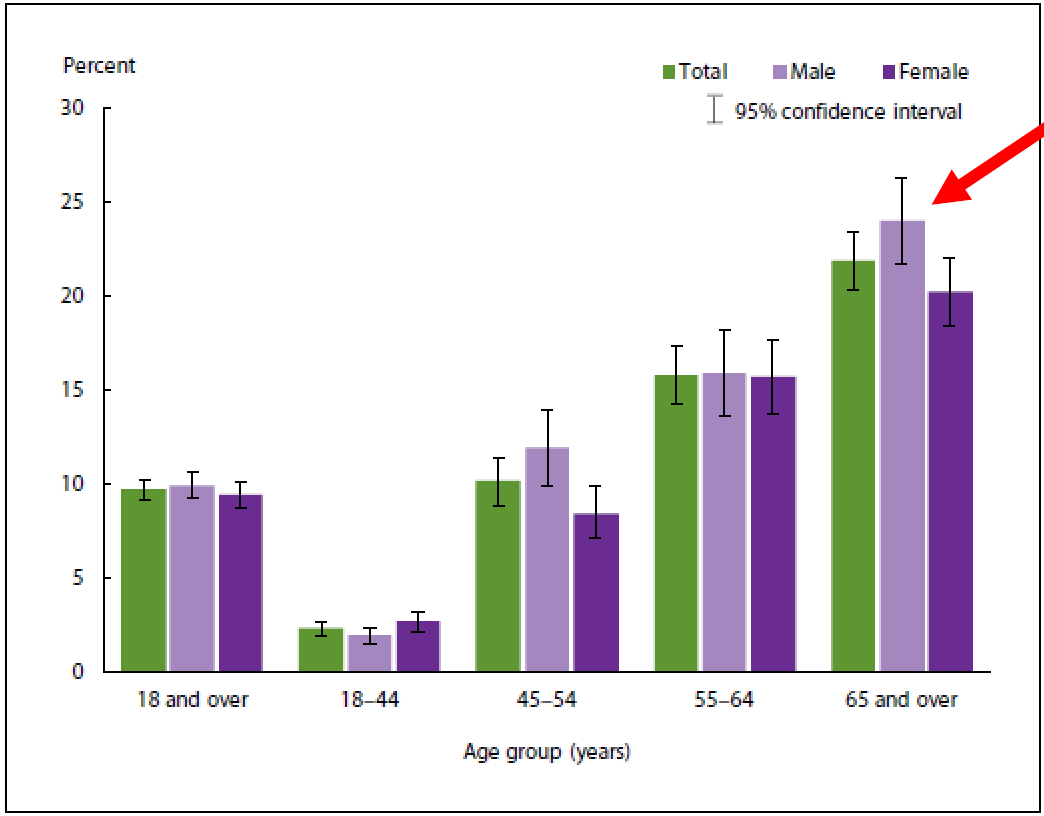
New cases of diagnosed diabetes among people aged 20 years or older, United States, 2012

	Number of new diabetes cases	Rate of new diabetes cases per 1,000 (unadjusted)
Total		
20 years or older	1.7 million	7.8
By age		
20–44	371,000	3.6
45–64	892,000	12.0
65 years or older	400,000	11.5

Source: 2010–2012 National Health Interview Survey, 2009–2012 National Health and Nutrition Examination Survey, and 2012 U.S. Census data.

¼ of newly diagnosed

Figure 14.2. Prevalence of diagnosed diabetes among adults aged 18 and over, by age group and sex: United States, January–September 2015



NOTES: Data are based on household interviews of a sample of the civilian noninstitutionalized population. Prevalence of diagnosed diabetes is based on self-report of ever having been diagnosed with diabetes by a doctor or other health professional. Persons reporting "borderline" diabetes status and women reporting diabetes only during pregnancy were not coded as having diabetes in the analyses. The analyses exclude the 0.1% of persons with unknown diabetes status. See Technical Notes for more details.

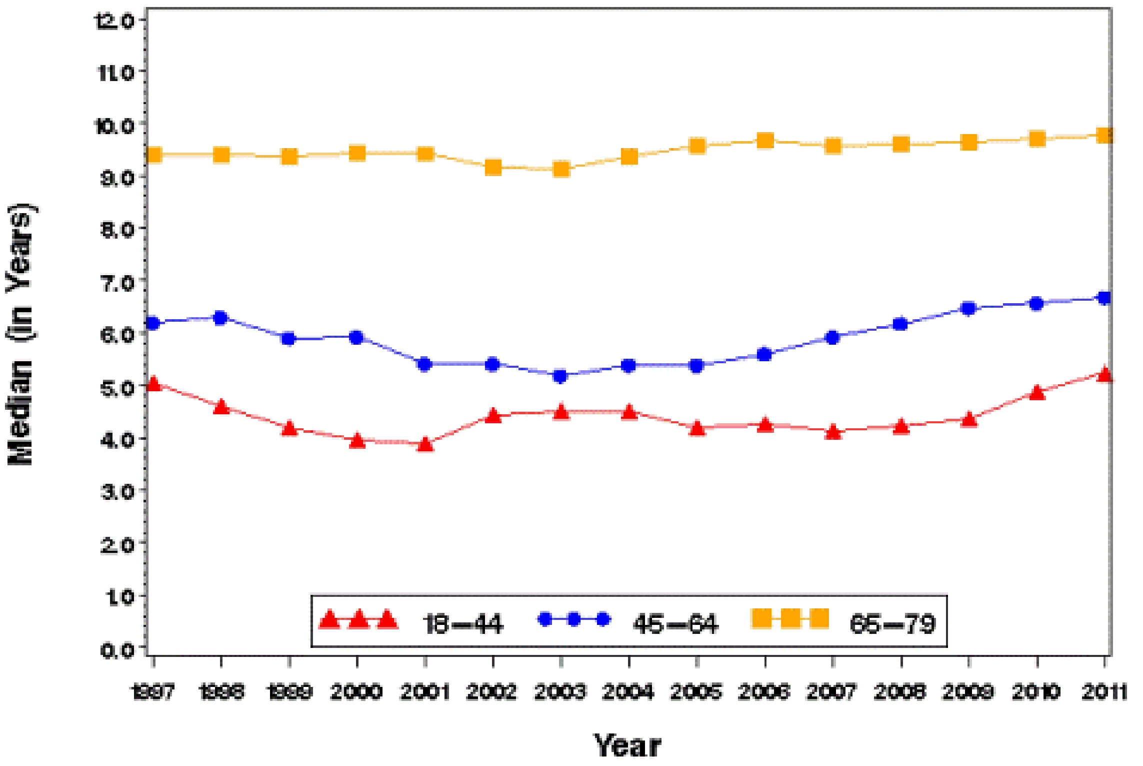
DATA SOURCE: CDC/NCHS, National Health Interview Survey, January–September 2015, Sample Adult Core component.

- For both sexes combined, the prevalence of diagnosed diabetes increased with age. Adults aged 65 and over (21.9%) were more than 9 times as likely as those aged 18–44 (2.3%) to have been diagnosed with diabetes. Men aged 65 and over (24.0%) were more than 10 times as likely as men aged 18–44 (2.0%) to have been diagnosed with diabetes, while women aged 65 and over (20.2%) were more than 7 times as likely as women aged 18–44 (2.7%) to have been diagnosed with diabetes.
- For adults aged 45–54 and 65 and over, women were less likely than men to have been diagnosed with diabetes.

National Health Interview Survey, January-September 2015

Median Duration of Diabetes Among Adults Aged 18-79 Years, by Age, United States, 1997-2011

From 1997 to 2011, the median diabetes duration for adults aged 18–79 years was longest among adults aged 65–79 years and shortest among adults aged 18–44 years. During this period, the median duration showed no change until 2000 and then increased among adults aged 18–44 years, and declined until 2004 and then increased among adults aged 45–64 years. No changes in median duration were observed in age group 65–79. In 2011, the median duration of diabetes was 5.2 years among adults aged 18–44 years, 6.7 years among those aged 45–64 years, and 9.8 years among those aged 65–79 years.



Data Source: Centers for Disease Control and Prevention (CDC), National Center for Health Statistics, Division of Health Interview Statistics, data from the National Health Interview Survey. Data computed by personnel in the Division of Diabetes Translation, National Center for Chronic Disease Prevention and Health Promotion, CDC

Forecast for 2025:
50% increase in diabetes prevalence and costs among seniors

Pre-Diabetes and Diabetes Trends[1] among Seniors in the United States

U.S. Seniors Diabetes Data and Forecasts	2010	2025
Population	40,229,000	63,907,000
Pre-diabetes	20,115,000	31,954,000
Diagnosed diabetes	7,901,000	12,551,300
Undiagnosed diabetes	2,920,600	4,639,700
Total with diabetes (diagnosed and undiagnosed)	10,821,600	17,191,000
Total with pre-diabetes or undiagnosed diabetes	23,035,600	36,593,700
Complications:		
Visual impairment	1,607,800	2,435,000
Renal failure	20,250	26,700
Leg amputations	27,180	31,400
Annual deaths attributable to diabetes	109,520	135,900
Total annual cost (2010 dollars)	$105.7 B	$168.0 B
Annual medical costs	$74.3 B	$118.1 B
Annual nonmedical costs	$31.4 B	$49.9 B

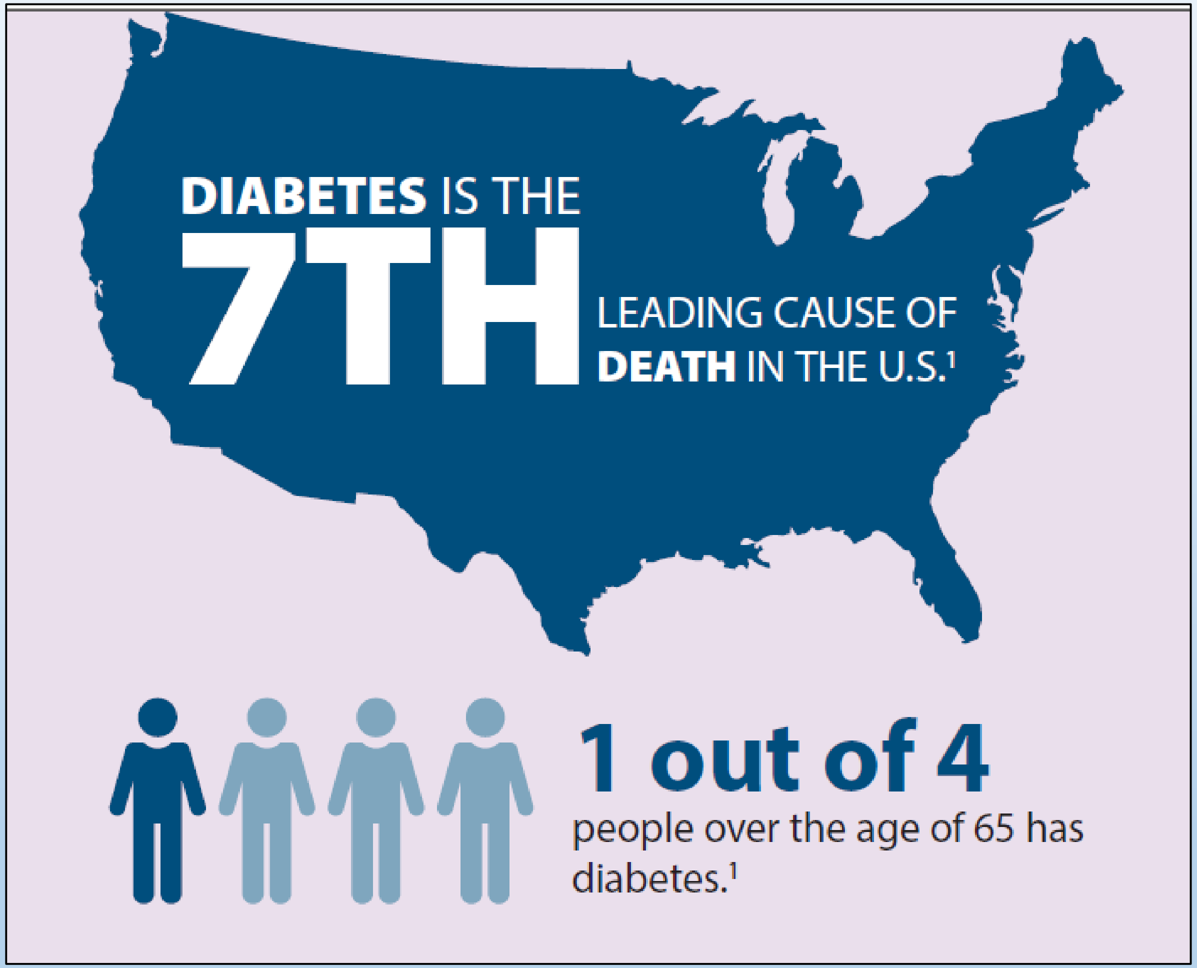
www.altfutures.org

2014 data

HOW
DIABETES
AFFECTS OLDER ADULTS

1. Centers for Disease Control and Prevention: National diabetes statistics report: estimates of diabetes and its burden in the United States A, GA: U.S. Department of Health and Human Services; 2014.

http://www.niddk.nih.gov/health-information/health-communication-programs/ndep/living-with-diabetes/older-adults/diabetes-older-adults-infographic/Documents/Diabetes-in-Older-Adults_Infographic_508.pdf



1. Centers for Disease Control and Prevention: National diabetes statistics report: estimates of diabetes and its burden in the United States A, GA: U.S. Department of Health and Human Services; 2014.

2 out of 4

people over the age of 65 has prediabetes.[1]

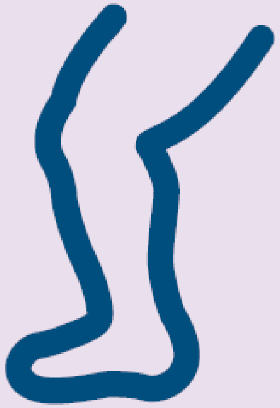
1. Centers for Disease Control and Prevention: National diabetes statistics report: estimates of diabetes and its burden in the United States A, GA: U.S. Department of Health and Human Services; 2014.

Burdens of diabetes for older adults

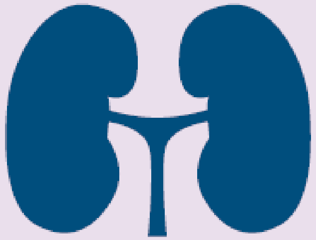
I. Trends and prevalence of diabetes, by age
II. Age-related cognitive and functional decline
III. Declines that increase the burdens of DSM
IV. DSM errors made by older adults
V. DSME/S that can lighten those burdens

Complications from diabetes:

Adults with diabetes are nearly 2 times more likely to die from **heart disease or stroke** than adults without diabetes.[1]



Diabetes is the leading cause of non-traumatic **lower limb amputations** in the United States.[1]



1 in 5 people with diabetes has **kidney disease** and it's most common in older adults over 70.[3]

1. Centers for Disease Control and Prevention: National diabetes statistics report: estimates of diabetes and its burden in the United States A, GA: U.S. Department of Health and Human Services; 2014.
3. Centers for Disease Control and Prevention (CDC). National Chronic Kidney Disease Fact Sheet: General Information and National Estimates on Chronic Kidney Disease in the United States, 2014. Atlanta, GA: US Department of Health and Human Services, Centers for Disease Control and Prevention; 2014.

Older adults with diabetes:

Are **2 times** more likely to develop dementia than older adults without diabetes[2]

1 in 5 has vision problems[2]

2. Kirkman MS, Briscoe VJ, Clark N, et al. Diabetes in older adults. Diabetes Care. 2012;35(12):2650-64.

People with diabetes over 75 years are 2 times more likely to visit the emergency room for low blood sugar than the general population with diabetes.[2]

2. Kirkman MS, Briscoe VJ, Clark N, et al. Diabetes in older adults. Diabetes Care. 2012;35(12):2650-64.

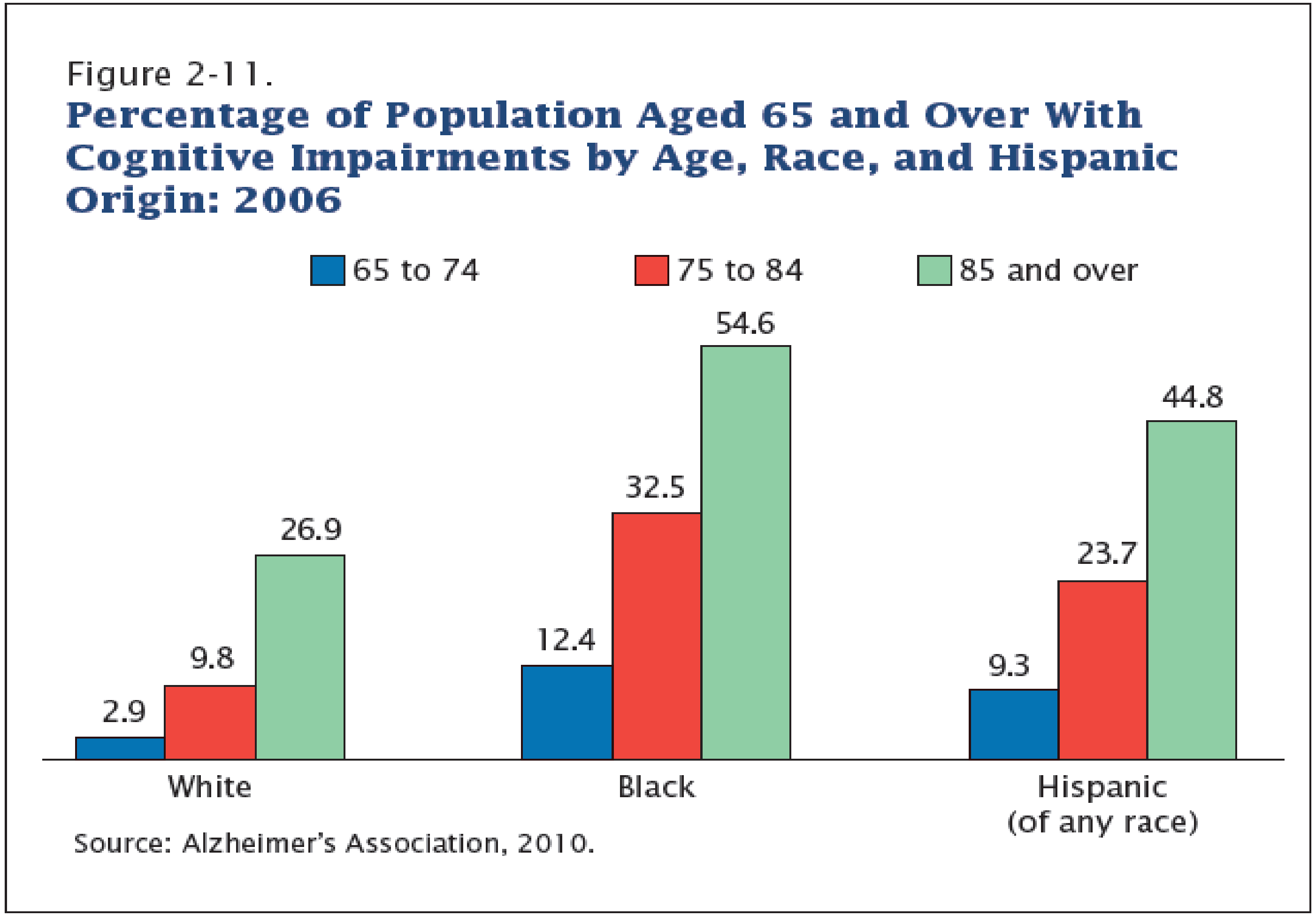
Hospital Admissions for Medicare PWDs age 65 and older

- Data on almost 34 million individuals who received Medicare benefits between 1999 and 2011 looking for information on diabetes patients who were hospitalized during those 12 years.

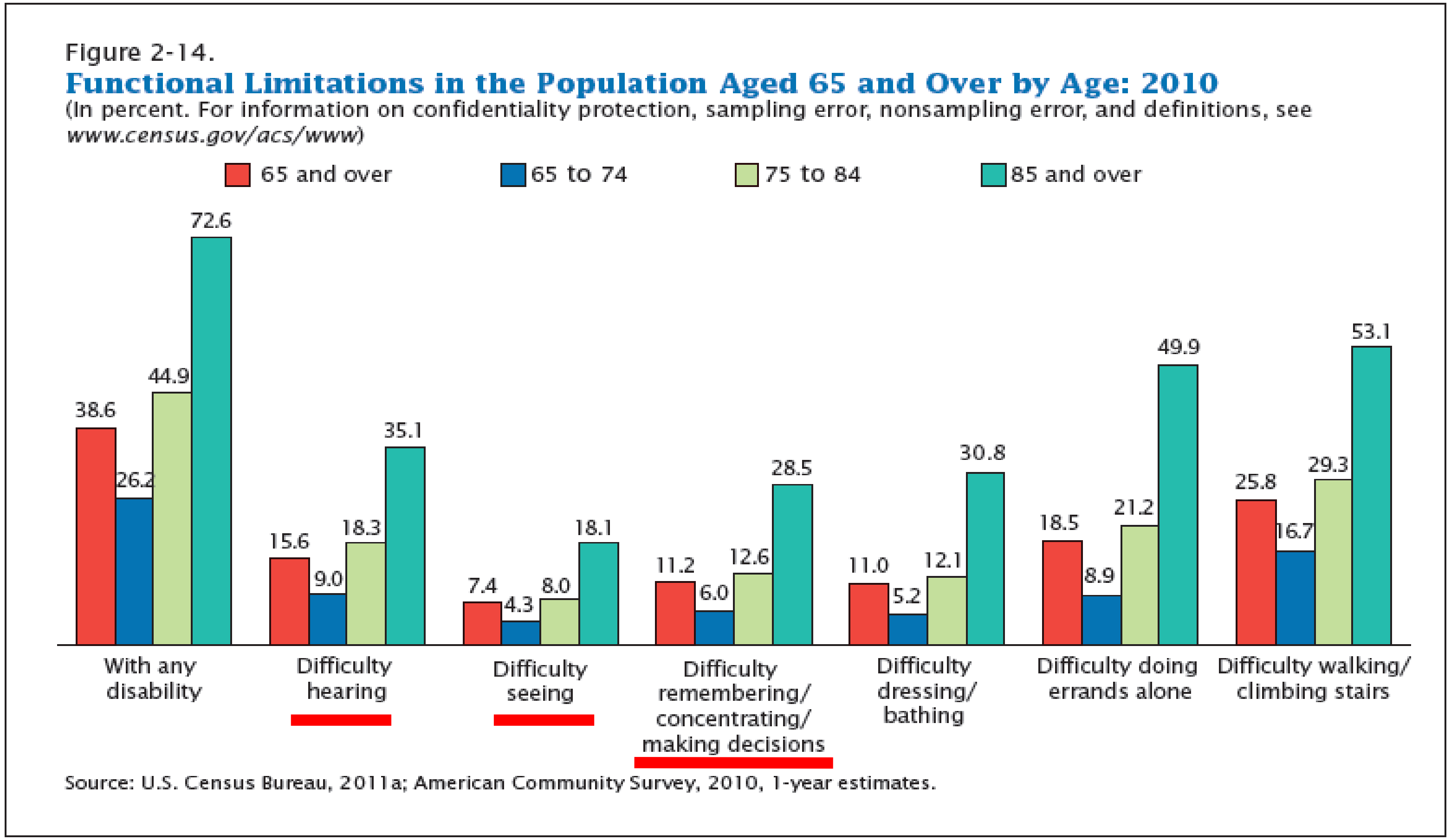
- The investigators calculated that the rate of admissions for hyperglycemia dropped by 38.6 percent over those 12 years, while the rate for admissions for hypoglycemia climbed by 11.7 percent.

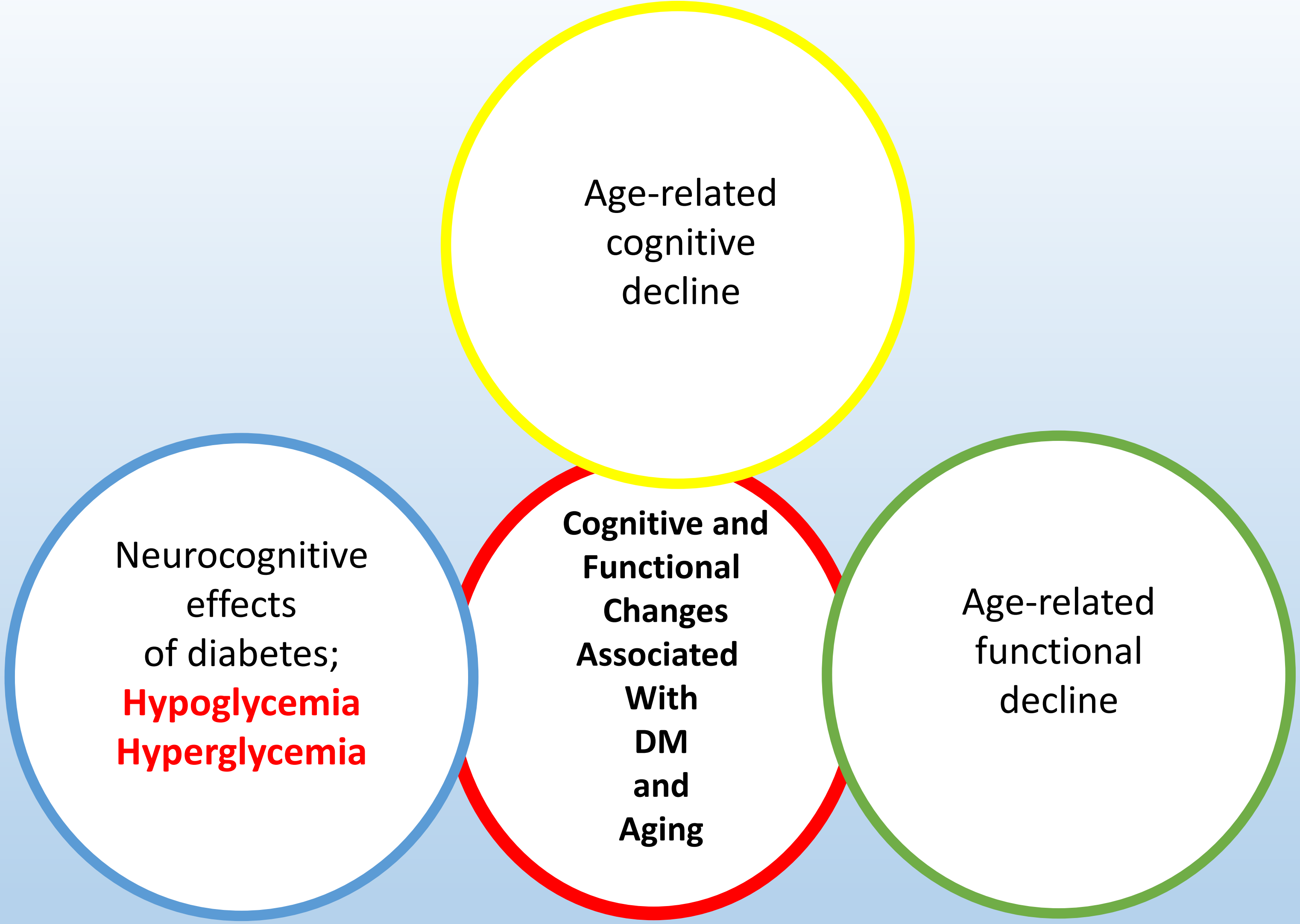
Lipska, K. L., MD. JAMA Internal Medicine. Published online May 17, 2014.

Persons aged 65-85+ with cognitive impairments



Persons aged 65-85+ with functional impairments




Age-related cognitive decline
Neurocognitive effects of diabetes; Hypoglycemia Hyperglycemia
Cognitive and Functional Changes Associated With DM and Aging
Age-related functional decline

Age-related
functional
decline

Geriatric Syndromes

Cognitive Dysfunction
Functional Impairment
Falls & Fractures
Polypharmacy
Depression
Vision & Hearing Impairment
Comorbidities (CVD)
Poor Oral Health
Unique Nutrition Issues
Low Income
Decreased Physical Activity & Fitness

Age-related functional decline

Frailty Syndrome

Anorexia

Sarcopenia

Osteoporosis

Fatigue

Risk of Falls

Poor physical health

"Diabetes in Older Adults"

Consensus report published jointly by the American Diabetes Association (ADA) and the American Geriatrics Society (AGS).

Based on information from the ADA Consensus Development Conference on Diabetes and Older Adults, held in February 2012.

Kirkman MS, Briscoe VJ, Clark N, et al. Diabetes in older adults. *Diabetes Care*. 2012;35(12):2650-2664

The ADA goals for glycemic control do not specifically mention age. The recommendation for many adults is an A1C <7%, but less stringent goals are recommended for those with limited life expectancy, advanced diabetes complications, or extensive comorbid conditions.[17]

In collaboration with the ADA and other medical organizations, the California HealthCare Foundation/American Geriatrics Society panel published guidelines for improving the care of older adults with diabetes in 2003. A significant proportion of the recommendations concerns geriatric syndromes. Highlights of diabetes-specific recommendations include A1C targets of $\leq$7.0% in "relatively healthy adults," while for those who are frail or with life expectancy less than 5 years, a less stringent target, such as 8%, was considered appropriate. The guidelines also suggested that the timeline of benefits was estimated to be at least 8 years for glycemic control and 2–3 years for blood pressure and lipid control.[2]

The U.S. Department of Veterans Affairs and the U.S. Department of Defense (VA/DOD) diabetes guidelines were updated in 2010. As with other guidelines, the VA/DOD guidelines do not distinguish by age-group. They highlight the frequency of comorbid conditions in patients with diabetes and stratify glycemic goals based on comorbidity and life expectancy. For glycemic goals, for exam-

Extensive review of the guidelines is beyond the scope of this report, but there are similar themes, which suggest pursuing an individualized approach with a focus on clinical and functional heterogeneity and comorbidities, and weighing the expected time frame of benefit of interventions against life expectancy.

WHAT ISSUES NEED TO BE CONSIDERED IN INDIVIDUALIZING TREATMENT RECOMMENDATIONS FOR OLDER ADULTS?

Comorbidities and Geriatric Syndromes

Diabetes is associated with increased risk of multiple coexisting medical conditions in older adults. In addition to the classic cardiovascular and microvascular diseases, a group of conditions termed geriatric syndromes, described below also occur at higher frequency in older adults with diabetes and may affect self-care abilities and health outcomes including quality of life.[58]

Cognitive Dysfunction

Alzheimer's-type and multi-infarct dementia are approximately twice as likely to occur in those with diabetes compared with age matched nondiabetic control subjects.[59] The

10. Older Adults

American Diabetes Association

Diabetes Care 2016;39(Suppl. 1):S81–S85 | DOI: 10.2337/dc16-S013

Recommendations

- Consider the assessment of medical, functional, mental, and social geriatric domains for diabetes management in older adults to provide a framework to determine targets and therapeutic approaches. **E**
- Screening for geriatric syndromes may be appropriate in older adults experiencing limitations in their basic and instrumental activities of daily living, as they may affect diabetes self-management. **E**
- Older adults (≥65 years of age) with diabetes should be considered a high-priority population for depression screening and treatment. **B**
- Hypoglycemia should be avoided in older adults with diabetes. It should be screened for and managed by adjusting glycemic targets and pharmacological interventions. **B**
- Older adults who are functional and cognitively intact and have significant life expectancy may receive diabetes care with goals similar to those developed for younger adults. **E**
- Glycemic goals for some older adults might reasonably be relaxed, using individual criteria, but hyperglycemia leading to symptoms or risk of acute hyperglycemic complications should be avoided in all patients. **E**

E = Expert consensus or clinical experience

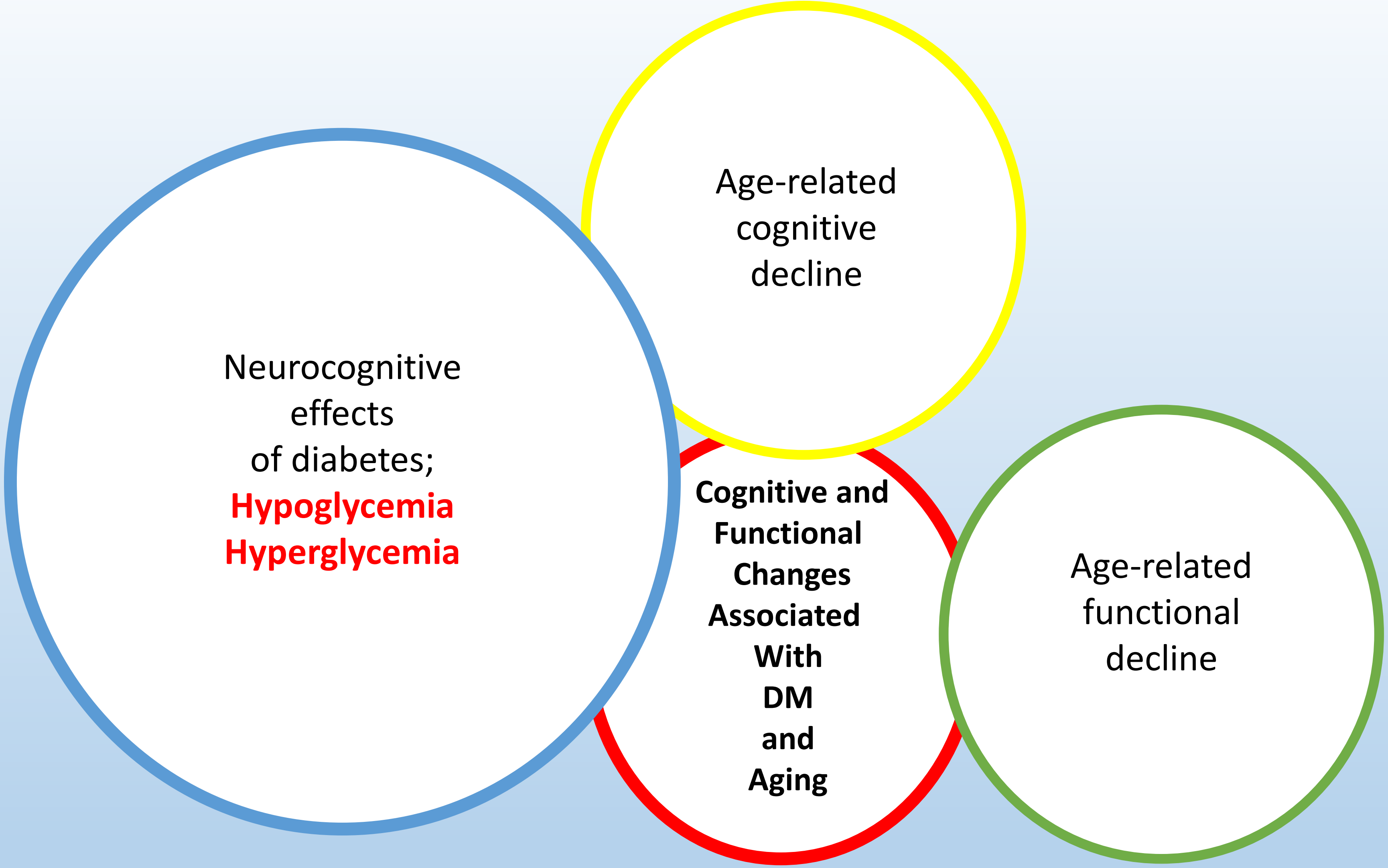
NEUROCOGNITIVE FUNCTION

Older adults with diabetes are at higher risk of cognitive decline and institutionalization (4,5). The presentation of cognitive impairment ranges from subtle executive dysfunction to memory loss and overt dementia. Diabetes increases the incidence of all-cause dementia, Alzheimer disease, and vascular dementia when compared with rates in people with normal glucose tolerance (6). The

Diabetes Care 2016;39(Suppl. 1):S81–S85 | DOI: 10.2337/dc16-S013

The presence of cognitive impairment can make it challenging for clinicians to help their patients to reach individualized glycemic, blood pressure, and lipid targets. Cognitive dysfunction makes it difficult for patients to perform complex self-care tasks, such as glucose monitoring and adjusting insulin doses. It also hinders their ability to appropriately maintain the timing and content of diet. When clinicians are managing these types of patients, it is critical to simplify drug regimens and to involve caregivers in all aspects of care.

Diabetes Care 2016;39(Suppl. 1):S81–S85 | DOI: 10.2337/dc16-S013


Age-related cognitive decline
Neurocognitive effects of diabetes;
Hypoglycemia
Hyperglycemia
Cognitive and Functional Changes Associated With DM and Aging
Age-related functional decline

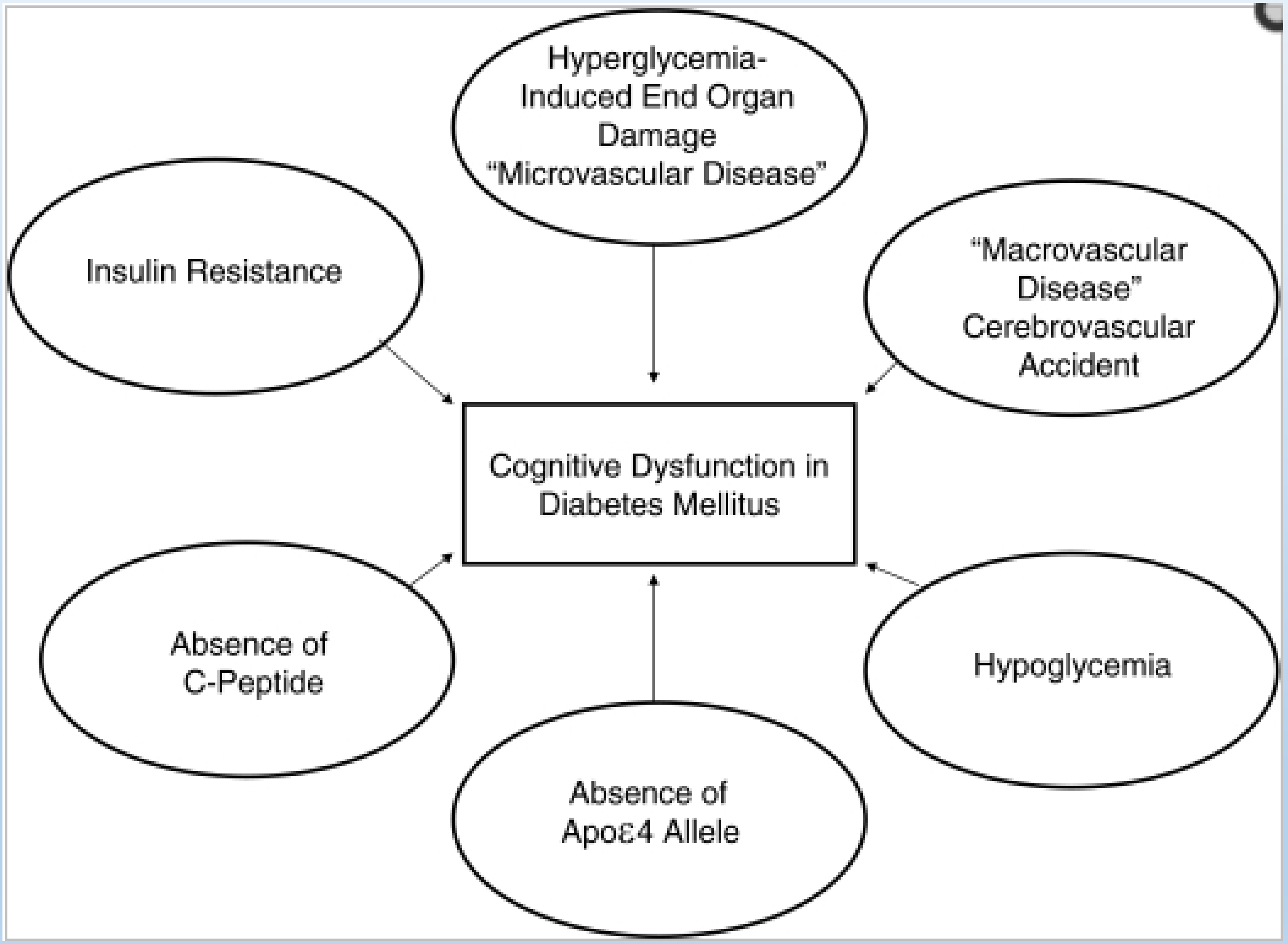
Neurocognitive
effects
of diabetes;
Hypoglycemia
Hyperglycemia

The exact pathophysiology of cognitive dysfunction in diabetes is not completely understood, but it is likely that these play significant roles:

- hyperglycemia
- hypoglycemia
- vascular disease
- insulin resistance

Endocr Rev. 2008 Jun; 29(4): 494–511.
Cognitive Dysfunction and Diabetes Mellitus
Christopher T. Kodl and Elizabeth R. Seaquist

Neurocognitive effects of diabetes;
Hypoglycemia
Hyperglycemia



Endocr Rev. 2008 Jun; 29(4): 494–511.

Cognitive Dysfunction and Diabetes Mellitus

Christopher T. Kodl and Elizabeth R. Seaquist

Neurocognitive effects
of diabetes;
Hypoglycemia
Hyperglycemia

Table 1

Summary of cognitive domains that have been found to be negatively affected by type 1 diabetes mellitus

Slowing of information processing*
Psychomotor efficiency*
Attention*
Memory
Learning
Problem solving
Motor speed
Vocabulary
General intelligence
Visuoconstruction*
Visual perception
Somatosensory examination
Motor strength
Mental flexibility*
Executive function

Domains marked by *asterisks* have particularly strong supporting data.

Endocr Rev. 2008 Jun; 29(4): 494–511.
Cognitive Dysfunction and Diabetes Mellitus
Christopher T. Kodl and Elizabeth R. Seaquist

Neurocognitive effects of diabetes; **Hypoglycemia** **Hyperglycemia**

Table 2

Summary of cognitive domains that have been found to be negatively affected by type 2 diabetes mellitus

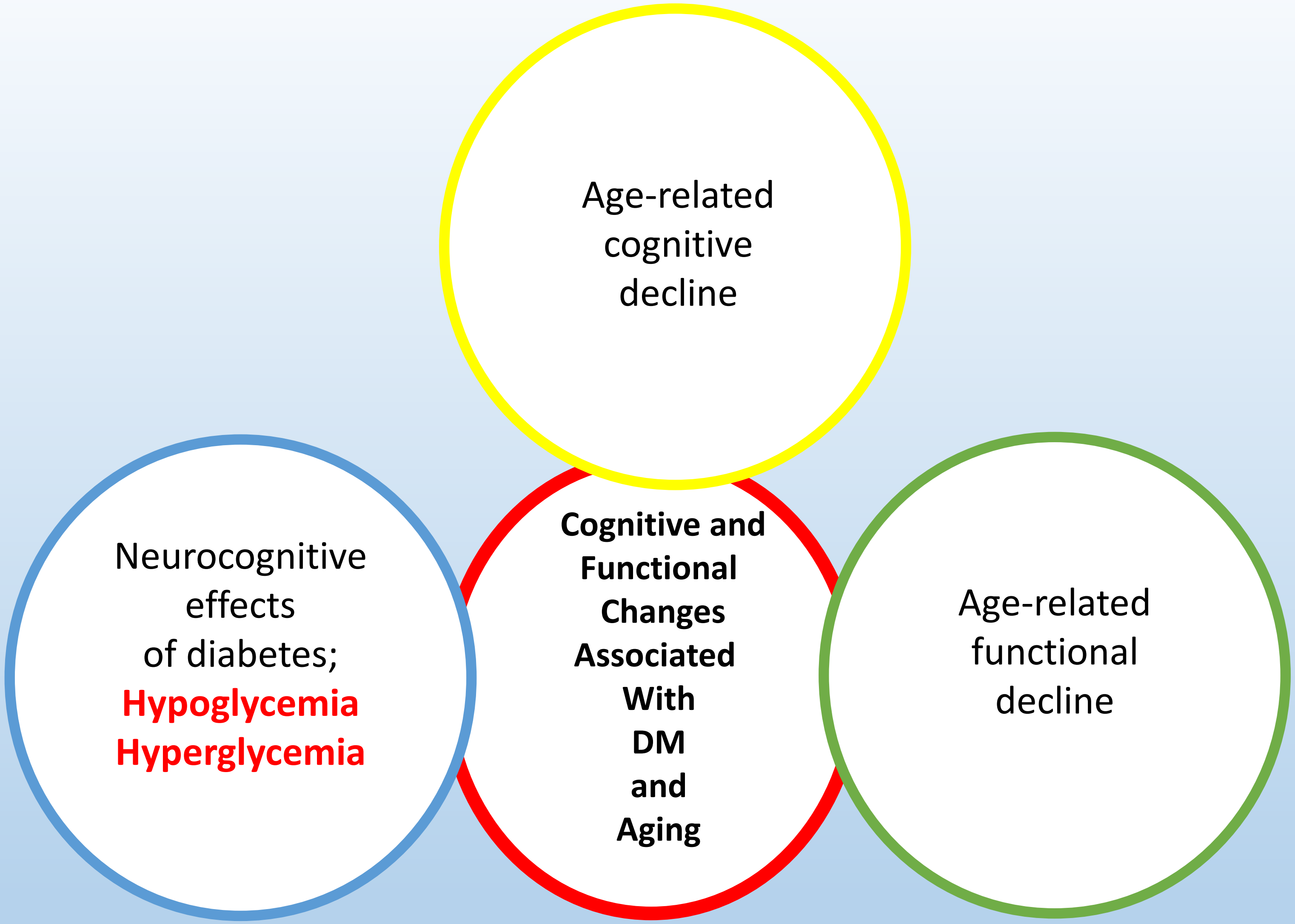
Memory*
Verbal memory
Visual retention
Working memory
Immediate recall
Delayed recall
Psychomotor speed*
Executive function*
Processing speed
Complex motor function
Verbal fluency
Attention
Depression

Domains marked by *asterisks* have particularly strong supporting data.

Endocr Rev. 2008 Jun; 29(4): 494–511.
Cognitive Dysfunction and Diabetes Mellitus
Christopher T. Kodl and Elizabeth R. Seaquist

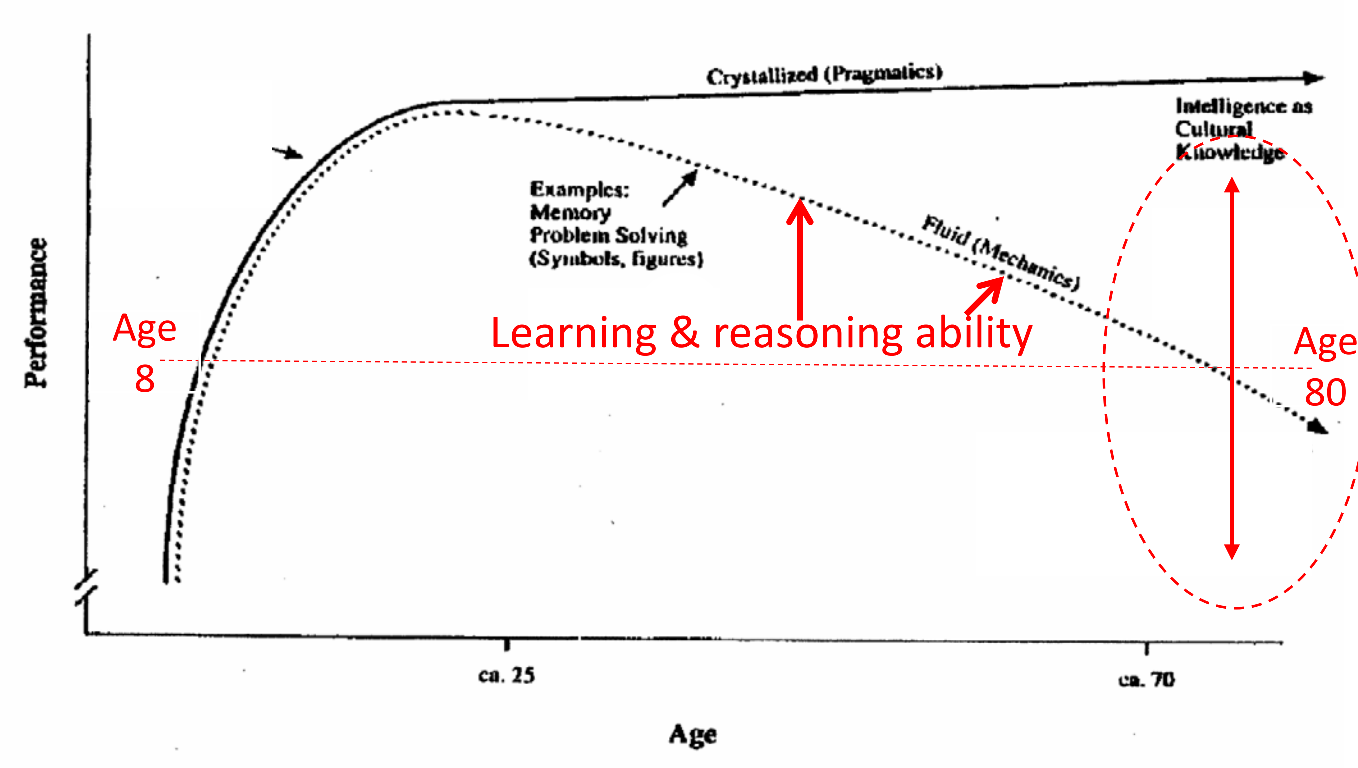
Burdens of diabetes for older adults

I. Trends and prevalence of diabetes, by age
II. Age-related cognitive and functional decline
III. Declines that increase the burdens of DSM
IV. DSM errors made by older adults
V. DSME/S that can lighten those burdens


Age-related cognitive decline
Neurocognitive effects of diabetes; Hypoglycemia Hyperglycemia
Cognitive and Functional Changes Associated With DM and Aging
Age-related functional decline

Age-related cognitive decline

Normal age-related cognitive decline



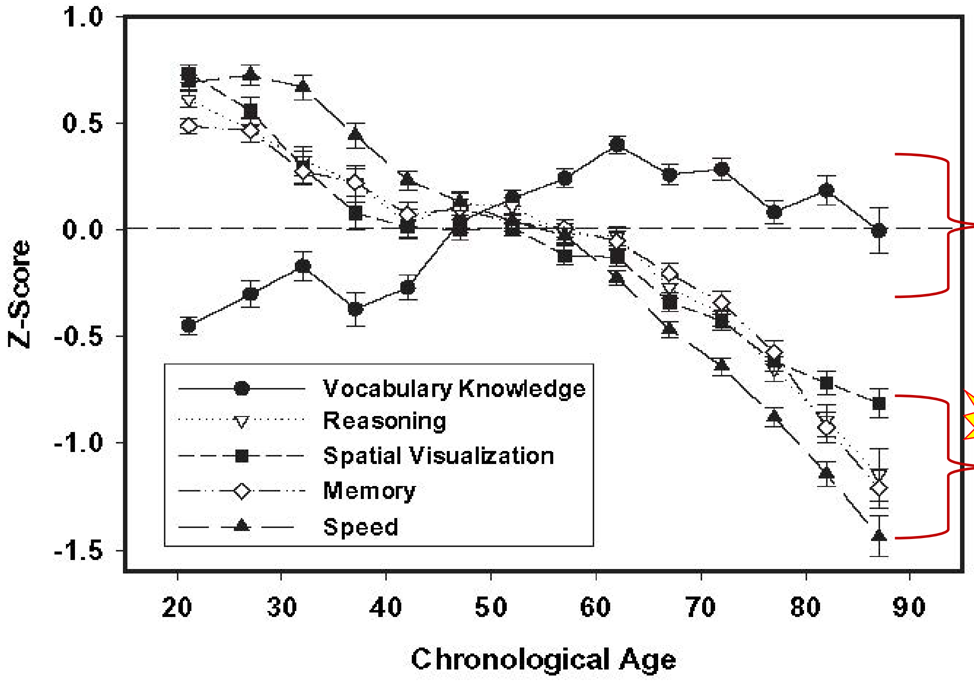
Basic cultural Knowledge (G_C)

g - Basic information processing (G_F)

Age-related cognitive decline

Normal age-related cognitive decline

A finer-grained look



“Crystallized” intelligence [past learning]

- Breadth/depth of general knowledge (e.g., language)
- Accrued over lifetime based on fluid intelligence, education, interests

“Fluid” intelligence [on-the-spot learning & reasoning]

- Aptness in processing information (e.g., learning, reasoning, abstract thinking, problem solving)
- Includes executive function, working memory
- Reflects overall integrity of brain (speed, connectedness, etc.)

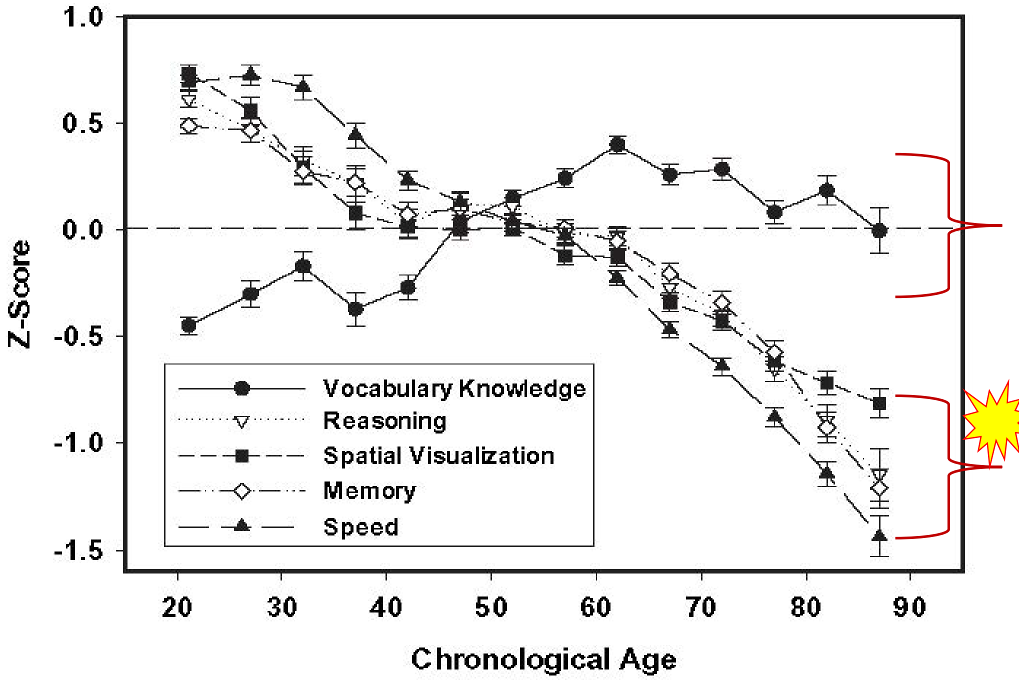
***This is the norm, but individuals vary a lot around the norm!**

Source: Figure 1 in Salthouse, T. A. (2009). Selective review of cognitive aging, *J of Int Neuropsych Soc, 16*, 754-760.

Age-related cognitive decline

Normal age-related cognitive decline

A finer-grained look



"Crystallized" intelligence [past learning]

- Breadth/depth of general knowledge (e.g., language)
- Accrued over lifetime based on fluid intelligence, education, interests

"Fluid" intelligence [on-the-spot learning & reasoning]

- Aptness in processing information (e.g., learning, reasoning, abstract thinking, problem solving)
- Includes executive function, working memory
- Reflects overall integrity of brain (speed, connectedness, etc.)

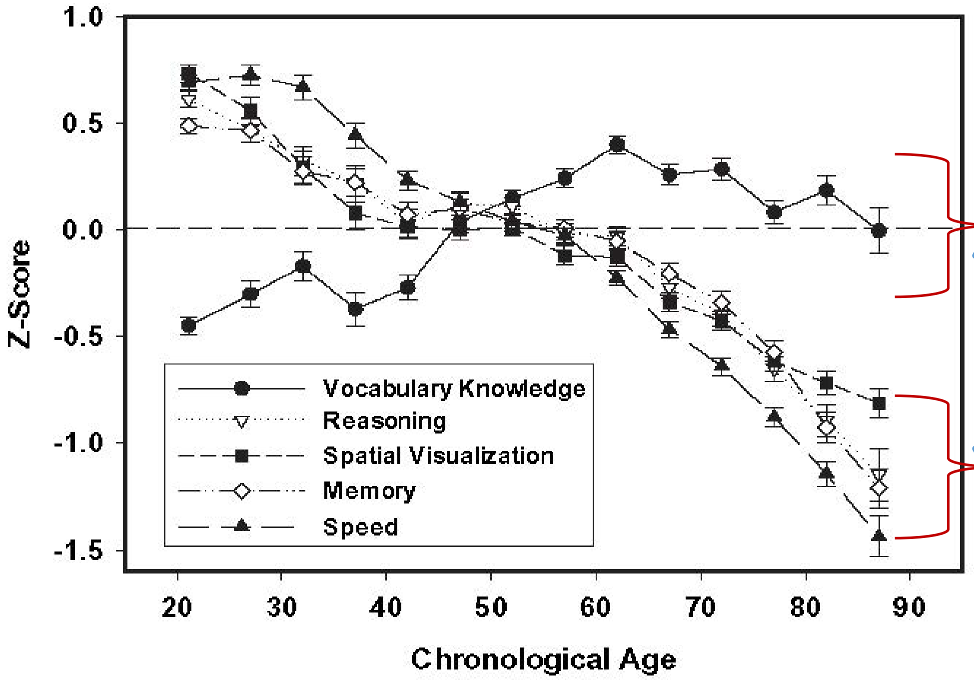
DSM tasks require "fluid intelligence"

Source: Figure 1 in Salthouse, T. A. (2009). Selective review of cognitive aging, *J of Int Neuropsych Soc, 16*, 754-760.

Age-related cognitive decline

Normal age-related cognitive decline

A finer-grained look



"Crystallized" intelligence [past learning]

- Breadth/depth of general knowledge (e.g., language)
- Accrued over lifetime based on fluid intelligence, education, interests

Growing gap – *past learning* is faulty guide to *current* cognitive capacity

"Fluid" intelligence [current ability to learn & reason]

- Aptness in processing information (e.g., learning, reasoning, abstract thinking, problem solving)
- Includes executive function, working memory
- Reflects overall integrity of brain (speed, connectedness, etc.)

Source: Figure 1 in Salthouse, T. A. (2009). Selective review of cognitive aging, *J of Int Neuropsych Soc, 16*, 754-760.

Age-related cognitive decline

Example: Your patient is an elderly professor starting a new meter and/or insulin device

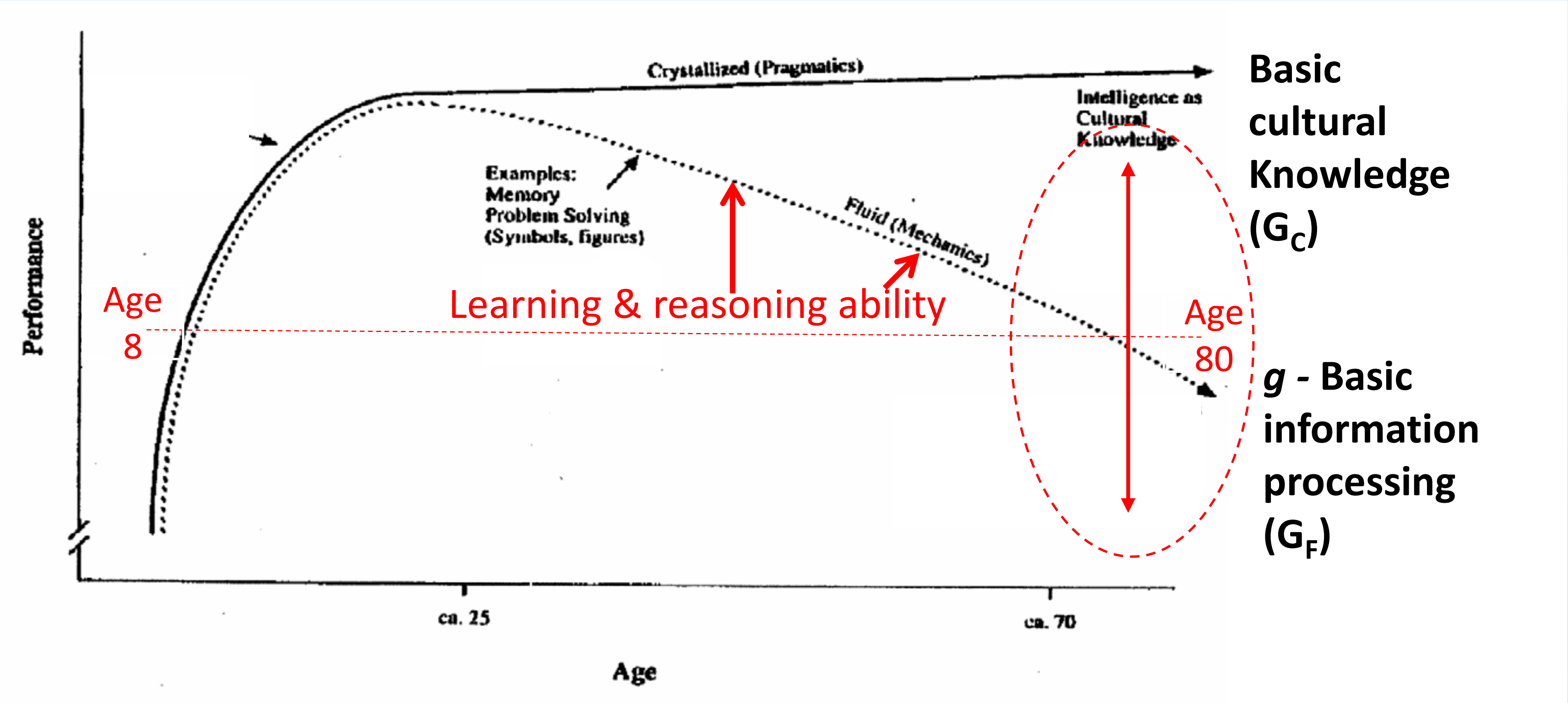
He may be highly literate and well-read *(crystallized intelligence)*, but that does not guarantee he grasped your instructions for how and when to use the new device *(fluid intelligence)*.

Age-related cognitive decline

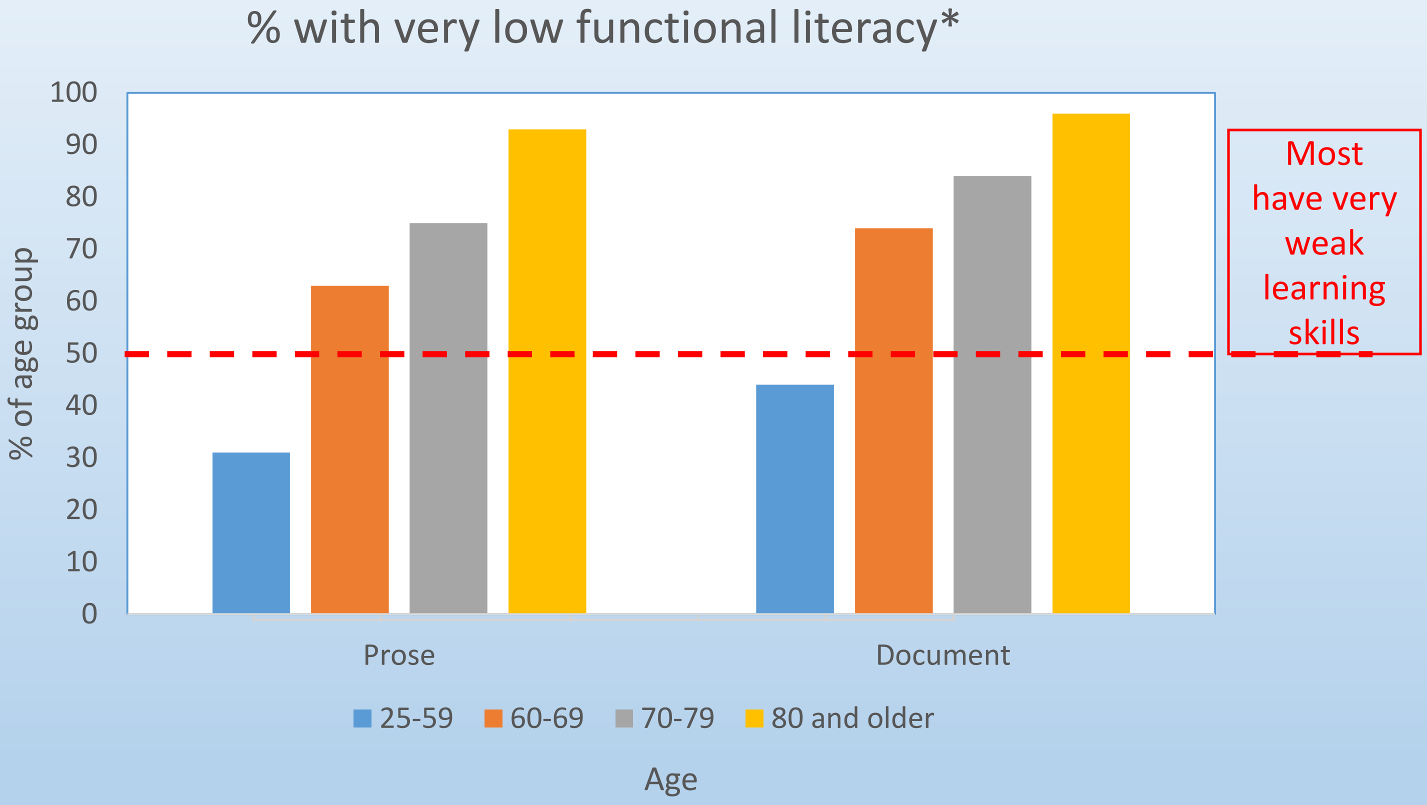
Normal age-related cognitive decline

How important?

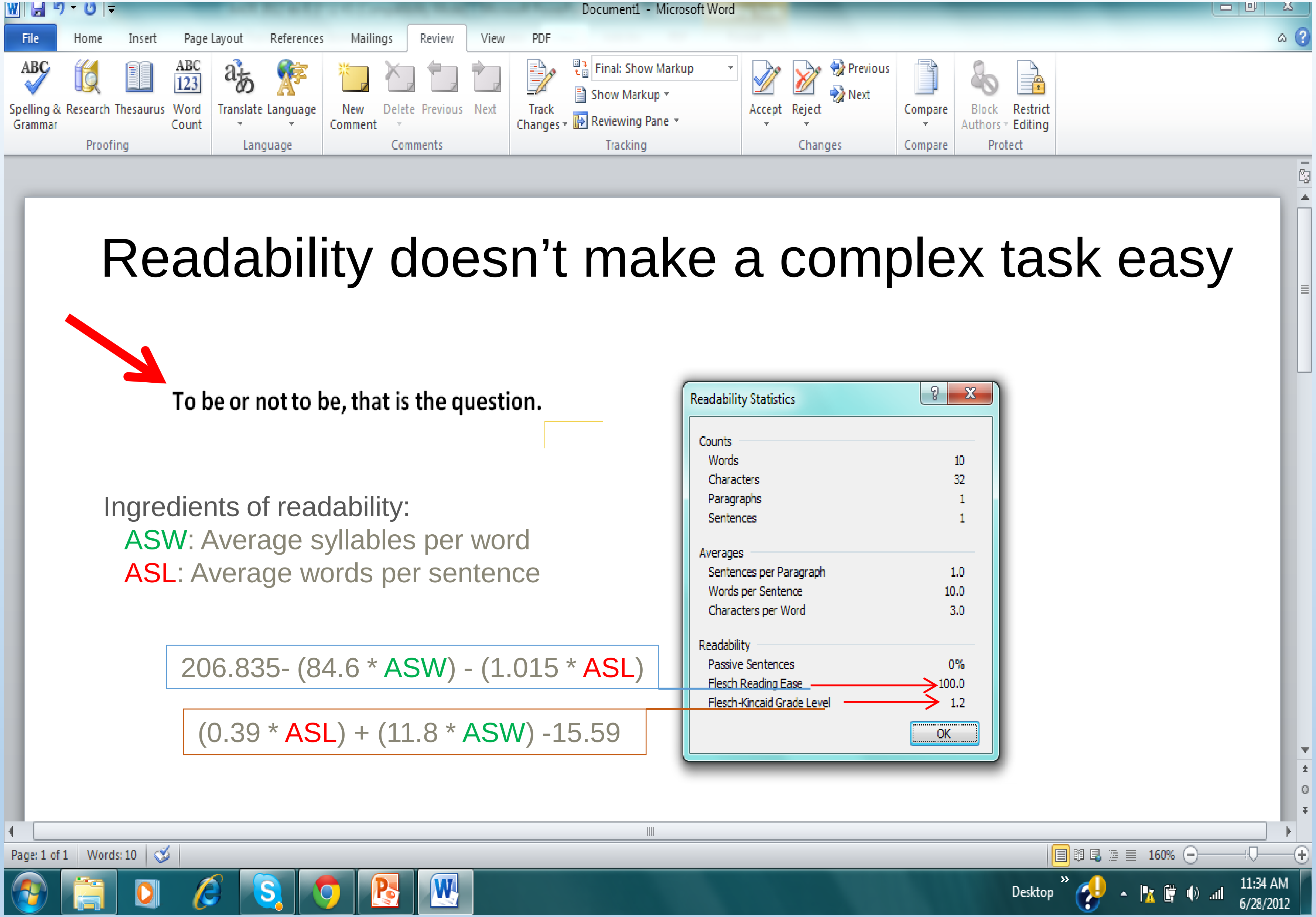
Cognitive ability ≈ ability to learn & reason well ≈ functional literacy
Cognitive ability ⇒ better DSM
Functional literacy ⇒ better adherence



Older adults have less functional literacy



*Level 1 or 2 on NCES adult literacy survey's 5-level scale Source: Tables 1.2 and 1.3 of *Literacy of Older Adults in America*, 1996, http://nces.ed.gov/pubs97/97576.pdf (accessed 8/1/14)


Document1 - Microsoft Word
File
Home
Insert
Page Layout
References
Mailings
Review
View
PDF
Spelling & Grammar
Research
Thesaurus
Word Count
Proofing
Translate
Language
Language
New Comment
Delete
Previous
Next
Comments
Track Changes
Final: Show Markup
Show Markup
Reviewing Pane
Tracking
Accept
Reject
Previous
Next
Changes
Compare
Compare
Block Authors
Restrict Editing
Protect
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
Readability Statistics
Counts
Words 10
Characters 32
Paragraphs 1
Sentences 1
Averages
Sentences per Paragraph 1.0
Words per Sentence 10.0
Characters per Word 3.0
Readability
Passive Sentences 0%
Flesch Reading Ease 100.0
Flesch-Kincaid Grade Level 1.2
OK
Page: 1 of 1
Words: 10
160%
Desktop
11:34 AM
6/28/2012

Typical literacy items, by difficulty level

National Adult Literacy Survey (NALS), 1993

Community dwelling

NALS difficulty level	% US adults peaking at this level: Prose scale				Simulated everyday tasks
	Age				Daily self-maintenance in modern literate societies
	16-59	60-69	70-79	80+	
5	4	1	1	0	▪ Use calculator to determine cost of carpet for a room ▪ Use table of information to compare 2 credit cards
4	20	8	5	1	▪ Use eligibility pamphlet to calculate SSI benefits ▪ Explain difference between 2 types of employee benefits
3	35	27	19	6	▪ Calculate miles per gallon from mileage record chart ▪ Write brief letter explaining error on credit card bill
2	25	33	22	27	▪ Determine difference in price between 2 show tickets ▪ Locate intersection on street map
1	16	30	42	66	▪ Total bank deposit entry ▪ Locate expiration date on driver's license

Includes normal cognitive decline

Typical literacy items, by difficulty level

National Adult Literacy Survey (NALS), 1993

NALS difficulty level	% US adults peaking at this level: Prose scale				Simulated everyday tasks
	Age				Daily self-maintenance in modern literate societies
	16-59	60-69	70-79	80+	
5	4	1	1	0	Use calculator to determine cost of carpet for a room; Use table of information to compare 2 credit cards
4	20	8	5	1	Use eligibility pamphlet to calculate SSI benefits; Explain difference between 2 types of employee benefits
3	35	27	19	6	Calculate miles per gallon from mileage record chart; Write brief letter explaining error on credit card bill
2	25	33	22	27	Determine difference in price between 2 show tickets; Locate intersection on street map
1	16	30	42	66	Locate expiration date on driver's license

NOT reliable informants!

Typical literacy items, by difficulty level

National Adult Literacy Survey (NALS), 1993

NALS difficulty level	% US adults peaking at this level: Prose scale				Simulated everyday tasks
	Age				Daily self-maintenance in modern literate societies
	16-59	60-69	70-79	80+	
5	4	1	1	0	Use calculator to determine cost of carpet for a room Use table of information to compare 2 credit cards
4	20	8	5	1	phlet to calculate SSI benefits between 2 types of employee benefits
3	35	27	19	6	gallon from mileage record chart xplaining error on credit card bill
2	25	33	22	27	nce in price between 2 show tickets Locate intersection on street map
1	16	30	42	66	Total bank deposit entry Locate expiration date on driver's license

a b i l i t y

The "simple" becomes harder or impossible to do

Typical literacy items, by difficulty level

National Adult Literacy Survey (NALS), 1993

NALS difficulty level	% US adults peaking at this level: Prose scale				Simulated everyday tasks
	Age				Daily self-maintenance in modern literate societies
	16-59	60-69	70-79	80+	
5	4	1	1	0	▪ Use calculator to determi ▪ Use table of information t
4	20	8	5	1	▪ Use eligibility pamphlet to ▪ Explain difference betwee
3	35	27	19	6	▪ Calculate miles per gallon ▪ Write brief letter explaini
2	25	33	22	27	▪ Determine difference in p ▪ Locate intersection on str
1	16	30	42	66	▪ Total bank deposit entry ▪ Locate expiration date on driver's license

complexity

Elements of "process complexity"

- number of features to match
- level of inference
- abstractness of info
- distracting info

Task difficulty level is *not* about readability,
but about "problem solving"

Burdens of diabetes for older adults

I. Trends and prevalence of diabetes, by age
II. Age-related cognitive and functional decline
III. Declines that increase the burdens of DSM
IV. DSM errors made by older adults
V. DSME/S that can lighten those burdens

Hospital Admissions for Medicare PWDs age 65 and older

Recall

- Data on almost 34 million individuals who received Medicare benefits between 1999 and 2011 looking for information on diabetes patients who were hospitalized during those 12 years.

- The investigators calculated that the rate of admissions for hyperglycemia dropped by 38.6 percent over those 12 years, while the rate for admissions for hypoglycemia climbed by 11.7 percent.

Lipska, K. L., MD. JAMA Internal Medicine. Published online May 17, 2014.

IHE = Insulin-related Hypoglycemia And errors

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.

Abbreviations: ED, emergency department; EMS, emergency medical services; IHEs, insulin-related hypoglycemia and errors.

[a] Case counts and estimates are from the National Electronic Injury Surveillance System–Cooperative Adverse Drug Event Surveillance project, Centers for Disease Control and Prevention. Percentages are of a total of 1829 cases (20 346 estimated ED visits) for which a precipitating factor was documented. Refer to eTable 1 [Supplement] for definitions of precipitating factors. Percentages may total more than 100% because categories are not mutually exclusive.

[b] Case descriptions are based on verbatim excerpts as reported by medical coders based on review of ED medical record narrative (with spelling corrected and abbreviations spelled out).

[c] "Other misadventure" included insulin administration at the incorrect time or without regard to checking blood glucose levels; administration of "too much insulin," not further described; or medication error with insulin, not otherwise specified.

National Estimates of Insulin-Related Hypoglycemia and Errors Leading to Emergency Department Visits and Hospitalizations
Andrew I. Geller, MD; Nadine Shehab, PharmD, MPH; Maribeth C. Lovegrove, MPH; Scott R. Kegler, PhD; Kelly N.Weidenbach, DrPH; Gina J. Ryan, PharmD, CDE; Daniel S. Budnitz, MD, MPH
JAMA Intern Med. 2014;174(5):678-686

DSM factors identified in ED visits for hypoglycemic events

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.

Abbreviations: ED, emergency department; EMS, emergency medical services; IHEs, insulin-related hypoglycemia and errors.

[a] Case counts and estimates are from the National Electronic Injury Surveillance System–Cooperative Adverse Drug Event Surveillance project, Centers for Disease Control and Prevention. Percentages are of a total of 1829 cases (20 346 estimated ED visits) for which a precipitating factor was documented. Refer to eTable 1 [Supplement] for definitions of precipitating factors. Percentages may total more than 100% because categories are not mutually exclusive.

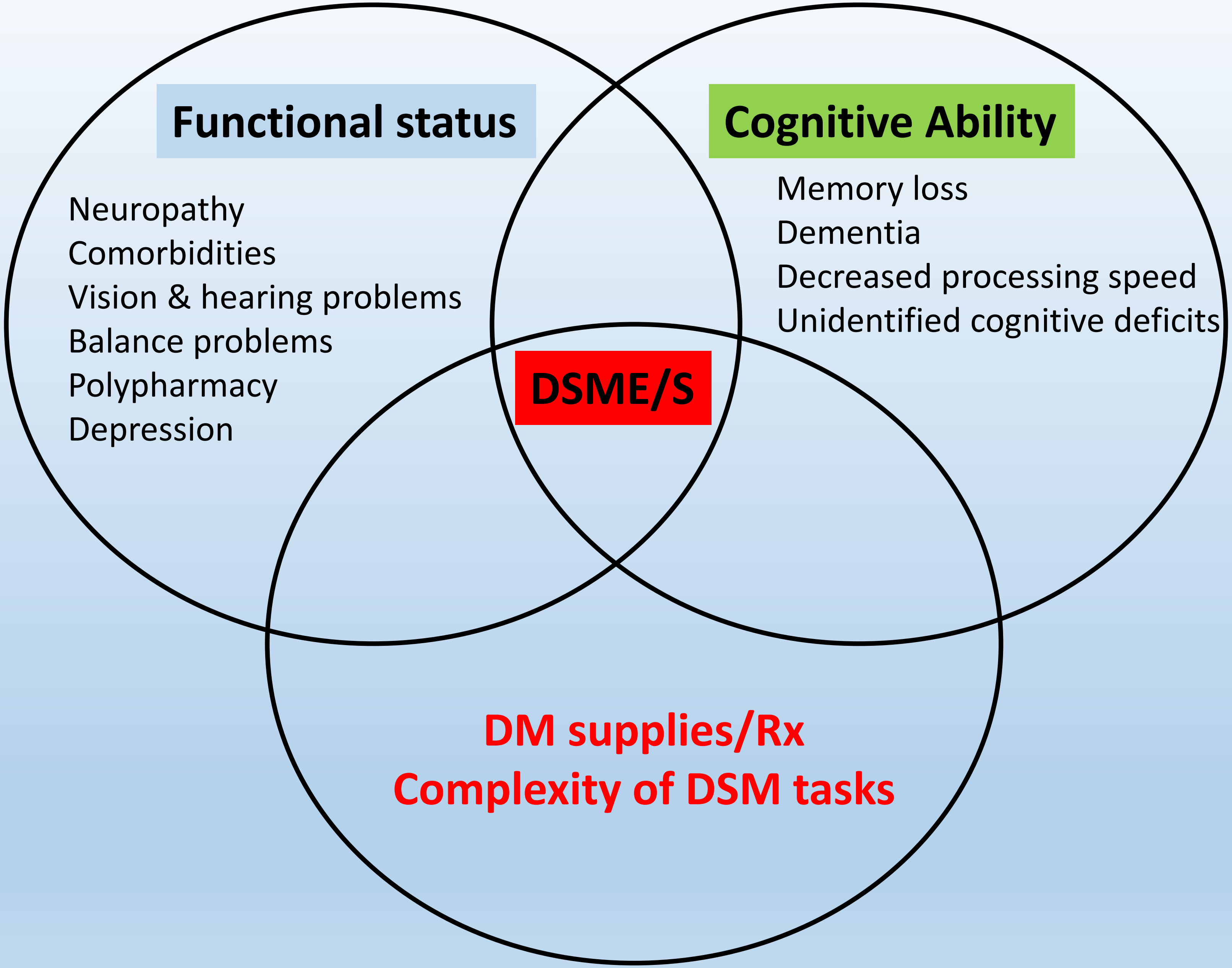
[b] Case descriptions are based on verbatim excerpts as reported by medical coders based on review of ED medical record narrative (with spelling corrected and abbreviations spelled out).

[c] "Other misadventure" included insulin administration at the incorrect time or without regard to checking blood glucose levels; administration of "too much insulin," not further described; or medication error with insulin, not otherwise specified.

- Meals-related misadventure
- Unintentionally took wrong insulin product
- Unintentionally tool wrong dose/confused units
- Pump-related misadventure
- Other misadventure

Burdens of diabetes for older adults

I. Trends and prevalence of diabetes, by age
II. Age-related cognitive and functional decline
III. Declines that increase the burdens of DSM
IV. DSM errors made by older adults
V. DSME/S that can lighten those burdens



Functional status
Neuropathy
Comorbidities
Vision & hearing problems
Balance problems
Polypharmacy
Depression
Cognitive Ability
Memory loss
Dementia
Decreased processing speed
Unidentified cognitive deficits
DSME/S
DM supplies/Rx
Complexity of DSM tasks

Diabetes is associated with increased risk of multiple coexisting medical conditions in older adults that may impact self-care abilities and health outcomes, including quality of life.

- Comorbidities: cardiovascular and macrovascular disease
- Geriatric syndromes: cognitive dysfunction; functional impairment; falls and fractures; depression; visual and hearing impairment
- Nutrition issues: risk for undernutrition; restrictive eating patterns
- Special needs in diabetes-self-management education/training and support: may need to account for sensation, cognition, and functional/physical impairments
- Ability to perform physical activity: decreased muscle mass, strength, fitness may be present
- Life expectancy: take into account when making decisions re: treatment targets, interventions.

Kirkman MS, Briscoe VJ, Clark N, et al. Diabetes in older adults. *Diabetes Care*. 2012;35(12):2650-2664

The presence of cognitive impairment can make it challenging for clinicians to help their patients to reach individualized glycemic, blood pressure, and lipid targets. Cognitive dysfunction makes it difficult for patients to perform complex self-care tasks, such as glucose monitoring and adjusting insulin doses. It also hinders their ability to appropriately maintain the timing and content of diet. When clinicians are managing these types of patients, it is critical to simplify drug regimens and to involve caregivers in all aspects of care.

Diabetes Care 2016;39(Suppl. 1):S81–S85 | DOI: 10.2337/dc16-S013

Bloom’s Taxonomy of Learning Objectives

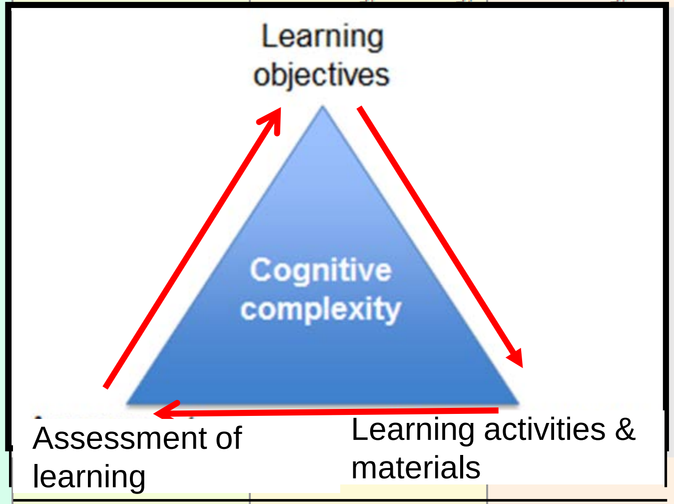
(2001 revision)

Bloom’s levels = continuum of cognitive complexity

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

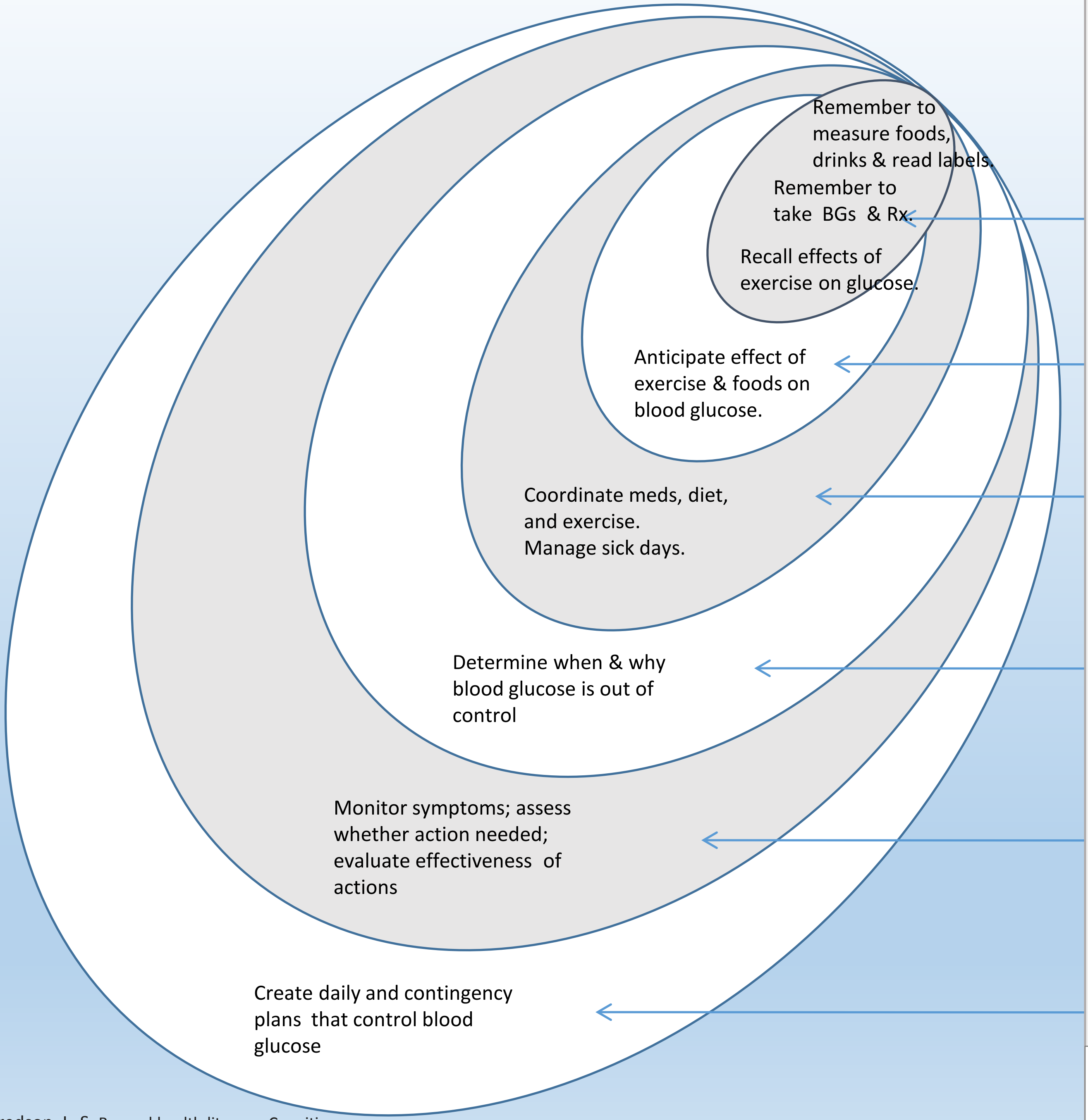
lower order thinking skills → higher order thinking skills

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.)

DSM tasks differ in complexity



<u>Bloom's taxonomy of educational objectives (cognitive domain)*</u>

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

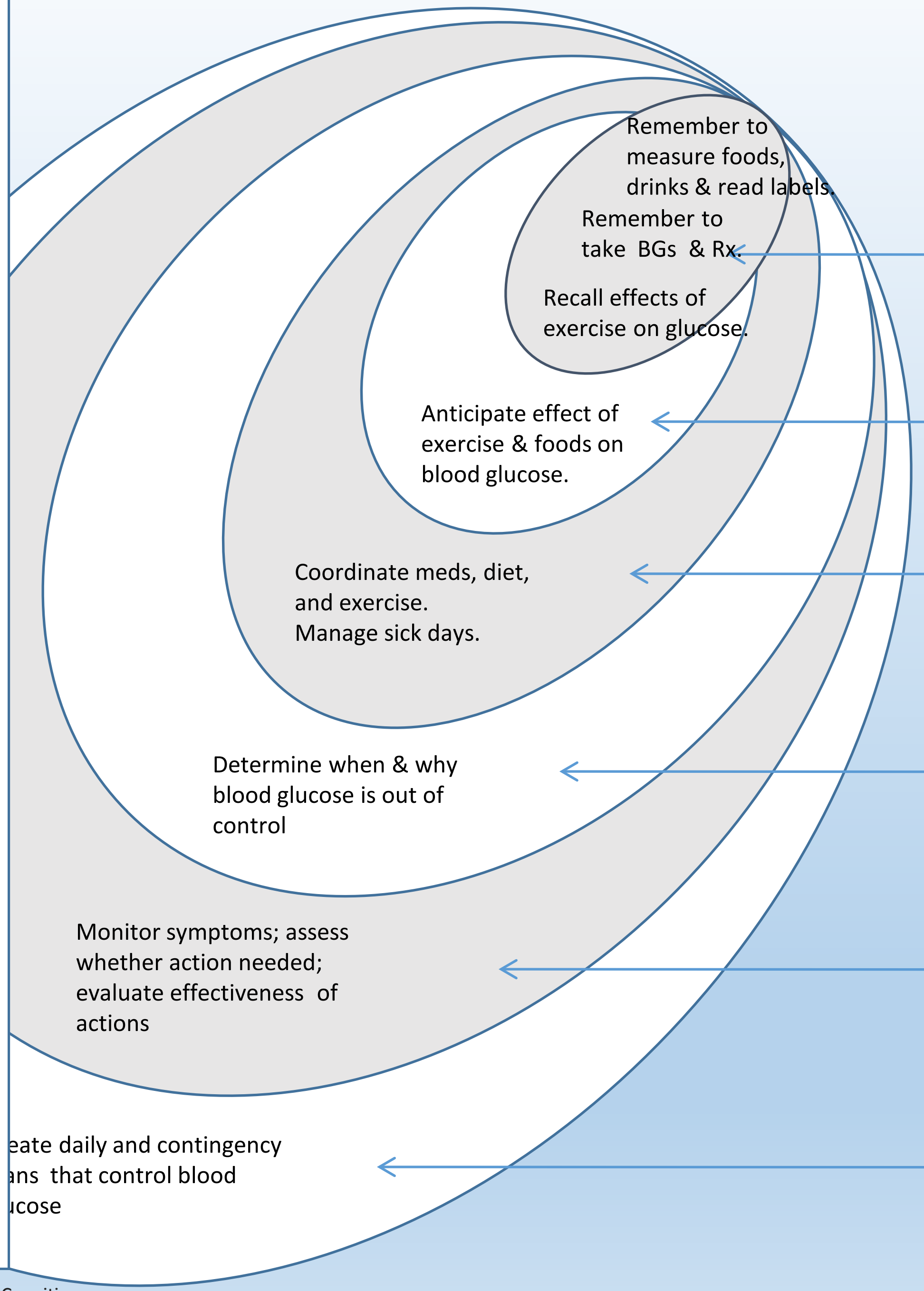
Most complex tasks

*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 Wesley Longman.

DSM tasks differ in complexity

Instructional strategy—minimize *unnecessary* cognitive load

- 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
- **<u>Never</u>** 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.



<u>Bloom's taxonomy of educational objectives (cognitive domain)*</u>

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 Wesley Longman.

© Stroh, K., & Gottfredson, L. S. Beyond health literacy: Cognitive demands of diabetes self-management. Presented at the annual meeting of the American Association of Diabetes Educators, Indianapolis, August 2, 2012.

DSME must assure *cognitive accessibility* of information & materials.

Even if the DSM “job” did not get more complex, cognitive decline makes it more difficult.

Case 1: Meal-related misadventure

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.

National Estimates of Insulin-Related Hypoglycemia
and Errors Leading to Emergency Department
Visits and Hospitalizations
Andrew I. Geller, MD; Nadine Shehab, PharmD, MPH; Maribeth C. Lovegrove, MPH; Scott R. Kegler, PhD;
Kelly N.Weidenbach, DrPH; Gina J. Ryan, PharmD, CDE; Daniel S. Budnitz, MD, MPH
JAMA Intern Med. 2014;174(5):678-686

the classification of hypoglycemia in 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-

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.** Pseudo-hypoglycemia 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.

Hypoglycemia and Diabetes: A Report of a Workgroup of the American Diabetes Association and The Endocrine Society.
Diabetes Care 36:1384–1395, 2013

Case 1: Meal-related misadventure

1. What was the error?

2. Describe the patient behavior resulting in the error?

3. Describe the task from the patient's' point of view.

4. What made it too difficult for the patient?

    a. Cognitive demands (complexity of task)?

    b. Physical/perceptual demands?

5. What is essential DSME/S for this patient?

6. Does someone else need to be involved to assure correct DSM?

Case 2: Unintentionally took wrong insulin

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]
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.

National Estimates of Insulin-Related Hypoglycemia
and Errors Leading to Emergency Department
Visits and Hospitalizations
Andrew I. Geller, MD; Nadine Shehab, PharmD, MPH; Maribeth C. Lovegrove, MPH; Scott R. Kegler, PhD;
Kelly N.Weidenbach, DrPH; Gina J. Ryan, PharmD, CDE; Daniel S. Budnitz, MD, MPH
JAMA Intern Med. 2014;174(5):678-686


Humalog
Humalog


HP 8799
Humalog®
100 U/ml
KwikPen™
solution for injection
insulin lispro (rDNA origin)
100 U/ml (3.5 mg/ml)
5 x 3 ml pre-filled pens
Subcutaneous and intravenous use


10 mL
HI0310
Humulin®
100 IU/mL
N
NPH
[human insulin
(rDNA origin)
isophane suspension]
U-100
Lilly
Humulin N
100 IU/mL


Humulin N Pen
NPH
human insulin
(rDNA origin)
isophane suspension
prefilled insulin
U-100


Apidra® SoloStar®
AutoPen®
Byetta® exenatide injection 10mcg
Byetta® exenatide injection 5mcg
Humalog® KwikPen™
Humalog® Mix 75/25® KwikPen™
Humalog® Mix 50/50 KwikPen™
HumaPen® LUXURA® HD
Humulin® N Pen
Humulin® 70/30 Pen
Lantus® SoloStar®
Levemir® FlexPen®
Novo Pen® 3
NovoPen® Junior
NovoLog® FlexPen®
NovoLog® Mix 70/30 FlexPen®
NovoPen® Echo®
SymlinPen® 60
(pramlintide acetate) pen injector
SymlinPen® 120
(pramlintide acetate) pen injector
Victoza® liraglutide injection
For Osteoporosis
Forteo® teriparatide (rDNA origin) injection

Case 2: Unintentionally took wrong insulin

1. What was the error?
2. Describe the patient behavior resulting in the error?
3. Describe the task from the patient's' point of view.
4. What made it too difficult for the patient?
   a. Cognitive demands (complexity of task)?
   b. Physical/perceptual demands?
5. What is essential DSME/S for this patient?
6. Does someone else need to be involved to assure correct DSM?

Case 3: Unintentionally took wrong dose

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

	ED Visits for IHEs		
Precipitating Factor	Cases, No.	Annual National Estimate, % (95% CI)	Illustrative Cases[b]
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.

National Estimates of Insulin-Related Hypoglycemia
and Errors Leading to Emergency Department
Visits and Hospitalizations
Andrew I. Geller, MD; Nadine Shehab, PharmD, MPH; Maribeth C. Lovegrove, MPH; Scott R. Kegler, PhD;
Kelly N.Weidenbach, DrPH; Gina J. Ryan, PharmD, CDE; Daniel S. Budnitz, MD, MPH
JAMA Intern Med. 2014;174(5):678-686

Case 3: Unintentionally took wrong <u>dose</u>

1. What was the error?
2. Describe the patient behavior resulting in the error?
3. Describe the task from the patient's' point of view.
4. What made it too difficult for the patient?
   a. Cognitive demands (complexity of task)?
   b. Physical/perceptual demands?
5. What is essential DSME/S for this patient?
6. Does someone else need to be involved to assure correct DSM?

Case 4: Unintentionally took "additional" dose

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]
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.

National Estimates of Insulin-Related Hypoglycemia
and Errors Leading to Emergency Department
Visits and Hospitalizations
Andrew I. Geller, MD; Nadine Shehab, PharmD, MPH; Maribeth C. Lovegrove, MPH; Scott R. Kegler, PhD;
Kelly N.Weidenbach, DrPH; Gina J. Ryan, PharmD, CDE; Daniel S. Budnitz, MD, MPH
JAMA Intern Med. 2014;174(5):678-686

Case 4: Unintentionally took “additional” dose

1. What was the error?
2. Describe the patient behavior resulting in the error?
3. Describe the task from the patient's’ point of view.
4. What made it too difficult for the patient?
    a. Cognitive demands (complexity of task)?
    b. Physical/perceptual demands?
5. What is essential DSME/S for this patient?
6. Does someone else need to be involved to assure correct DSM?

Case 5: Insulin timing misadventure

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]
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.

National Estimates of Insulin-Related Hypoglycemia
and Errors Leading to Emergency Department
Visits and Hospitalizations
Andrew I. Geller, MD; Nadine Shehab, PharmD, MPH; Maribeth C. Lovegrove, MPH; Scott R. Kegler, PhD;
Kelly N.Weidenbach, DrPH; Gina J. Ryan, PharmD, CDE; Daniel S. Budnitz, MD, MPH
JAMA Intern Med. 2014;174(5):678-686

Case 5: Insulin timing misadventure

1. What was the error?
2. Describe the patient behavior resulting in the error?
3. Describe the task from the patient's' point of view.
4. What made it too difficult for the patient?
   a. Cognitive demands (complexity of task)?
   b. Physical/perceptual demands?
5. What is essential DSME/S for this patient?
6. Does someone else need to be involved to assure correct DSM?

Case 6: Changing doses can be confusing

Changing Doses Can Be Confusing

A woman with newly diagnosed type 2 diabetes mellitus and also on blood pressure and anti-lipid medication was given prescriptions for: glucophage 500mg QD for one week, and then an increase to two 500mg tablets the second week.

On her return appointment, diabetes education was prescribed and the patient was instructed to continue on her other medications. During a review of her treatment regimen during the fourth week after the initial prescription, the patient reported having gastrointestinal side effects.

After questioning the patient further and digging a little deeper, the medical staff discovered that she was taking two 500mg glucophage at bedtime just once weekly.

Switching her schedule to one 500mg tablet before breakfast and dinner cut down on the side effects and improved the blood glucose control by the time she returned for more education three weeks later.

Lesson Learned:

Following up with patients whenever there is a change of medication or dosage can help prevent medication errors.

Diabetes Disaster Averted series:
http://www.diabetesincontrol.com/articles/practicum

Substituting

is more complex

than

adding or

subtracting something.

Case 6: Changing doses can be confusing

1. What was the error?
2. Describe the patient behavior resulting in the error?
3. Describe the task from the patient's' point of view.
4. What made it too difficult for the patient?
    a. Cognitive demands (complexity of task)?
    b. Physical/perceptual demands?
5. What is essential DSME/S for this patient?
6. Does someone else need to be involved to assure correct DSM?

Case 7: Changing insulins—2 long-acting

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.

I advised him that he would not have been prescribed both since they were both long-acting insulins. However the patient insisted he was started on 10 units of Lantus and then was ordered 13 units of Levemir and told to take them both.

After the support group meeting I called his physician's office and advised them of the patient's medication regimen. The medical staff person then told me the 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 doctor's office was very appreciative of my report since the patient had been doing this for 3 months with some low blood sugars in the morning.

Lesson Learned

When changing drug regimens, make absolutely sure the patient understands what is being discontinued, and what medications are being added as replacement(s).

Diabetes Disaster Averted series:
http://www.diabetesincontrol.com/articles/practicum

Case 7: Changing insulins—2 long-acting

1. What was the error?
2. Describe the patient behavior resulting in the error?
3. Describe the task from the patient's' point of view.
4. What made it too difficult for the patient?
    a. Cognitive demands (complexity of task)?
    b. Physical/perceptual demands?
5. What is essential DSME/S for this patient?
6. Does someone else need to be involved to assure correct DSM?

These tasks were low complexity.

Cognitive complexity was minimal.

But

tasks were difficult for these patients,

because their

cognitive abilities were declining.

Case 8

The Power and Dangers of Advertising

Recently a 69 year old man returned to see me after being started on a single bedtime dose of Levemir via the Flex pen along with a long acting sulfonylurea. He had received education about basal insulin action from the start. On return his morning glucose was terrible but I noticed that the rest of the day his glucose was near goal. I began to wonder if his sulfonylurea was working better with the addition of basal insulin but was puzzled by the worsening overnight rise. I was considering lowering the oral dose and increasing the basal dosing to balance glucose control better when he volunteered a critical piece of information nonchalantly....

He proudly announced that he had been listening to NovoNordisk commercials on TV and realized that when you use the Flex pen you need to eat a meal right afterwards. Since he was getting his insulin at bedtime, he decided he should add a fourth meal to the day. This was occurring after his bedtime dose of insulin and AFTER his glucose check.

It was then obvious he did not need a basal rate increase but instruction in the action of Levemir and the difference to the Novolog Flex pen action. If adjustments had been made without changing the dietary cause, this individual may have needed a very high basal dose to control this prandial problem and could have experienced increased hypoglycemia during the day.

Lesson Learned:

Many other sources of information through the media are now available and can be very confusing to a patient. Take time to re-evaluate a patient's understanding of their medications at subsequent visits.

Diabetes Disaster Averted series:
http://www.diabetesincontrol.com/articles/practicum

Case 8: Power and dangers of advertising

1. What was the error?
2. Describe the patient behavior resulting in the error?
3. Describe the task from the patient's' point of view.
4. What made it too difficult for the patient?
    a. Cognitive demands (complexity of task)?
    b. Physical/perceptual demands?
5. What is essential DSME/S for this patient?
6. Does someone else need to be involved to assure correct DSM?

Case 9: “Do not crush, chew or cut”

"Do Not Crush, Chew or Cut"

From the Institute for Safe Medication Practices (ISMP): When a patient is prescribed a timed release medication such as Glucotrol XL or Glucophage XR, clinicians need to ensure that the patients understand that they should not crush, chew or cut these pills. The medications must be swallowed whole.

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....

In some cases pills are coated so the medication won't be released in the stomach where it may cause irritation. In other cases, special coatings or other properties slow the delivery of the medication into the body so that the drug is delivered over a period of time. This is more convenient than having to take a drug several times a day, but if these pills are crushed or chewed, the way they are supposed to work will be destroyed and the medication may go into the body too fast. If that happens, then a large amount of the drug will be released all at once, which could cause side effects or serious harm.

Diabetes Disaster Averted series:
http://www.diabetesincontrol.com/articles/practicum

Case 9: “Do not crush, chew or cut”

1. What was the error?

2. Describe the patient behavior resulting in the error?

3. Describe the task from the patient's’ point of view.

4. What made it too difficult for the patient?

    a. Cognitive demands (complexity of task)?

    b. Physical/perceptual demands?

5. What is essential DSME/S for this patient?

6. Does someone else need to be involved to assure correct DSM?

Case 10: Sugar-free candy

The Wrong "Sugar-Free" Candy

At a recent diabetes education class I give for a local utility company, we went over label reading. The discussion on sugar alcohols was very lively as patients noticed the number of sugar-free foods that contain these products.

I explained that these have little or no effect on raising glucose levels in non-insulin using patients and that, like fiber, they could subtract this number from the total carbs. The Pecan Delights from Russell-Stover were quite popular with only 1 net carb per 2 pieces of candy.

During the next session I asked if they'd tried any of the foods discussed the week before. Most patients reported positive results, and a couple -- who tested their glucose after eating the candies -- found no increase in glucose levels.

However, one gentleman complained that his glucose increased over 100 mg/dl on the 3 occasions he tried the product. I found this odd and others in the class thought he was cheating. He then pulled out the package and my patients saw immediately what was wrong. The fellow had bought "fat free" not "sugar free" -- 4 pieces of this "fat free" candy had 68 carbs rather than the 2 carbs he thought he was getting. His wife picked the candy up at the grocery store for him, mistakenly thinking he wanted "fat free." I am quite proud of these patients for figuring out the solution themselves.

Lesson Learned

Patients are often looking for ways to control their glucose levels without giving up everything they like, so recommending products that can help is a good idea. Ask them to write down the full name and description of specific products recommended though, and also talk to their spouses and any other caregivers about their dietary needs.

Diabetes Disaster Averted series:
http://www.diabetesincontrol.com/articles/practicum

Case 10: Sugar-free candy

1. What was the error?
2. Describe the patient behavior resulting in the error?
3. Describe the task from the patient's' point of view.
4. What made it too difficult for the patient?
    a. Cognitive demands (complexity of task)?
    b. Physical/perceptual demands?
5. What is essential DSME/S for this patient?
6. Does someone else need to be involved to assure correct DSM?

? ? ? ? ?

Contact Info:

kathy.stroh@westsidehealth.org

gottfred@udel.edu