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How to Increase Older Adults' Cognitive Access to Diabetes Self-Care

Linda S. Gottfredson, PhD
Professor Emeritus
School of Education
University of Delaware
Newark, DE

Abstract

Diabetes self-management (DSM) regimens can become too complex, even unsafe, when physical and mental capacities wane with age. Standards in diabetes care recommend matching the complexity of a patient's care regimen to their capacity. Research in adult functional literacy, employment psychology, and accident analysis reveals how the inherent information-processing demands of self-care create special cognitive hurdles and hazards for older persons with diabetes (PWDs).

DSM is More Cognitively Demanding and Hazardous for Older Adults

Adherence to a DSM regimen is possible when its cognitive demands remain within the individual's cognitive reach. Finding a good match between a regimen's cognitive demands and the individual's cognitive capacity requires accurate assessment of both. For older adults assessment is especially difficult because both sides of the equation keep changing as they age. This article describes strategies for keeping DSM cognitively accessible to older adults.

Older adults, especially those with diabetes, accumulate more comorbidities, complications, functional impairments, and geriatric syndromes as they age. Physical aging also erodes the brain's integrity and efficiency, as does the progression of diabetes itself (1). Daily diabetes self-management requires higher levels of physical and mental abilities to successfully control glucose while problem solving to avoid acute complications such as severe hypoglycemia. Older adults who are newly diagnosed are faced with learning and applying a tremendous amount of new information and potentially complex tasks. The complexities of self-care increase while the individual's capacity for dealing with them declines, steadily widening the complexity-capacity gap. Medical standards in diabetes care recommend simplifying nutrition plans and insulin regimens to accommodate low or declining cognitive capacity (1).

Research on insulin-related hypoglycemia and errors (IHEs) among insulin-treated patients illustrates how the complexities of DSM invite patient error and heighten risk of harm, especially among the oldest and frailest. Of the estimated 100,000 insulin-related emergency department visits annually from 2007 – 2011, one-third required hospitalization. Those patients 80 and older were twice as likely to require emergency department visits and five times as likely to require subsequent

hospitalization as those age 65-79 (2). Table 1 shows almost half of these preventable adverse events (46%) were precipitated by "misadventures in eating," such as failing to eat after taking insulin.

Cognitive Accessibility of Everyday Literacy Tasks, By Age

The 1993 National Adult Literacy Survey (NALS) sampled a wide variety of everyday tasks and written materials and administered them to 26,091 Americans ages 16 and older. Table 2 lists typical items at each level of NALS task difficulty. The second set of columns gives the percentages of adults whose proficiency (answering correctly 80% of the time) peaks at each level (3). For example, 17% of this nationally-representative sample of adults age 16-59 topped out at Level 1 tasks (e.g., total the entries on a bank deposit slip, finding the expiration date on a driver's license) while 52% of adults age 70-79 topped out at Level 1. Additionally, 75% of adults over the age of 80 peaked at Level 1. Only a tiny percentage (3%) of younger adults was routinely able to perform tasks at the highest level, 5 (e.g., use table of information to compare two credit cards) while 0% of seniors were able to perform at Level 5. The percentages of American adults who routinely function at Level 2 literacy rise with age: from 44%, 74%, 84%, to 96% across ages 16-59, 60-69, 70-79, and 80 or above (4).

Research demonstrates that error rates balloon when older individuals are asked to perform higher-complexity tasks. Error rates for individuals functioning at literacy Level 1 and 2 rise from 53% to over 90% when they attempt tasks at difficulty levels 3 to 5 (5). To the extent that DSM requires work at these higher difficulty levels, it will overwhelm the vast majority of older adults unless they get intense instruction and/or consistent cognitive support.

Table 1. Insulin-Related Hypoglycemia and Errors (IHEs) by Insulin-Treated Individuals that Precipitated Emergency Department Visits and Hospitalizations, 2007-2011 (2)

Examples of the three most common precipitating errors by insulin-treated patients
1. Took correct insulin but did not eat appropriate meal (46%) • Did not eat • Did not eat enough carbohydrate (only a salad) • Did not count carbohydrates • Counted carbohydrates incorrectly (used g weight of one serving as grams for carbs)
2. Unintentionally took wrong insulin product (22%) • Used up "leftover" insulin • Mixed up bottles for bolus (short-acting) and basal (long-acting) insulins • Used bolus at times when should use basal insulin • Failed to stop old insulin when switched to new one
3. Unintentionally took wrong dose (12%) • Split or chewed time release pills • Based dose on wrong factor • Administered dose improperly

Origins of Task Complexity

NALS researchers found the difficulty level of a task is related to the complexity of information-processing required and is not specific to educational content, format, or modality. Instead, functional literacy calls for generic thinking skills useful for manipulating any kind of information; not simply the acquisition of knowledge, but the application of that knowledge in different situations. DSM tasks are more difficult because good performance requires integrating more pieces of information (glucose readings, carbohydrate content of foods), drawing inferences from it (glucose levels are higher because my morning meal contained more carbohydrate than usual), using more abstract concepts ("good diabetes control"), navigating more complex arrays of information (adjusting meal-time insulin dose for current glucose reading and carbohydrate content of meal), and having to ignore more bits of information that seem relevant but actually are not ("sugar," "added sugar," "natural," "organic," "% DV" on food labels).

DSM is more complex because it involves several quantitative numerical tasks. NALS researchers found quantitative tasks are more difficult when they require multiplying and dividing quantities rather than adding and subtracting, manipulating decimals and fractions rather than whole numbers, and selecting rather than just carrying out the appropriate arithmetic operation (6). Carbohydrate counting and insulin dosing often require competence with all of these quantitative tasks.

DSM is Cognitively Complex

DSM shares key features of the most cognitively demanding jobs (7). Like all complex jobs, DSM is also more than the sum of its individual tasks. It requires scheduling and coordinating different tasks, often in fluid and

Table 2. Selected Tasks and Results, by Age, from the 1993 National Adult Literacy Survey (NALS) of 26,091 American Adults Ages 16 and Older (3)

NALS task difficulty level	% of adults peaking at this literacy level*					Sample NALS tasks
	All adults	By age (4)				
		16-59	60-69	70-79	80+	
5	3	3	1	~0	~0	• Use calculator to determine cost of carpet for a room • Use table of information to compare 2 credit cards
4	15	18	5	3	~0	• Use eligibility pamphlet to calculate SSI benefits • Determine correct change using info in menu
3	31	34	21	13	4	• Use bus schedule to find appropriate bus for given conditions • Write brief letter explaining error on credit card bill
2	28	27	37	32	21	• Determine difference in price between 2 show tickets • Locate intersection on street map
1	23	17	37	52	75	• Total bank deposit entry • Locate expiration date on driver's license

*Percentages are for NALS Document items, but results for Prose and Quantitative scales nearly identical.

ambiguous circumstances. Many of the hypoglycemic emergencies discussed earlier were traced to patients failing to coordinate eating and insulin administration. PWDs are likewise expected to demonstrate a high degree of responsibility, self-direction, criticality of good performance, and independent updating of knowledge.

DSM also calls on PWDs to deal with unexpected situations; learn and recall job-related information; reason and make judgments; identify problem situations quickly; and react swiftly when unexpected problems occur. All are key to controlling blood glucose and avoiding the complications of diabetes. Hypoglycemia unawareness, which is more common among older adults, makes low blood glucose harder to spot. The mental confusion it causes makes hypoglycemia harder to solve, especially for individuals of already low or declining capacity.

Comparisons can also be made between DSM and defensive driving including components of accident prevention (8). DSM includes planning ahead, diligent monitoring, taking immediate corrective action when needed to bring it back into control, and closely examining past adverse events to identify where prevention and mitigation failed, as in the examples of IHEs found in Table 1.

Making DSM More Cognitively Accessible

Clear communication requires removal of needless complexity from patient education materials (big words, confusing sentences) (9). Educators can also choose more user friendly tools such as glucose meters that require fewer steps and have bigger displays. But DSM is inherently complex and requires processing diverse sorts of information. When the cognitive demands of DSM exceed the individual's capacity, some tasks may need to be shifted to caregivers or the job itself simplified. Keeping DSM cognitively accessible requires identifying the most critical self-care tasks. As health risks rise, priority should be given to DSM tasks most likely to help the PWD avoid serious harm and preserve quality of life. Diabetes educators can utilize data from near-misses (those outlined in Table 1) and Diabetes Disasters Averted (10) to help identify high-priority self care behaviors and guide instructions.

Diabetes curricula and patient education materials often use action verbs such as "analyze" and "adjust" which signal heavier cognitive demands for learning and performing a task than do the verbs "remember" and "understand." Many DSM learning objectives call for sophisticated information processing way beyond the capabilities of individuals commonly functioning at NALS literacy levels 1 and 2. What does the self-care objective actually require PWDs to master? How does this information need to be taught for it to be effective? (See Table 3)

Label reading and carbohydrate counting can be very complex tasks.

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Table 3. Bloom's Taxonomy of Educational Objectives, Illustrated with Healthy Eating

More Cognitively Complex

Bloom's Level	Sample Action Verbs	Sample tasks in healthy eating
6. Create	Generate, design, develop, construct, invent, plan	Create contingency plans for delays in meals. Using favorite restaurant's menu, plan for an evening out.
5. Evaluate	Check, assess, detect problems, judge fit or effectiveness	Judge whether portion sizes in meal are appropriate. Judge whether meals are properly timed relative to medication.
4. Analyze	Organize, integrate, distinguish, compare & contrast, find pattern or function	Analyze possible impact of food intake on recent excursions in blood glucose level. Determine need for a snack before exercise.
3. Apply	Execute, implement, carry out, use, measure, calculate	Extract relevant information from food label. Measure appropriate portion size using label. Calculate insulin dose using insulin-carb ratio.
2. Understand	Explain, summarize, describe, paraphrase, classify, compare, match, translate	Describe effects of carbohydrates & other foods on blood glucose level. Explain that all carbohydrates turn into sugar when digested.
1. Remember	Recall , recognize, identify	Identify sources of carbohydrates. Recall that milk, juice, fruit, starches & many condiments contain carbohydrate.

For example, educators can reduce cognitive demands by using simple yes-no rules of thumb when evaluating carbohydrate containing foods for use as a snack. If the carbohydrate content matches their goal, the decision is yes, if carbohydrate content exceeds the goal, then the decision is no. Educators could also prepare a list of acceptable snack choices in commonly available portion sizes that provide similar amounts of carbohydrate. Reading a typical food label with clients can reveal potential stumbling blocks. See Figure 1 for an example of simplifying the label for older adults.

Determine Cognitive Needs and Individualize Instruction Accordingly

The specific content and delivery of DSM instruction should be tailored to an individual's cognitive needs. It can be more difficult to identify educational needs when an individual's ability to articulate problems and provide relevant information decline with memory and reasoning skills. Providers can elicit better information by asking concrete, highly specific questions that require no inferences and by not rushing through an assessment (11). Family members and caregivers may be able to fill gaps or correct errors in the individual's reporting. (see Side Bar 3)

Despite using well-crafted questions, substantial declines in information-processing capacity (fluid intelligence) may not be obvious (12). The enduring benefits of higher fluid intelligence earlier in life (crystallized intelligence) – educational credentials, occupations, sophistication of language, and general knowledge—can camouflage a substantial decline in thinking skills. The degree of cognitive decline may only become evident when practical problems occur with DSM. Which tasks does the PWD find particularly complicated or confusing? How did they interpret the questions and response options on a routine Medicare intake form? Family and caregivers can also describe changes in how much help the individual needs.

Research confirms that individuals benefit most when the type of instruction matches their abilities (13). Those with lower-ability need more time and slower-paced instruction. They also do best when instruction is highly concrete, precise, structured, task specific, hands-on, and complete (i.e., no steps skipped and no inferences required). Subject matter must be broken into small bits and logically ordered, and it must not

KEYS

To Making DSM Cognitively Accessible

Simplify the work

- Focus regimen on most critical tasks
- Simplify tasks to prevent errors

Simplify the instruction

- Identify individual's cognitive needs & supports
- Sequence instruction by complexity of material taught
- Adjust pace and content of instruction to person's capacity & progress in mastering it

PRINCIPLES

For Fitting DSM Instruction to Individual's Cognitive Needs

Individualize. Create a self-care care plan with the patient that takes all aspects of their life and condition into consideration (15).

Differentiate. Adapt the same curriculum content to cognitively diverse individuals by modifying (differentiating) learning objectives, materials, and difficulty level of instruction to accommodate their differences in prior knowledge, cognitive ability, and perhaps interests as well (16).

Contextualize. Promote the learning of foundational skills and knowledge by focusing teaching and learning on concrete applications in a specific context that is of interest to the learner (17).

Scaffold. Provide successive levels of temporary support to help students reach higher levels of comprehension and skill acquisition than they would have been able to achieve without assistance. For example, breaking up a learning experience, concept, or skill into discrete parts, and then giving students the assistance they need to learn each part (18).

SAMPLE QUESTIONS

For Probing Client's Level of Cognitive Need and Capacity

Overall difficulties in managing diabetes

- What's the hardest thing about managing your diabetes right now?
- What happens in your day that makes it hard to stick with your diabetes care routine?

Cognitive difficulties in managing diabetes

- What's most confusing/frustrating when it comes to eating healthy with diabetes?
- Is managing your diabetes getting too complicated to do by yourself?

Cognitive difficulties at specific levels of Bloom task complexity

Remember

- Do you have trouble remembering to take your medicine/eat on time/test your blood sugar/ keep your doctor appointments?

Understand

- Do you need someone to go with you to doctor visits to explain or help you remember what the doctor told you?
- How often do you need someone to help you read instructions and other material from your doctor or pharmacy? (Never, Sometimes, Often, Always) [20]
- What have you been told/understand about eating with diabetes?

Apply

- Does someone help you prepare your meals/organize your medications?
- Does someone help you test your blood sugar?
- When you grocery shop, do you look for information on the nutrition facts label? What do you look for on the nutrition label?

Analyze

- How does/does the label help you decide what to buy?
- Do you use your blood glucose readings to make decisions about eating/medication/exercise?

Evaluate

- What is your blood sugar supposed to be fasting/after meals/at bedtime? [Understands the goals differ] How do you decide whether your blood sugar is actually too high or too low at those times? [*Evaluates* whether excursions from them are actionable]

Create

- How could you improve your diet, if cost were not an issue?
- How could your doctor/family/friends make it easier for you to eat healthy?

[20] Question adapted from Morris MS, MacLean DC, Chew, LD, Littenberg G. The Single Item Literacy Screener: Evaluation of a brief instrument to identify limited reading ability. *BMC Family Practice.* 2006;7:21. doi:10.1186/1471-2296-7-21

be decontextualized (abstracted) from common, everyday familiar experiences. More able learners benefit from instruction that is more theoretical, less structured, and covers more information. As older adults' cognitive capabilities decline, their instruction should shift toward the slower, more concrete, and more complete.

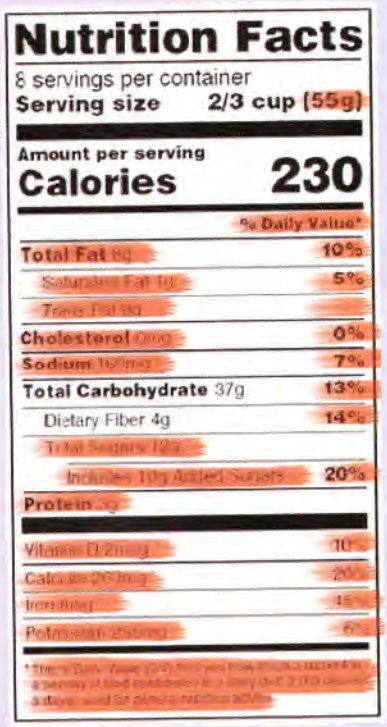
Making Learning More Efficient by Scaffolding

Learning is most efficient when content is taught in order of cognitive complexity. Bloom's Taxonomy of Educational Objectives (14) orders instruction by level of information-processing complexity: Remember, Understand, Apply, Analyze, Evaluate, and Create. A task analysis lists a task's steps in the order to be performed; Bloom's taxonomy lists them in the order to be taught. Table 3 illustrates how to sequence learning objectives for instruction on healthy eating. For example, PWDs must identify carbohydrates (Remember) before they can count them (Apply). Scaffolding also means giving students sufficient practice and support to master each level before moving on. The action verbs at each complexity level also guide how mastery is assessed. For instance, it would not demonstrate competence in figuring out what caused yesterday's excursion in blood glucose (Analyze) to merely explain which factors should be considered (Understand).

Conclusion

People learn and perform best when the information processing required of them is just within their reach, neither too high nor too low, called their zone of desirable difficulty (19). This balance can benefit all PWDs. However, it is more critical for older adults at risk of adverse events. Their regimens and instruction should be streamlined and simplified where possible. When self-care tasks are essential but exceed their cognitive capacity, despite additional instruction, other individuals or support services are needed to help carry the load and ensure safety.

Figure 1- Suggested Simplification of the FDA Nutrition Facts Panel



Source: U.S. Food and Drug Administration. "Changes to the Nutrition Facts Label." Available at https://www.fda.gov/Food/GuidanceRegulation/GuidanceDocumentsRegulatoryInformation/LabelingNutrition/ucm385663.htm. Accessed February 7, 2019.

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Prediabetes in the Older Adult

Mary Jean Christian, MA, MBA, RD, CDE
Diabetes Program Coordinator
University of California, Irvine

Prediabetes prevalence is rising in the older adult population in the United States. According to the Centers for Disease Control and Prevention (CDC) almost half of adults age 65 or older have prediabetes. This article will explore the diagnostic tools to identify the condition and current evidenced-based tools to assist persons with the condition to make lifestyle changes to prevent type 2 diabetes.

Prevalence

According to the latest statistics from the CDC there are 23.1 million adults age 65 or older in the United States with prediabetes. That represents 48.3% of the total older adult population (1).

Diagnosing Prediabetes

The most recent American Diabetes Association (ADA) Standards of Medical Care in Diabetes 2019 guidelines recommend that testing for prediabetes should be considered in adults of any age who are overweight or obese. The body mass index (BMI) criteria is a BMI >=25kg/m2 or >=23kg/m2 in Asian Americans. An elevated BMI coupled with one or more risk factors for diabetes identifies those adults at risk for type 2 diabetes. In addition, all adults age 45 or older should be screened for prediabetes or risk for type 2 diabetes regardless of BMI or risk factors (2). The benefits of screening must be considered in light of several factors such as: life expectancy, serious comorbidities, and the desire and ability of the older adult to participate in rigorous interventions.

The known risk factors for type 2 diabetes in adults age 65 or older as defined by Medicare are in Table 1.

The health care provider (HCP) can use prediabetes risk assessment tools such as the "ADA Diabetes Risk Test" or the CDC's "Prediabetes Risk Test" to identify an individual's risk for type 2 diabetes or prediabetes (3). If the individual meets the assessment tool criteria for high risk, the HCP should order lab tests to identify possible prediabetes. Fasting plasma glucose (FPG), 2-hour plasma glucose during a 75 g oral glucose tolerance test (OGTT) or a hemoglobin A1c (A1c) may be used for testing. The A1c offers specific advantages over the other tests because fasting is not required and it does not require several hours of laboratory testing time. These screening tests are covered by Medicare.

Prediabetes is then identified by lab testing as listed in Table 2 (4).

Diabetes Prevention

Healthcare systems in the United States are increasingly utilizing models of care that can identify at-risk populations and provide improvements in care to decrease the disease burden and cost of care. The HCP may have system level processes in place that guide the care and resources that will be utilized to improve patient outcomes. These may

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ON THE
CUTTING EDGE
Diabetes Care and Education

NAVIGATING CARE FOR THE OLDER ADULT WITH DIABETES

Message from the Theme Editors:

Kathy W. Warwick, RDN, LDN, CDE
Mary Lou Perry, MS, RDN, CDE

Each day in the U.S., 10,000 baby boomers celebrate their 65th birthdays. One in five Americans will be over the age of 65 by 2030 and ten percent of the population will be over the age of 90 in 2050. Estimates are that 98 million adults over the age of 65 will be living in America by 2060. This age group is becoming much more racially and ethnically diverse (1). Currently diabetes affects more than 25% of those over the age of 65. The Centers for Disease Control (CDC) projects that the number of adults (ages 18 to 79) with diabetes will double or perhaps triple by 2050 affecting one in three in this age group (2). One out of every three Medicare dollars is spent on care of those with diabetes. Compared to Medicare beneficiaries without diabetes, the Centers for Medicare Services calculates the cost of care related to diabetes increases the annual expenditure per beneficiary by $1,500 for Part D prescription drugs, $3,100 for hospital and facility services, and $2,700 for physician and other clinical services. In 2016 alone, Medicare spent $42 billion dollars more for care of those with diabetes than those without the diagnosis. In those ages 45-74, diabetes alone is responsible for nearly half of all hospital admissions and more than half of all long-term care or nursing home admissions (3).

Prediabetes affects approximately 86 million adults and 9 out of 10 don't realize they have it. In 2015, nearly half of those adults over 65 had prediabetes with the potential for progression to type 2 if no lifestyle changes are made. Only 14.6% of these older adults were aware of the diagnosis of prediabetes (3).These statistics are staggering for the healthcare system and providers who care for older adults. The historical fee-for-service Medicare system is based on episodic visits and acute care rather than interdisciplinary integrated care for healthy aging with ongoing support between clinic visits. RDNs are uniquely qualified to provide nutrition and lifestyle guidance that can improve the health and quality of life for older adults affected by diabetes or prediabetes. Despite the fact that Diabetes Self Management Education and Support (DSMES) is a covered benefit for those with Medicare, only 5% of eligible beneficiaries take advantage of it.