CHAPTER 73

Dementia and the Rural Emergency Department

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Vignette

A 78-year-old farmer presents to your rural emergency department (ED) with his family for evaluation of exertional chest pain. While initiating your diagnostic evaluation for chest pain (see Chapter 25) his son who resides out-of-town notes that "Dad seems more forgetful than last year. Last night Mom told me that he cannot find the keys to the truck and he forgot his oldest grandchild's name this morning." After carefully inquiring about any recent standing level falls or other trauma, medication changes, or acute illnesses, you contemplate the differential diagnosis of altered mental status (see Chapter 20) and consider the possibility of dementia.

The **key questions** you contemplate are:

1. *How likely is dementia amongst geriatric patients in the ED?*

2. *What are the clinical implications for my ED patient if I do or do not assess for dementia during an emergency care encounter?*

3. *How do I screen for dementia in the ED?*

4. *What do I do with a patient with abnormal dementia screening test results?*

Epidemiology of Dementia in Rural Settings

Because of aging baby-boomers and the successes of modern medicine prolonging individual's anticipated lifespan, geriatric adults continue to present to EDs in unprecedented numbers.[1] However, the contemporary ED practice model was not designed for geriatric care.[2] Consequently, ED healthcare providers rarely screen for geriatric syndromes such as cognitive dysfunction, standing level falls, and baseline functional status.[3] Octogenarians with cognitive dysfunction are a potentially vulnerable subset of patients and many reside at home without a reliable safety net.[4] Multiple studies over the last two decades demonstrate that ED providers fail to recognize cognitive dysfunction in up to 70% of cases.[5-8] Outpatient physicians also commonly miss the diagnosis of cognitive dysfunction.[9, 10]

Cognitive dysfunction includes mild cognitive impairment, delirium, and dementia. We review altered mental status (Chapter 20) and delirium (Chapter 80) elsewhere so this chapter will focus on the diagnosis and management of dementia in rural settings. Dementia progresses from mild cognitive impairment to severe, debilitating dementia.[11] The most common cause of dementia is Alzheimer's Disease, but vascular disease, head trauma, and nutritional deficiencies also cause dementia.[12] Ongoing debate questions the value of non-specialty based dementia screening[13-15] with opponents noting the lack of valid screening instruments and inadequate curative therapy for this chronic, debilitating neurodegenerative disorder. These biases against dementia detection are a form of therapeutic nihilism and represent real-world barriers to detecting dementia.

Even without a cure for dementia, definitive diagnosis provides emergency clinicians, patients and caregivers several potential benefits. First, emergency care providers establish a baseline mental status in the medical record so that future evaluations can more promptly identify altered mental status as a deviation from baseline. Second, healthcare providers who recognize abnormal mental status earlier can re-evaluate the chief complaint and seek additional history for family and friends to ensure that the true reason for the current ED evaluation has been identified. Third, patients and families with concerns for memory deficits have the otherwise ignored opportunity to seek definitive testing and obtain access to ongoing clinical trials for dementia care. Fourth, early diagnosis provides patients with preclinical dementia with the opportunity to establish and communicate decisions about advanced directives and financial commitments with loved ones. Ideally, early stage dementia is identified by primary care providers, but this is the exception rather than the norm.[9]

When formally assessed, approximately 35% of ED adults over age 65 have cognitive dysfunction as defined by a Mini

Mental Status Exam (MMSE) score of less than 24.[8,16] Although no rural ED studies have yet assessed the prevalence or impact of dementia, it is common in rural settings worldwide.[17,18] In fact, patients with dementia may be more common in rural settings than in urban environments.[19] More severe cognitive impairment amongst rural patients is found with increasing age, less formal education, and impaired functional ability.[20] However, rural patients and communities often lack awareness of dementia as a geriatric syndrome limiting impetus to seek medical care.[21] Rural primary care providers are less likely to diagnose dementia compared with their urban counterparts.[22] Consequently, rural dementia patients are less likely to receive neurologist or psychiatrist specialty care.[23] Rural nursing residents are more likely to reside in facilities without accreditations or special care program access, which may promote more frequent transfers to the rural ED for evaluation.[24]

Economic and Clinical Relevance of Dementia to Rural ED Healthcare Providers

Worldwide, over 34 million individuals have dementia, including over 5 million Americans.[25,26] Dementia care costs $150 billion annually in the United States.[27] These expenses include medical visits, pharmaceutical therapy, diagnostic tests, home nursing resources, and institutionalization, as well as non-medical costs such as consumables and professional and non-professional supervision. These costs are often borne by the patient's family.[28] The cost of dementia care worldwide was estimated at $422 billion, a 34% increase between 2005 and 2009.[25] By 2050, the worldwide prevalence of dementia will increase four-fold to about 107 million individuals.[29] It is projected that if 30 years from now dementia interventions can delay cognitive decline by just one-year then over 9 million less individuals would require more expensive, higher levels of

care so the impetus is on the healthcare system to continue to identify dementia patients and develop effective management strategies.[29] The presence of dementia also affects individual patients and healthcare systems. Dementia is independently associated with short-term ED readmissions, functional decline, institutionalization, and increased hospital length of stay.[30-32]

Screening for Dementia in the Rural ED

Geriatric patients do not present to the ED with the chief complaint that "I have dementia". Instead, they (or their caregivers on their behalf) present with distinct constellations of symptoms, impairments, and concerns that the astute physician molds into a diagnosis using the art and science of medicine.[33] Dementia will only be identified in the ED by proactive case finding, but the screening does not require a physician's expertise. Physician extenders, nurses, students, or volunteers can screen for dementia using validated, ED-appropriate instruments.[3]

Traditional instruments to assess for dementia in the clinical setting require time, equipment, training, and personnel that are not readily available in most EDs. Examples of these lengthy instruments include the MMSE and the Montreal Cognitive Assessment instruments.[34,35] Brief dementia screening instruments for rural environments have been derived, but await validation in ED settings where acute illness-related distress and discomfort, as well as the chaotic milieu, can affect cognitive assessment diagnostic test performance.[36,37] The ideal ED screening instrument (for dementia or anything else) would be brief (< 2 minutes to administer), sufficiently accurate to rule-in (positive likelihood ratio >10) or rule-out (negative likelihood ratio < 0.1) dementia, easy to remember without requiring special equipment, and acceptable to patients. Unfortunately, this dementia-screening instrument does not exist.[38] However, geriatric emergency medicine researchers recently validated several instruments with negative likelihood ratios ≤ 0.10 (**Table 1**).[8,16] We will present four of these ED-appropriate screening

TABLE 1: Diagnostic Test Characteristics of ED-Validated Dementia Screening Instruments

	Sensitivity % (95% CI)	Specificity % (95% CI)	Positive Likelihood Ratio (95% CI)	Negative Likelihood Ratio (95% CI)
SBT	95 (88-98)	65 (61-67)	2.7 (2.2-3.0)	0.08 (0.03-0.2)
BAS	95 (88-98)	52 (48-54)	2.0 (1.7-2.2)	0.10 (0.03-0.3)
O3DY	95 (85-99)	51 (46-53)	2.0 (1.6-2.1)	0.10 (0.03-0.3)
cAD8	83 (71-91)	63 (55-68)	2.2 (1.6-2.8)	0.27 (0.1-0.5)

Abbreviations: Confidence Interval (CI), Short Blessed Test (SBT), Brief Alzheimer's Screen (BAS), caregiver-administered AD8 (cAD8).

instruments beginning with the most feasible, least complex and progressing to the more time-consuming, more accurate instruments. We propose the algorithm in **Figure 1** as one pragmatic approach for cognitive dysfunction screening in the rural ED.

The Ottawa 3DY (**Figure 2**) is the easiest instrument to use. It consists of 4 simple questions that the healthcare provider or designated screener can ask while the patient awaits ED evaluation.[39] Any incorrect response is an "abnormal" Ottawa 3DY result and merits additional testing, usually outside of
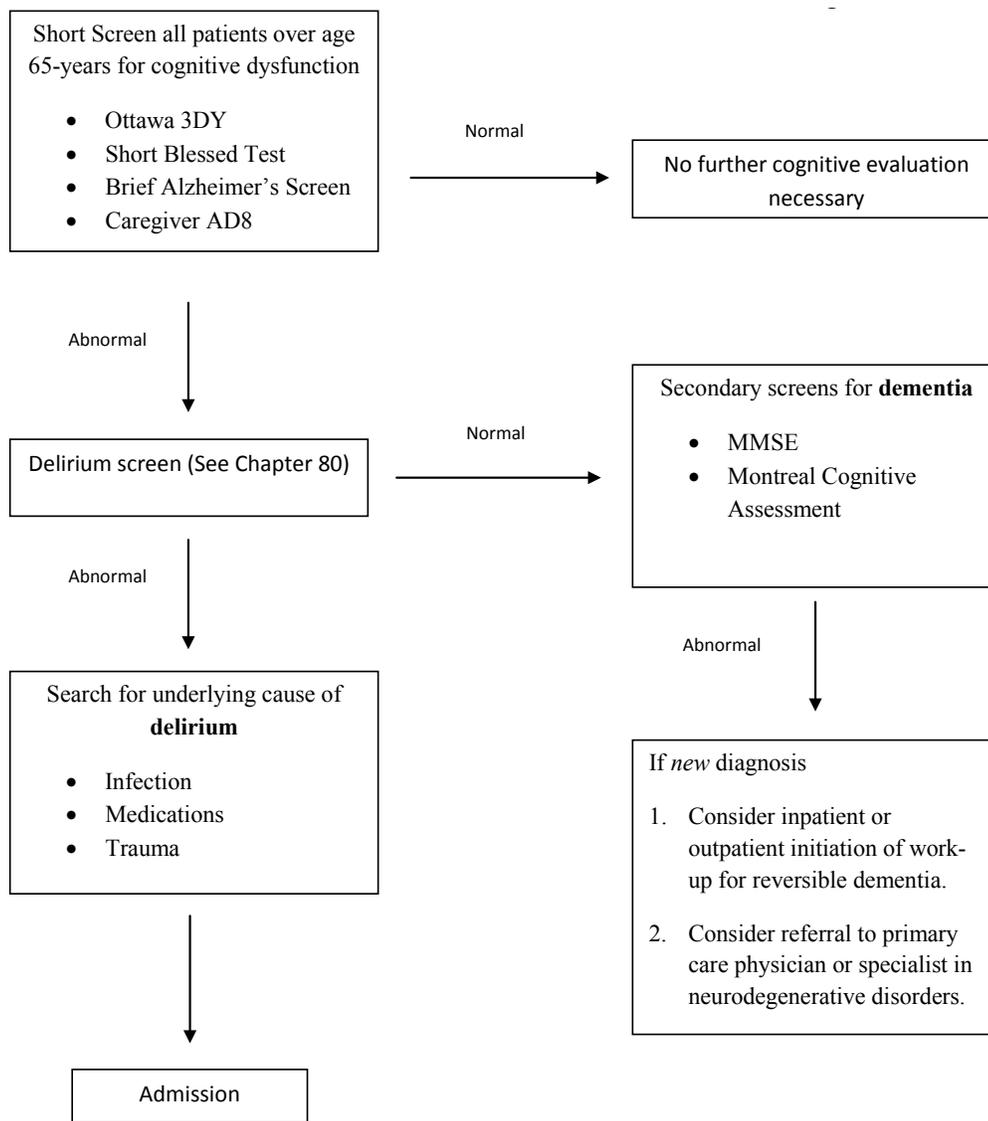
FIGURE 1: Rural ED Dementia Screening Protocol

Short Screen all patients over age 65-years for cognitive dysfunction

- Ottawa 3DY
- Short Blessed Test
- Brief Alzheimer's Screen
- Caregiver AD8

→ **Normal** → No further cognitive evaluation necessary

↓ **Abnormal**

Delirium screen (See Chapter 80)

→ **Normal** → Secondary screens for **dementia**

- MMSE
- Montreal Cognitive Assessment

↓ **Abnormal**

Search for underlying cause of **delirium**

- Infection
- Medications
- Trauma

↓

Admission

(from Secondary screens) ↓ **Abnormal**

If *new* diagnosis

1. Consider inpatient or outpatient initiation of work-up for reversible dementia.

2. Consider referral to primary care physician or specialist in neurodegenerative disorders.

FIGURE 2: Ottawa 3DY

1. What day is today? — Correct — Incorrect

2. What is the date? — Correct — Incorrect

3. Spell "world" backwards — Number Correct   0   1   2   3   4   5

4. What year is this? — Correct — Incorrect

A single incorrect response on any of these four items is consistent with cognitive impairment

the ED. The Short Blessed Test (**Figure 3**) is the next most feasible dementia-screening instrument, consisting of six basic questions and cognitive tasks.[40] Patient's responses are noted and screeners then score the Short Blessed Test based upon an algebraic weighting formula. The Brief Alzheimer's Screen (**Figure 4**) consists of four questions and cognitive tasks with scoring based upon an algebraic interpretation of correct and incorrect responses.[41] The AD8 (**Figure 5**) consists of eight

FIGURE 3: Short Blessed Test

Instructions to the patient: Now I would like to ask you some questions to check your memory and concentration. Some of them may be easy and some of them may be hard.

		Correct	Incorrect
1.	**What year is it now?**	0	1
2.	**What month is this?**	0	1

Please repeat this name and address after me:

John Brown, 42 Market Street, Chicago; John Brown, 42 Market Street, Chicago; John Brown, 42 Market Street, Chicago *(underline words repeated correctly in each trial)*

Trials to learn _____ *(if unable to do in 3 trials = C)*

3. **Without looking at your watch or clock, tell me what time it is. (If response is vague, prompt for specific response within 1-hour)hat year is it now?**

	Correct	Incorrect
	0	1

4. **Count aloud backwards from 20 to 1 (mark correctly sequenced numerals—if subject starts counting forward or forgets the task, repeat instructions and score one error)**

0   1   2   Errors

20   19   18   17   16   15   14   13   12   11   10   9   8   7   6   5   4   3   2   1

5. **Say the months of the year in reverse order. If the tester needs to prompt with the last name of the month of the year, one error should be scored—mark correctly sequenced months.**

0   1   2   Errors

D   N   O   S   A   JL   JN   MY   AP   MR   F   J

6. **Repeat the name and address you were asked to remember. (John Brown, 42 Market Street, Chicago)**   *0   1   2   Errors*

_____, _____, ___, _____, _____, _____

Item	Errors	Weighting Factor	Final Item Score
1		x4	
2		x3	
3		x3	
4		x2	
5		x2	
6		x2	

Sum Total (range 0-28)

0-4 = normal cognition

5-9 = questionable impairment

≥ 10 = impairment consistent with dementia

FIGURE 4: Brief Alzheimer's Screen

Instructions to the patient: I would like to ask you some questions that ask you to use your memory. I am going to name three objects. Please wait until I say all three words, then repeat them. Remember what they are because I am going to ask you to name them again in a few minutes.

Please repeat these words for me: APPLE, TABLE, PENNY *(may repeat names 3 times if necessary, repetition not scored)*

Did the patient correctly repeat all three words? **Yes** **No**

1. **What is the date? (D)** Correct Incorrect

2. **Name as many animals as you can in 30-seconds. (A)** _____ (number)

3. **Spell "world" backwards (S)** Number Correct 0 1 2 3 4 5

4. **Three-item recall (R)** Number Correct 0 1 2 3 4 5

Brief Alzheimer's Screen = (3.03 x R) + (0.67 x A) + (4.75 x D) + (2.01 x S)

BAS ≤ 26 is consistent with dementia

FIGURE 5: AD8

If the patient has an accompanying reliable informant, they are asked the following questions.

Has this patient displayed any of the following issues? Remember a "yes" response indicates that you think there has been **a change in the last several years** caused by thinking and memory (cognitive) problems.

1. **Problems with judgment (for example, falls for scams, bad financial decisions, buys gifts inappropriate for recipients)?**
2. **Reduced interest in hobbies/activities?**
3. **Repeats questions, stories, or statements?**
4. **Trouble learning how to use a tool, appliance, or gadget (VCR, computer, microwave, remote control)?**
5. **Forgets correct month or year?**
6. **Difficult handling complicated financial affairs (for example, balancing checkbook, income taxes, paying bills)?**
7. **Difficulty remembering appointments?**
8. **Consistent problems with thinking and/or memory?**

Each affirmative response is one-point. *A score of ≥ 2 is considered high-risk for cognitive impairment.*

yes/no questions related to the clinical effects of dementia on daily life.[42] ED personnel screening for dementia can administer the AD8 to either a patient or their caregiver (cAD8), which can be useful for non-communicative or critically ill ED patients.

Using Bayesian logic, healthcare providers can estimate the probability of dementia for these patients.[43,44] What is Bayesian logic and how exactly is this computation accomplished in a busy ED? One needs only a pre-test probability estimate and the diagnostic accuracy (sensitivity and specificity or likelihood ratios) for the screening test. ED research indicates that the pre-test probability of dementia in patients 65 years

or older is approximately 35%.[8, 16, 38] Next, using the ED-based diagnostic accuracy estimates from Table 1, evidence-based clinicians can derive estimates for the presence of dementia. For example, assume that the Brief Alzheimer's Score is 12, which is abnormal with a positive likelihood ratio of 2.0. One can use readily available websites (example http://www.dokterrutten.nl/collega/LRcalcul.html) as depicted in **Figure 6**. These computer-based resources are particularly useful to bypass the onerous mathematics underlying Bayesian analyses. We demonstrate the computations underlying Bayesian quantification of post-test probability in **Figure 7**. The Brief Alzheimer's Score of 12 yields a

FIGURE 6: Example of Online Bayesian Calculator (http://www.dokterrutten.nl/collega/LRcalcul.html)

Bayesian Calculator

The bayesian formula (posterior odds = LR x prior odds) is awkward in daily use, because we prefer chances over odds.

With a computer it is very easy to do the necessary calculations. In the Flash movie below the formula is integrated.

You just have to give the prior chance, like 20 (%), and the LR, like 5.5, and click the button with your mouse.

Bayesian calculations
use positive numbers

Prior chance = | 35 | %

Likelihood Ratio = | 2.0 |

Click button to
calculate posterior chance   =   51.8 %

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FIGURE 7: Mathematics of Bayesian Analysis

> Pre-test probability = 35%
> Positive likelihood ratio = 2.2

Step 1: Convert Pre-test Probability to Pre-test Odds
Odds = [Probability/(1-Probability)] = [0.35/(1-0.35)] = 0.35/0.65 = 0.538

Step 2: Multiple Pre-test Odds by Likelihood Ratio to Obtain Post-test Odds
Post-test Odds = Pre-test Odds * Likelihood Ratio = 0.538 * 2.2 = 1.184

Step 3: Convert Post-test Odds to Post-test Probability
Probability = [Odds/(Odds+1)] = [1.184/(1+1.184)] = 0.54

52% probability of dementia. On the other hand, using the same principles a Brief Alzheimer's Score ≤ 4 (negative likelihood ratio 0.10) produces a post-test probability for dementia of about 4%. Excel-based calculators are provided with the electronic version of this chapter to perform these computations for ED screeners and bedside clinicians. The AD8 is now available on iTunes as a fee application. In addition, fee-based tablet- and smartphone-based platforms like PEPID® (http://www.pepid.com/) now provide these dementia-screening calculators to clinicians in easy-to-use formats.

Note two key facts about the Bayesian process in screening for dementia in the ED. First, none of these dementia-screening instruments is diagnostic. A diagnostic instrument would yield post-test probabilities for dementia nearing 0% (to rule-out) and 100% (to rule-in). In particular, these screening instruments are inadequate to significantly increase the probability of dementia with positive likelihood ratios ranging 2.0-2.7. Emergency physicians cannot diagnose or exclude dementia with these instruments. Instead, they can only provide direction for patients as to whether more time-consuming and definitive testing is indicated. Second, we do not know the exact accuracy for any of these instruments (or for most diagnostic tests in medicine). Each estimate from the research setting is accompanied by confidence intervals in **Table 1**. These confidence intervals should be considered when evaluating the merits of a diagnostic test. Specifically, would the clinical interpretation and associated actions differ significantly if the true diagnostic accuracy were one extreme of the confidence interval? If so, the diagnostic test is probably less useful. For example, the Brief Alzheimer's Screen's 95% confidence interval is 1.7 to 2.2 so the post-test probability for dementia is somewhere between 48% and 54%, although our best guess is 52% based upon the point estimate for the test's diagnostic accuracy.

Responding to Abnormal Dementia Screening Results in the Rural ED

Awareness of disease alone does not equate to better outcomes in any setting. The most pertinent challenge of using dementia-screening results in rural emergency medicine is what to do with the information. Since the screening test interpretation is not definitive, simply informing patients may produce undue anxiety without promoting recovery from the illness that brought them to the ED. Similarly, notifying caregivers may also yield unwarranted stress. A paucity of evidence exists to guide rural practice in general and dementia care is no exception.[45,46] However, some research indicates that patients and their family value screening.[47]

Emergency clinicians in rural and austere practice-settings face another challenge in managing patients with abnormal dementia screening test results. Dementia and memory service providers must address the stigma related to this diagnosis, particularly in rural areas.[48] Healthcare providers in rural settings have identified inadequate access to consultants, as well as insufficient community support and educational resources as barriers to routine dementia screening.[49] Local leaders need to target pre-hospital and hospital (nurse, emergency/primary care/specialty clinicians, and administration) leadership and outpatient resources in order to develop reliable dementia care protocols. Nursing leadership is essential to building sustainable dementia care programs within a community.[50,51] Although administrators recognize the demographic imperative of dementia within the context of a rapidly aging society, locally pertinent financial data will be needed to propel rural-based dementia care initiatives forward.[51] Primary care clinicians must be included within dementia care protocols,[52] but the most readily identified rural barrier to standard dementia testing and ongoing care is lack of access to dementia specialists.[53]

Dementia diagnosis and ongoing management is a collaborative effort that transcends medical specialization and compartmentalized care.[54] Fortunately, evolving technology is providing rural patients and practitioners with increased access to sub-specialty care. Specifically, telemedicine is demonstrating an increasing role in knowledge translation for a variety of high-intensity acute medicine evaluations.[55] Rural telemedicine dementia "clinics" are mutually acceptable to patients and healthcare providers, yielding enhanced clinical decision-making, more timely access to specialty care with fewer visit cancellations, and better follow-up for complex patients.[56-58] Evaluating local dementia service availability as well as collaborative continuing medical education resources for nurse, physician assistant, and physician staff also promotes more rapid uptake of academic research knowledge.[59] Successful in-person[60, 61] or remote videoconference[62] dementia training workshops have been described.

Unanswered Questions and Future Directions

Multiple uncertainties exist about the optimal emergency care of aging adults with many opportunities for rural investigators to explore diagnostic and therapeutic models of care.[63, 64] Questions related to dementia care in the rural environment include

- Identification of the most feasible, diagnostically accurate and reliable dementia-screening instrument;

- Reproducibility of ED cognitive screening test results (are acutely ill patients less apt to display their baseline cognitive status?);

- Pragmatic screening personnel and strategies in the midst of increasing ED volumes and declining reimbursements;

- Patient and caregiver screening test result communication strategies to facilitate shared decision making;

- Efficacy and cost-effectiveness of dementia screening in improving ED chief complaint diagnostic accuracy, length of stay, and readmission rates.

Vignette Resolution

Working through the algorithm in Figure 1, your patient has an abnormal Ottawa 3DY screening test so you proceed to a formal delirium screen (see Chapter 80) which is "negative" for acute delirium. Lacking any history or physical exam evidence of trauma, you do not pursue a head CT but initiate an evaluation for acute coronary syndrome in the ED. The initial EKG is unchanged and non-diagnostic, and the first troponin is non-elevated. He displays no fluctuation in mental status during the three-hour course of care in your ED. He denies any chest pain while in the ED and his blood pressure is well-controlled, so after prescribing aspirin you call his primary care provider recommending admission to the hospital for provocative cardiac testing. While on the telephone with the primary care physician, you report the abnormal Ottawa 3DY screening test result and discuss further confirmatory testing, either in the hospital or after discharge. The primary care physician explains that she typically does not test for dementia because her rural clinic does not have access to dementia specialty care and no effective therapeutic strategies exist in 2014 anyway. You note that a rapidly expanding network of telemedicine services exist to provide rural dementia subspecialty care and the primary care physician states that she will explore those resources. You inform the patient and his family of the cardiac and cognitive test results, as well as the need for more definitive testing for dementia and the availability of telemedicine resources to expedite these work-ups. After answering their questions, you receive thanks for your thorough geriatric emergency care and resource awareness within your healthcare setting.

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