Cognitive-Linguistic Interventions for Persons With Dementia

A Practitioner’s Guide to 3 Evidence-Based Techniques

Nidhi Mahendra, PhD, CCC-SLP; Amanda Scullion, BA; Cassandra Hamerschlag, BA

The purpose of this article is to present practitioners with current empirical evidence on 3 nonpharmacological, cognitive-linguistic interventions for persons with dementia. We begin with a brief review of cognitive-communicative functioning in Alzheimer disease, followed by presenting rationale for conducting comprehensive assessments and systematic interventions for persons with dementia. We then review recently published evidence and new empirical data on the treatment outcomes of 3 contemporary intervention approaches—spaced retrieval training, use of memory books and wallets, and Montessori-based interventions. These interventions were selected on the basis of high quality, replicable evidence of positive treatment outcomes, interdisciplinary appeal, and potential for optimizing functioning and quality of life of persons with dementia and their caregivers.

Key words: Alzheimer disease, cognitive impairment, cognitive-linguistic training, Montessori

The syndrome of dementia is characterized by pervasive memory impairments and the impairment of at least 1 other cognitive domain, including executive function, language, praxis, or visuospatial ability. For a clinical diagnosis of dementia, these impairments must occur in the absence of delirium and be severe enough to interfere with a person’s social participation, occupation, and daily living. Alzheimer disease (AD) is the most common cause of dementia, accounting for 60% to 80% of all diagnosed persons, followed by vascular dementia. Approximately 5.3 million Americans currently have AD, and the prevalence of AD is greater in women than men and among older adults of African American and Hispanic ethnicity.

Dementia is a progressive syndrome. However, it has a long trajectory and, in AD, postdiagnosis survival duration ranges from 7 to 10 years for persons diagnosed in their 60s and 70s. Furthermore, multiple researchers have demonstrated that persons with dementia (PWD) have spared neuropsychological abilities at each stage of dementia severity and can benefit from specific pharmacological and nonpharmacological, cognitive interventions that enhance functioning and quality of life. Historically, clinicians and caregivers have been plagued with “therapeutic nihilism,” a negative attitude entailing assumed limited potential of PWD to benefit from cognitive interventions. Yet, this type of attitude is increasingly being rejected by researchers, clinicians, and consumers in light of mounting empirical evidence to the contrary and important observations. First, PWD are being diagnosed and identified much earlier in the disease process, at a time when they are prime candidates for interventions that build cognitive reserve and neuroplasticity. Second, many studies have been made and continue to be made in developing novel pharmacological treatments for AD and related dementias. Third, neuroscientists have made significant advances in understanding experience-dependent neuroplasticity and have identified behavioral interventions and experience as critical for optimizing such plasticity after brain damage. Fourth, researchers have begun to demonstrate that PWD have superior treatment outcomes when provided a synergistic combination of pharmacological and nonpharmacological behavioral interventions compared to drug treatment alone.

In this article, we invite practitioners to revisit the importance of cognitive linguistic interventions for PWD and to examine state-of-the-art evidence on 3 influential therapeutic approaches. The 3 approaches that we detail in this article are spaced retrieval training (SRT), interventions using memory books and memory wallets, and Montessori-based interventions (MI). Throughout the article, we focus on AD, because it is the most common cause of dementia, and most published studies most often include findings from persons diagnosed with AD. To facilitate readers in re-framing the way in which dementia is defined, we begin by discussing both impaired and the overlooked but well-documented, spared cognitive-communicative abilities in AD.

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COGNITIVE-COMMUNICATIVE FUNCTION IN AD: IMPAIRED AND SPARED ABILITIES

In this section, a brief review is provided of attention, executive function, and memory impairments resulting from AD. Attention is the gateway to what happens in the rest of human cognition. It is “the ability to focus on sensations received from the environment and internal needs and desires.” Along with the hallmark episodic memory (EM) deficits, impairments of attention are among the first to appear in AD. Attention may be categorized as selective attention (ie, focusing on a specific stimulus), sustained attention (ie, maintaining focus on a stimulus for a specific length of time), divided attention (ie, simultaneously attending to multiple stimuli/tasks), or attention switching (ie, shifting attention from one task to another). Whereas persons with AD are easily distracted and have early-appearing attention impairments, researchers have shown that in the early stages, sustained attention and divided attention are somewhat spared, whereas all aspects of attention are impaired in mild dementia. Because sustained attention is preserved in early stage AD, persons can typically follow 2-step and 3-step commands and carry on conversations. By the middle stages of AD, typically 4 to 10 years after diagnosis, individuals can usually follow 2-step commands, participate in standardized testing, and make relevant statements about tangible stimuli in conversation. In the late stages of AD, corresponding with the final 1 to 3 years of the disease, persons with AD are still able to attend to pleasant stimuli (eg, music).

Executive function encompasses multiple higher-order cognitive abilities such as decision making, planning, self-monitoring, initiation, organization, cognitive flexibility, and inhibition. In AD, significant executive function impairments appear in the very early stage of AD and precede impairment of praxis (ie, ability to carry out a skilled motor activity such as dressing or using utensils to self-feed) or communication. Next, we detail the impact of AD on human memory systems. Human memory is widely agreed upon to consist of 2 primary aspects—shorter-duration sensory and working memory (WM) versus long-term memory. Long-term memory (Figure 1) consists of 2 neuroanatomically and functionally distinct systems of stored knowledge—declarative or explicit memory and nondeclarative or implicit memory. Working memory is “a dynamic, short-term, limited capacity buffer that enables storing information briefly and actively manipulating it while it is being processed.” It has multiple components, with some more affected by AD than others. An example of one type of WM called the articulatory or phonologic loop is when we repeat a phone number to ourselves to remember it long enough to dial it. Impairments of WM and EM appear earliest in AD. These impairments of WM interact with selective attention deficits, also present in AD to make persons less efficient at encoding information. In general, WM deficits worsen with increasing dementia severity. Yet, persons with AD retain simpler aspects of WM capacity, as demonstrated on digit span tasks (ie, being able to remember a short string of numbers in sequence).

Episodic memory is a component of declarative or explicit memory that allows us to consciously recall episodes and events. An example of an EM problem in AD may be having a telephone conversation with someone and minutes later, having no recollection of the specific details of this conversation. The neuropathology distinctive of AD begins in brain areas important to EM—specifically the hippocampus and the entorhinal and perirhinal cortices in the medial temporal lobe (Table 1). Thus, early-appearing and severe EM impairments are the hallmark of AD and are required for its clinical diagnosis. In contrast, semantic memory (ie, knowledge of facts and conceptual knowledge of the world) is more spared early on than EM. Next, we discuss nondeclarative memory in AD.

Nondeclarative memory (Figure 1) consists of habits, procedural memory, priming, and conditioned responses. Habits are well-rehearsed and almost automatic, behavioral
TABLE 1  
Major Memory Systems and Associated Neurobiological Substrates22,29

<table>
<thead>
<tr>
<th>Memory System</th>
<th>Neurobiological Substrates</th>
</tr>
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<tbody>
<tr>
<td>Working memory</td>
<td>Frontal Lobes</td>
</tr>
<tr>
<td></td>
<td>Dorsolateral prefrontal cortex (DLPFC)</td>
</tr>
<tr>
<td></td>
<td>Broca’s area</td>
</tr>
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<td></td>
<td>Inferior parietal and inferior temporal cortices</td>
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<tr>
<td></td>
<td>Occipitoparietal cortex</td>
</tr>
<tr>
<td>Declarative memory</td>
<td>Medial temporal lobe (hippocampus, entorhinal cortex, perirhinal cortex, parahippocampal cortex)</td>
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<tr>
<td></td>
<td>Basal forebrain</td>
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<tr>
<td></td>
<td>Amygdala</td>
</tr>
<tr>
<td></td>
<td>Lateral temporal lobe, thalamus, and hypothalamus</td>
</tr>
<tr>
<td></td>
<td>Sensory association cortices</td>
</tr>
<tr>
<td></td>
<td>Modulated by estrogen and acetylcholine</td>
</tr>
<tr>
<td>Nondeclarative memory</td>
<td>Corticostriatal system (i.e. reciprocal connections between the cortex and the basal ganglia, via the thalamus)</td>
</tr>
<tr>
<td></td>
<td>Cerebellum</td>
</tr>
<tr>
<td></td>
<td>Primary motor and sensory cortices</td>
</tr>
<tr>
<td></td>
<td>Modulated by dopamine</td>
</tr>
</tbody>
</table>

Adapted with permission from Mahendra, N. and Apple, A. (November 27, 2007). Human memory systems: A framework for understanding dementia. The ASHA Leader, 12, 8-11.

routines that we use daily. Procedural memory enables an individual to learn motor and cognitive skills through repeated practice and performance. Priming is an unconscious ability to detect, identify, or respond to a stimulus favorably after recent exposure to it or a related stimulus. Finally, conditioned responses are automatically produced behaviors that are induced by a specific stimulus.23 There is substantial evidence that persons with AD have spared aspects of implicit memory,27-29 likely because brain areas responsible for this type of nondeclarative memory remain spared until later stages of AD.

Individuals with AD can benefit from interventions designed to take advantage of their relatively preserved implicit memory abilities and to minimize demands on WM and EM.9,30,31 Next, we discuss language production, its comprehension, and functional communication in AD.

As a direct result of these aforementioned memory impairments in AD, production and comprehension of spoken and written language as well as functional communication are affected. These impairments worsen as AD progresses and dementia severity increases. Persons with AD are able to comprehend most of what they hear and read but then quickly forget it. The form of language (eg, phonology and syntax) often remains relatively spared throughout AD, even when meaningful verbal output has diminished significantly in later stages. Anomia, that is, the inability to retrieve the name of an item, becomes common as AD progresses and semantic content of language becomes empty with less cohesion and frequent repetition of ideas. In the middle stages of AD, affected persons can hold small amounts of information in WM and are able to repeat single words or short phrases.7 In the late stages of AD, individuals frequently retain nonverbal, social communicative behaviors such as shaking hands and waving.32

Functional communication includes automatic, over-learned communication actions, pragmatics or the social use of language, and other skills that support activities of daily living.7,33,34 These communication abilities change significantly over the course of AD. In early stages of AD, individuals can answer open-ended questions and contribute meaningfully to discussions while adhering to turn-taking conventions. Yet, as AD progresses, persons become less adept at following conversational rules, interpreting abstract or nonliteral language (eg, in idioms, metonymies, or sarcastic remarks), and using conversational repair strategies35 and struggle with cognitively demanding communicative activities36 (eg, those requiring reading or calculating). In the middle stages of AD, the ability to produce stereotypical social utterances and to greet, name, converse, and express basic needs remain somewhat preserved.32,34 In the late stages of AD, functional communication is markedly reduced and discourse impairments are prominent. These are characterized by echolalia (repetition of another speaker’s utterances), incoherent statements, utterance of nonsense syllables, or muteness (being unable to use speech to communicate). Yet persons with late-stage AD may be able to answer simple yes/no questions, read single words aloud, and retain the ability to greet others or respond appropriately to a compliment.35 It must be emphasized that if the aforementioned spared communicative abilities can be utilized, persons with AD may successfully participate in and benefit from cognitive interventions.

SPARED ABILITIES IN DEMENTIA:
EXTENDING THE PURPOSE OF COMPREHENSIVE ASSESSMENT
Having discussed spared abilities in AD, it is important to reflect on the scope and purpose of a comprehensive assessment for a PWD. Undoubtedly, key goals of a comprehensive assessment are to establish a clinical diagnosis, rule out alternative explanations for cognitive impairments, and quantify the severity of cognitive-communicative deficits. Such assessments for staging dementia severity23,35 are well established, widely used, and enable clinicians to generate meaningful profiles of cognitive domains that are most spared versus most impaired. Another important, yet often overlooked, purpose of an assessment is to yield objective
evidence of restorative potential and to provide data that explicitly demonstrate the candidacy of a PWD for a specific intervention. Indeed, the Centers for Medicare and Medicaid Services require such evidence to be present in assessment reports to favorably reimburse claims for therapeutic interventions provided.36

A thorough understanding of spared abilities that are retained at various stages of dementia allows clinicians to showcase a patient’s restorative potential and to capitalize on these strengths when designing interventions. Key spared abilities in persons with mild to moderate AD include aspects of attention, recognition memory (ie, being able to identify or recognize previously presented stimuli), implicit and procedural memory, and somewhat spared semantic memory, responsiveness to cueing (ie, benefiting from a verbal or nonverbal prompt) and select functional and social communication abilities. Standardized assessments are very useful in identifying dementia and quantifying the severity of resulting cognitive impairments. However, alternative testing approaches are better suited to reveal evidence of the ability of PWD to participate in and benefit from a specific intervention or therapeutic strategy. Such approaches include dynamic assessment techniques37 that incorporate test-teach-retest methodology, use of rating scales, environmental observation, and documentation of participant response to a brief trial of an intervention strategy.

INTERVENTIONS

Cognitive-linguistic interventions may be direct or indirect. Direct interventions are those in which PWD participate in restorative or compensatory programs.10 These are contrasted with indirect interventions, which impact the functioning of PWD through training of professional and personal caregivers, environmental modifications, and the development of meaningful and stimulating therapeutic activities.38 Another method of categorizing interventions is with regard to their intended impact. The World Health Organization39 has developed a conceptual framework—the International Classification of Functioning, Disability, and Health (Figure 2)—that illustrates how dementia affects an individual at 3 levels. Thus, dementia affects a person’s body functions and structures (ie, a person’s physiological or psychological functioning), activities (ie, ability to complete specific tasks), and participation (ie, being able to participate fully in life roles). A person’s performance at each level is, in turn, impacted by environmental and personal factors. Hopper40 stresses that the purpose of designing and administering skilled interventions to PWD is not to alter their body functions and structures or underlying impairment but to impact a person’s activity and participation despite his or her dementia diagnosis.

FEATURES OF A SUCCESSFUL INTERVENTION FOR PERSONS WITH DEMENTIA

In this section, we emphasize important features that render an intervention more likely to succeed for PWD. Based on emerging principles of experience-dependent neuroplasticity14 and published research1,9,10, these features are as follows:

a. Providing repeated presentation of target information;

b. Incorporating learning by doing and requiring active generation of target responses;

c. Reducing the possibility of errors during initial learning;

d. Tapping into relatively spared sustained attention and minimizing distractions; and

e. Using rich, tangible sensory stimuli and meaningful cues to support retrieval.

These features are all exemplified in the 3 interventions reviewed in this article. We selected SRT,41-43 memory books and wallets,44,45 and MI46,47 for discussion in this article. These 3 techniques were chosen for analysis based on the quality of available scientific evidence supporting their use, strong evidence of positive treatment outcomes for PWD, and their potential to address the activity and participation levels of World Health Organization’s framework.39 Furthermore, these techniques have interdisciplinary appeal and have been successfully implemented by clinicians and researchers from multiple disciplines (recreational activities, speech-language pathology, occupational therapy, physical therapy, and nursing).

Intervention 1: spaced retrieval training

Description and existing evidence

Spaced retrieval training was first detailed by Landauer and Bjork48 as a technique for enhancing episodic recall in healthy young adults. Later, in a landmark study, Schacter et al49 reported on the efficacy of SRT for teaching face-name associations to individuals with memory disor-
ders. Subsequent to these early studies, Camp adapted SRT for persons with AD. Spaced retrieval training is best conceptualized as a shaping paradigm applied to memory training and has been used with considerable success for facilitating new learning of facts and procedures in persons with early-stage, mild, and moderate dementia severity. In SRT, new facts are presented or a new motor procedure is demonstrated to a PWD who first recalls the information or demonstrates the procedure immediately and then over gradually lengthening time intervals. Time intervals after each successful recall attempt are doubled, whereas intervals subsequent to unsuccessful recall attempts are maintained or reduced in duration (see Figure 3 for a visual display of recall attempts). Thus, PWD learn and retain functionally relevant information or skills over longer periods of time, and this new learning, in turn, supports improved functioning, greater independence, and reduced need for assistance or cueing during specific activities. Consider a PWD who comes to a nursing station, repeatedly asking a question (eg, “when do we have coffee?”). Instead of staff recurrently answering this question and reinforcing this undesirable response, SRT may be used to teach this person to reinforce a desired response of looking at a laminated card attached to his or her walker or handbag that lists the times on which coffee is served daily.

Many empirical studies provide evidence for the success of SRT for PWD as well as for persons with amnesia, traumatic brain injury, and anoma associated with aphasia. For persons diagnosed with dementia, SRT has been efficacious for teaching items on word lists; cue-task associations; names of people; object orientation tasks; prospective memory tasks; and compensatory strategies for safe swallowing, communication with caregivers, and using external memory aids. Readers are directed to a recent evidence-based systematic review on the outcomes of SRT for persons with AD.

In a recently completed research study, we reported positive outcomes of computer-assisted SRT for teaching face-name associations and novel motor procedures to 25 persons with mild to moderate dementia of the Alzheimer type. More than 21 (80%) of our 25 dementia participants successfully learned and recalled novel and previously familiar (but forgotten) names of caregivers over a 32-minute interval and maintained this performance for 8 weeks posttraining. These same participants learned multistep, novel procedures (eg, using a digital camera, sending e-mail, and compensatory memory strategies) using digitized video clips that were played followed by participants demonstrating the entire procedure successfully over gradually increasing time intervals. Twenty-two (88%) of these 25 PWD learned and retained novel procedures over a 32-minute interval and maintained this new learning for 6 to 8 consecutive weeks posttraining.

Why does spaced retrieval training work?

A central question about SRT is how and why it works to facilitate recall and retention in PWD, despite their significant

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**Figure 3.** Visual schematic of spaced retrieval training for a fall prevention strategy.
EM deficits. Although this mechanism is not fully understood, current evidence reveals several factors that underlie the success of SRT. It is likely that SRT works because of repeated opportunities to retrieve target information,\textsuperscript{3,10} emphasizing on retrieval success,\textsuperscript{41} and gradual building up of duration over which recall is maintained.\textsuperscript{40} Furthermore, SRT capitalizes on relatively spared implicit memory processes\textsuperscript{59} and requires little cognitive effort from dementia patients.\textsuperscript{49}

Another reason why SRT works so well is because of the incidental use of errorless learning in its implementation.\textsuperscript{59} Errorless learning is contrasted with routine trial and error learning. For persons with intact EM, trial and error learning works well as individuals remember their erroneous response and subsequent corrective feedback and retain the entire episode of making the error and being corrected. This retention of the learning episode reduces the likelihood of subsequent erroneous responses. For PWD, however, the very act of making an error is undesirable early in the learning process. This is because PWD have severe EM impairments and remember neither their errors nor corrective feedback in response to errors. Therefore, they make the same errors recurrently,\textsuperscript{44} and the more frequently an error is made, the more it gets reinforced. Thus, using errorless learning principles\textsuperscript{65,66} for constraining stimulus presentation, task instructions and permitted responses may better facilitate new learning in PWD. Errorless learning is incorporated into SRT by ensuring that participants always end a recall trial or therapeutic session with a correct desired response (eg, recalling facts or procedures).

It is important to establish whether the positive outcomes of SRT are because of the repeated retrieval attempts or the gradual increase in interval spacing. Most investigators have used gradually lengthening time intervals in SRT; however, 2 groups of researchers have recently reported similar successful outcomes from spaced and fixed length of recall intervals. Hochhalter et al\textsuperscript{37} compared expanding intervals to other rehearsal schedules (eg, random intervals and uniformly distributed intervals) with a small sample of persons with AD and found no significant advantage for spaced retrieval over equally spaced practice schedules. Similarly, Balota et al\textsuperscript{46} found no advantage of expanded retrieval over an equal interval schedule in improving the memory performance of healthy older adults and PWD. Together, these results suggest that spaced intervals may not be as critical to the success of SRT as repeated presentation and frequent retrieval of a correct response.

Another issue for practitioners implementing SRT pertains to activities conducted during recall intervals. It seems intuitive that task-related activities during intervals may maximize learning, whereas unrelated activities may interfere with and adversely impact subsequent recall performance. However, empirical evidence does not support this intuition. Recently, Hopper and her colleagues\textsuperscript{50} demonstrated that filling intervals with tasks unrelated to a target face-name association did not negatively impact learning by persons with mild to moderately severe AD. This finding has important implications for practitioners because it suggests that various activities such as conversation, having a snack, or taking vital signs can be nested within SRT recall intervals. Regarding candidacy for SRT, Hopper et al\textsuperscript{49} suggest that this technique is effective for PWD with mild to moderately severe dementia, associated EM impairments, and the ability to attend to structured learning tasks.

### Intervention 2: memory books and memory wallets

**Description and existing evidence**

Memory aids, such as memory books (Figure 4) and memory wallets (Figure 5), have been shown to enhance functioning and quality of life of PWD by improving verbal communication and factual content in conversations,\textsuperscript{44,45} supporting turn taking and topic initiation,\textsuperscript{49} encouraging meaningful verbal interaction between PWD and caregivers,\textsuperscript{70-71} and reducing caregivers’ nonfacilitative communicative behaviors. In 1990, Bourgeois\textsuperscript{44} conducted the first experiment validating the use of memory wallets with 3 persons with mid-stage AD. Twice a day, these participants read approximately 30 sentences in their memory wallets out loud to their partners during therapy sessions. Subsequently, these PWD made more on-topic, factual statements and decreased irrelevant statements. Originally designed to enhance conversational efficiency, memory wallets and memory books have since been used to enhance orientation and expression of basic needs and to reduce repetitive question-asking and disruptive vocalizations.\textsuperscript{45,72} Bourgeois\textsuperscript{72(p63)} cited an example of the frustration a daughter felt with her father who frequently asked about the whereabouts of her deceased mother. When she told her father that the mother was deceased, he would react with surprise and distress and they would both end up crying. They created a memory book page with a picture of her gravestone and this statement “My
wife, Lillian, died of liver cancer in 1995 and is resting peacefully in Woodlawn Gardens.” The daughter would hand her father his memory book, opened to that page, when he asked about his wife. Eventually, he stopped asking about his wife. In this situation, using a memory book allowed this individual with dementia to review important biographical information and eventually modify his repetitive behavior.

Memory books and memory wallets also can be used to enhance orientation to self, time, place (immediate environment and local community), and person. To enhance orientation to self, a memory book may include past and current self photos with short descriptive titles such as This Is Me in High School and This Is Me Now at Age 90. To enhance orientation to immediate locations, a page in the memory book can have a picture of an individual’s house and a description such as “This is my home” (Figure 4) and the person’s address. A memory wallet (Figure 5) typically consists of written and graphic cues to aid PWD with prompt recall of personally relevant and meaningful information. It may be thought of as a memory book on a smaller scale and is designed to be portable so that its consistent use may be facilitated in all contexts. A memory book or wallet should be personalized and designed to fit the needs of the person using it. Therefore, physical characteristics such as the size of the pages, images, and the font and color of the text should be appropriate. Similarly, the number of pages, weight of the book or wallet, and the length of sentences or phrases should match the cognitive abilities of the person for whom it is designed.

Recently, we conducted single-subject studies in which we taught 2 individuals with young-onset AD to use memory books as a compensatory strategy to answer basic biographical questions. Participant 1 was a 52-year-old woman with moderate dementia and progressively diminishing verbal output. After eighteen 50-minute sessions over a 10-week timeframe, she learned to use a memory book to answer biographical questions with 80% or better accuracy, given minimal cueing. Participant 2 was a 63-year-old man with mild dementia and increasingly nonspecific content in conversations and when asked about his prior work or his hobbies (eg, “I don’t know,” “Yeah, sure”). At baseline, he could not correctly answer questions about himself (eg, his children, his recent retirement). After seven 50-minute sessions over 4 weeks, he required only occasional verbal reminders to use his memory book and could answer short, biographical questions (eg, “what is your daughter’s name?” “what work did you do prior to retiring?”) with 60% or better accuracy.

**Why do memory books and memory wallets work?**

Memory books and memory wallets provide tangible sensory cues (eg, words, pictures) that reduce reliance on impaired EM and WM in PWD. Next, use of once-familiar information and simple-written text offers individuals with dementia the opportunity to utilize their relatively spared recognition memory and oral reading abilities. Furthermore, memory books/wallets can enhance communication of wants and needs for PWD who have recently moved from their home to a residential facility and have limited ability to verbally express preferences. The content in a memory book primes personally relevant information and biographical details and also assists professional caregivers in becoming more familiar with an individual and his or her preferences. For example, a page with the heading My Favorite Lunch Foods could have 4 pictures (eg, a turkey sandwich, soup, fruit salad, green salad) and labels underneath the pictures. Finally, memory books and memory wallets can increase positive engagement and facilitate independence in activity completion by helping an individual remember his or her preferred activities and steps or procedures to participate in these activities. For instance, a page may include simple steps accompanied by pictures reminding an individual how to water plants or make a pot of coffee. Memory books are ideally suited for use with persons who have mild to moderate dementia, who possess the requisite reading and visual processing ability, procedural memory, and the motivation to enhance their functional communication.

**Intervention 3: Montessori-based interventions**

**Description and existing evidence**

In the last decade, researchers have demonstrated the efficacy of MIs for maximizing functional cognitive and communicative performance in PWD as well as improving engagement and participation in activities (see Mahendra et al for an evidence-based systematic review). Montessori-based interventions are inspired by the Montessori method, developed in the early 1900s, by Italian educator Maria Montessori. This influential instructional method has been widely applied in child pedagogy. The guiding principle for designing MIs is to provide a stimulating experiential
environment that allows individuals to learn at their own pace, while promoting independence.47 Other key elements that make Montessori methods especially well suited for planning activities and designing functional treatments for PWD include the following:

a. Breaking down tasks and activities into component parts;
b. Using guided repetition and cues to reduce errors;
c. Progressing through tasks sequentially or in stages; and
d. Moving from tasks based on simple, concrete concepts to those based on complex, abstract concepts.

Multiple researchers have demonstrated that MIs have a positive effect on cognitive functioning of PWD on participant motivation and on observed affect and engagement during therapeutic activities. Vance and Johns, and Vance and Porter used change scores from 22 cognitive measures to derive a Montessori benefit score to compare overall cognitive function of PWD before and after Montessori interventions and routine activities (eg, watching TV). They reported improved cognitive performance (based on change scores) and observed that dementia residents seldom became agitated during Montessori activities. Because PWD often experience agitation, reduced frequency of such challenging behavior is the strong evidence of the efficacy of Montessori interventions.

Vance and Johns compared the stages of dementia to Piaget’s distinct stages of cognitive development and provided multiple examples of Montessori-based activities appropriate for persons with differing severity of dementia. Information from the seminal work of Vance and Johns and Camp has been combined to provide readers with examples of specific functional and recreational Montessori activities (Table 2) and the stage of dementia for which these are appropriate. For example, an activity that may be appropriate for a person with mild dementia (with an Mini-Mental State Examination score between 15 and 25 of 30) would be “Color Tiles.” This activity relies on repetition and requires a person to arrange tiles in a sequence ranging from yellow to darkest. This activity requires complex, logical analysis and is similar to Piaget’s later operational stage of development. From successful completion of such an activity, a PWD can logically progress to tasks such as sorting laundry into light and dark clothing. Similarly, a person with moderate to moderately severe dementia (Mini-Mental State Examination score between 5 and 15 of 30) can participate in pouring tasks. These tasks involve pouring beans, rice, or other material into containers of different sizes and shapes to illustrate the conservation of volume, a key milestone in Piaget’s preoperational stage. Successful performance on pouring tasks can then be utilized by engaging residents to assist with pouring drinks in a social setting or in the dining room. For persons with severe dementia, an appropriate activity would be the “Discovery Bowl” in which participants search for colorful objects such as 3-dimensional shapes, hidden in a bowl of rice. Such activities correspond with Piaget’s early sensorimotor stage and emphasize object permanence.

In most studies, researchers, clinicians, or professional caregivers facilitate Montessori activities and PWD participate. However, some investigators have demonstrated the success of Resident-Assisted Montessori Programming (RAMP) approaches. In RAMP activities, PWD themselves successfully lead others in Montessori

<table>
<thead>
<tr>
<th>TABLE 2 Montessori Activitiesa</th>
<th>Functional and Recreational Tasks</th>
<th>Stage of Dementia for Which Usually Appropriate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensory discrimination</td>
<td>Sound discrimination (eg, loud versus soft), color discrimination (eg, red vs blue), weight discrimination, temperature discrimination, smelling jars</td>
<td>Late-stage or advanced dementia</td>
</tr>
<tr>
<td>Scooping exercises</td>
<td>Scooping by hand (eg, discovery bowl), scooping with tools (eg, pasta, grains)</td>
<td>Late stage dementia Moderate dementia</td>
</tr>
<tr>
<td>Pouring activities</td>
<td>Pouring drinks</td>
<td>Moderate dementia</td>
</tr>
<tr>
<td>Seriation activities</td>
<td>Arranging items in a series (eg, measuring bowls, fabric swatches)</td>
<td>Moderate dementia</td>
</tr>
<tr>
<td>Squeezing activities</td>
<td>Using tongs or a garlic press, hole punching</td>
<td>Mild and moderate dementia</td>
</tr>
<tr>
<td>Fine motor activities</td>
<td>Stringing beads, lacing, painting, cutting with scissors</td>
<td>Mild and moderate dementia</td>
</tr>
<tr>
<td>Care of the environment</td>
<td>Arranging flowers, watering plants, place setting, polishing metal</td>
<td>Mild and moderate dementia</td>
</tr>
<tr>
<td>Care of the person</td>
<td>Folding and hanging clothes</td>
<td>Mild and moderate dementia</td>
</tr>
<tr>
<td>Matching activities</td>
<td>Sorting activities (eg, shapes, faces, light and dark clothing)</td>
<td>Mild and moderate dementia</td>
</tr>
</tbody>
</table>

a Based on information from Camp and Vance and Johns.
activities. Persons with mild dementia have been effectively trained to lead a Montessori activity called “Memory Bingo” to preschool children and to small groups of persons with more advanced dementia. Camp and Skrajner assessed the feasibility of training persons with mild dementia to lead others with more advanced dementia in Montessori activities. They also documented social engagement and pleasure in both the participants and the leaders. Their findings demonstrate that PWD can be trained to effectively fill the role of activity staff, with little to no assistance in carrying out the activities. Both participants and leaders showed increased positive engagement and affect in the Montessori-based activities, compared with their standard activities. In another study, Skrajner and Camp successfully trained 6 participants with mild dementia to facilitate a small group in reading activity for persons with more advanced dementia in an adult day health care setting and in a skilled nursing facility. It is noteworthy that they documented better effect and engagement in residents participating in peer-led Montessori activities than when participating in routine programming. These authors posit that RAMP interventions have a dual benefit for participants receiving interventions and for enhancing satisfaction and sense of self-worth among residents who serve as facilitators or leaders. Furthermore, these researchers have reported that caregivers and facility staff view resident leaders differently when witnessing them as activity leaders and regard them as allies in assisting those with more advanced dementia. Next, we discuss why MIs are effective for PWD.

Why do Montessori-based interventions work?

Multiple factors likely underlie the success of Montessori principles for designing interventions for PWD. First, Montessori activities involve everyday practical tasks and engage the learning-by-doing system, thus relying on implicit memory rather than explicit or declarative memory. This provides an added advantage for PWD of the Alzheimer type because many implicit, nondeclarative memory processes are relatively spared in AD. Next, based on Vance and Porter, MIs are particularly effective for PWD, because the use of novel and rich sensory stimuli within structured learning experiences likely induces experience-dependent neuroplasticity. Another reason for the success of MIs is likely based on the concept of “reverse ontogeny.” Reverse ontogeny refers to the observations that skills documented by Piaget to be acquired early in child development are the same skills that are among the last to be affected in AD. Therefore, Vance and Johns reason that novel cognitive activities that are based on Piagetian concepts and incorporate Montessori principles can help persons with AD maintain and, perhaps, even enhance their cognitive functioning. Furthermore, stimuli routinely used in Montessori-based activities are tangential sensory materials (eg, real objects, colorful tokens, textured fabric swatches, etc) that are functional and aesthetically pleasing, while emphasizing visual, auditory, and tactile discrimination. Finally, Montessori activities are designed with inbuilt controls to facilitate self-recognition of errors in task completion. For example, persons with moderate dementia may be assigned a task of sorting red spoons and blue forks into a red and blue bin, respectively. Because each item has a distinct primary color and must match the color of the bin in which it is placed, a person with dementia is more likely to complete this task successfully and be able to monitor his or her own performance and self-correct errors.

Regarding candidacy for MIs, Mahendra et al recommend that suitable candidates for such interventions are PWD who have some spared motor learning capacity, social skills, and ability to initiate verbal communication. Furthermore, ideally, candidates for Montessori interventions will have mild to moderate severity of dementia, absence of combative behavior, and functional hearing and vision abilities to attend to sensory stimuli, understand task instructions, and participate in intervention sessions.

CONCLUSIONS

In summary, we have presented robust evidence for the efficacy of 3 specific interventions for PWD—SRT, memory books and memory wallets, and MIs. This evidence provides a compelling foundation for clinicians, researchers, and caregivers to change their perceptions about the restorative potential of PWD. Furthermore, on the back of such empirical evidence, current standards of clinical care must change to provide PWD optimal opportunities to maintain and enhance cognitive and communicative function, thereby promoting their sense of self and preventing excess disability, given a diagnosis of dementia.

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