

Administration for Community Living

**Aging Guide:  
Considerations and Best  
Practices for Older Adults  
with Brain Injury**

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# Foreword

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## Purpose

In recent years awareness of brain injury has seen a marked increase, primarily due to sports-related concussions and brain injuries sustained in the Iraq and Afghanistan conflicts. However, there remains a significant gap in knowledge and awareness about brain injury and considerations for treatment. This is especially true for older adults. Older adults experience the *highest* rates of TBI-associated emergency department visits, hospitalizations, and deaths. Yet there are few geriatric-specific TBI guidelines to assist with complex management decisions in this population, and there are several barriers in management of geriatric brain injury, including under-representation of older adults in TBI research and a general lack of resources and tools.<sup>1</sup>

Brain Injury can have long-lasting physical, cognitive, behavioral, and emotional effects for older adults. Roughly 1 in 5 people may experience BI-related mental health symptoms up to six months after a mild traumatic brain injury.<sup>2</sup> Major depression is the most common mental health diagnosis,<sup>3</sup> followed by:

- Anxiety disorders
- Post-traumatic stress disorder
- Irritability, anger, emotional lability
- Adjustment disorder
- Substance misuse or abuse
- Psychosis and mania
- Personality changes

People who have sustained a TBI also have higher-than-normal rates of non-fatal self-harm and suicide.<sup>4</sup>

Certain predisposing factors can make it more likely for an older adult to experience mental health challenges after a BI, including sleep problems, anxiety, substance use disorders, low income, negative thinking, and poor social functioning. A brain injury can increase the symptoms of a pre-existing mental health disorder. Secondary factors can complicate mental health conditions, such as loss of employment, inability to drive, sleep issues, relationship problems, and social isolation.<sup>5</sup>

There are often regulations in place that can inadvertently restrict access to state-funded supports for individuals with brain injury. Given the significant prevalence of brain injury and co-occurring behavioral health conditions across the entire lifespan, there is a need for guidance to states about how to effectively support older adults. State government-led brain injury programs are in a unique position to affect policy, increase training and implement practice changes within state behavioral health systems and aging networks to ensure improved identification, treatment, and ultimately, outcomes for this population.

This guide will provide states with tools for initiating or improving partnerships within both state aging networks and mental health systems. This guide provides:

- An overview of the prevalence, sequelae, and systemic issues that add to the complexity of supporting older adults with brain injury and co-occurring behavioral health.
- A review of partners and strategies, including an overview of the national landscape, the Older Americans Act, and the state aging network structure and programs.
- Insight into training mechanisms and practical approaches that states might implement.
- An overview of the importance of screening, related mandates, protocols, and methods that aging systems can implement, as well as contrasts between brain injury and dementia that impact approaches and outcomes.
- Strategies for modifying clinical interventions, including additional evaluation, treatment and related factors.
- Guidance for successful medical management and the pharmacology of aging that can be shared with behavioral health and aging networks, clinicians, and prescribers.



## Audience

The intended audience for this guide includes directors and staff of state government brain injury programs and personnel who serve as grantees for the Traumatic Brain Injury (TBI) State Partnership Program. The purpose of the TBI State Partnership Program is to create and strengthen person-centered, culturally competent systems of services and supports that maximize the independence and overall health and well-being of people with TBI across the lifespan and the people who support them. Many federal, state, and local entities share the goals of the TBI State Partnership Program and have the capacity to serve as valuable partners. The ability to lead, engage and support effective partnerships and collaboration, including behavioral health treatment providers, is critical to the success of their effort. The intent is to provide them with tools to effect change within their state aging networks and ultimately to improve outcomes for older individuals with brain injury and co-occurring behavioral health conditions.

## Note on terminology

Federal and state systems often have separate funding streams for supporting those with mental illness versus those with substance use issues. For the purpose of this guide (aside from when it is important to distinguish between the two) the term “behavioral health” is used and is meant to be inclusive of both mental illness and substance use.

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# Section I: TBI in Older Adults

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## Prevalence

The overall rate of TBI in older adults in the U.S. is increasing.<sup>1,2</sup> In 2017, adults aged 65 years and older accounted for 38.4 percent of all TBI-related deaths and 43.9 percent of all TBI-related hospitalizations.<sup>3</sup> In 2020, adults aged 75 years and older accounted for about 32 percent of TBI-related hospitalizations and 28 percent of TBI-related deaths.<sup>4,5</sup> These estimates are substantially underestimated as they do not include the many TBIs that are only treated in the emergency department, primary care, urgent care, or those that go untreated.<sup>6</sup> The most common mechanism for TBI in older adults is a fall,<sup>1,7</sup> which often occurs when getting in or out of bed, due to dizziness, negotiating stairs, falling backward from standing, and during activities of toileting.<sup>8</sup>

There are notable demographic characteristics in those more likely to sustain a TBI in older adulthood including: being of female sex,<sup>1,2,7</sup> greater age (85+),<sup>7,8</sup> pre-injury depression,<sup>9</sup> impairments in activities of daily living,<sup>9</sup> greater disease comorbidity,<sup>2,9</sup> poorer cardiovascular health,<sup>9</sup> sleep disorders,<sup>10</sup> and past history of TBI.<sup>11</sup> Additionally, factors that place an older adult at greater risk of falls are also common in those who sustain TBI: changes in gait and balance, slower reaction times, decreased muscle strength, changes in cognition, and increased use of medications.<sup>12,13</sup>

Mortality is higher in older adults as compared to younger adults with TBI.<sup>14–19</sup> The leading cause for in-hospital mortality in those with severe TBI is withdrawal of care,<sup>20</sup> and post-discharge death across injury severities is most commonly due to accidents and cardiovascular disease.<sup>21</sup> Factors associated with mortality include: greater impairments in activities of daily living,<sup>9</sup> comorbid cardiovascular disease,<sup>9</sup> older age (i.e., oldest old),<sup>1,14,15,22</sup> and greater injury severity.<sup>1,14,22–24</sup>

## Outcomes

It is well established that, on average, older adults have poorer outcomes after TBI than their younger counterparts,<sup>25,26</sup> and there are high rates of impairment and disability.<sup>27</sup> However, it is also well established that a substantial number of older adults with TBI recover well,<sup>15,25</sup> especially those with milder injuries.<sup>27</sup> Older adults do benefit from

inpatient rehabilitation, showing improvements in cognition and motor function,<sup>28–30</sup> albeit at a slower rate than their younger counterparts.<sup>30</sup>

## Cognition

Cognitive impairment and both short-term and long-term cognitive trajectories are varied in older adults with TBI.<sup>31–39</sup> This may be due to study designs, sensitivity of cognitive measures, or reflect known heterogeneity in outcomes seen across the lifespan of TBI survivors.<sup>40</sup> Overall, more consistent cognitive impairments are found in those with moderate-severe, TBI<sup>41,42</sup> whereas the evidence is mixed for mild TBI.<sup>31,41–45</sup> For those who do show impairments in cognition, this is most often in their information processing speed,<sup>46,47</sup> attention,<sup>35</sup> working memory,<sup>46,48</sup> fluency of language production,<sup>48</sup> executive function,<sup>35</sup> and memory.<sup>47</sup>

The few studies that have adjusted for expected age-related decline in cognitive function have reported that older adults may have equivalent or even better cognitive outcomes as compared to younger TBI survivors.<sup>49</sup> Older adults do, however, experience slower recovery of cognitive function during rehabilitation<sup>50</sup> and over the year<sup>51</sup> after TBI compared to younger adults. Finally, it has been consistently reported that there are no significant differences in cognition between older adults with mild TBI as compared with those with orthopedic trauma,<sup>43,45,47,52</sup> suggesting a general effect of trauma on cognitive function.

## Functional Independence

Older adults consistently show worse functional performance on average compared to their non-injured peers<sup>46</sup> and to younger adults with TBI.<sup>17,18,53–57</sup> In line with this, older adults are less likely to be discharged home and more likely to be discharged to long-term care or a skilled nursing facility following hospitalization for moderate to severe TBI.<sup>15,18,30,58</sup> However, many older adults do show good functional outcome, albeit with rates of recovery slower than younger TBI survivors.<sup>59</sup>

## Mood and Behavior

Depression and anxiety are common and often comorbid after TBI during older adulthood.<sup>60–62</sup> Other mood and behavioral symptoms experienced by older adults with TBI include agitation, apathy, and disinhibition.<sup>63</sup> This notwithstanding, older adults do seem to have better emotional outcomes than their younger injured counterparts.<sup>44,54,62,64,65</sup> This mirrors trends seen in the general community, in which emotional experience and psychological well-being improves with age.<sup>66,67</sup> Possible explanations for these older age benefits in psychological outcome have not been

systematically addressed but may reflect the reduced psychosocial stressors inherent to older age (e.g. less vocational, educational, and familial responsibilities).<sup>59</sup>

## **Medical Health & Sleep**

TBI can be thought of as disease accelerative and disease causative,<sup>68</sup> potentially exacerbating pre-existing comorbidities and also being associated with the development of new medical issues.<sup>69</sup> This is particularly problematic for older adults, who often have poorer pre-injury medical health and greater comorbidities at the time of their injury.<sup>9,70,71</sup> Older adults also have higher rates of post-injury comorbidities, with diabetes, high blood cholesterol, osteoarthritis, and hypertension more common among older individuals with TBI.<sup>69</sup> Sleep disorders are also common in older adults with TBI.<sup>10</sup> Compared to their non-injured peers, they have a higher prevalence of obstructive sleep apnea (OSA), insomnia, and daytime sleepiness.<sup>72</sup>

In addition, compared to younger TBI survivors, older adults are more likely to experience physical symptoms following their injury such as fatigue, balance, and coordination problems, have pronounced changes in metabolism, as well as complain of being bothered by noise.<sup>13,54</sup> Finally, older adults also have higher rates of re-hospitalization,<sup>73-75</sup> which can interrupt rehabilitation<sup>75</sup> and prolong recovery.

## **Participation**

Within TBI research, “participation” is typically defined as engagement in employment/ education, social activities, and leisure pursuits.<sup>76</sup> There is some evidence to suggest older adults have poorer participation outcomes than their younger counterparts;<sup>57</sup> however, evidence for participation outcomes is mixed.<sup>59</sup> Maintaining participation is important, as this has been associated with greater satisfaction with life in older TBI survivors.<sup>77</sup>

Experiencing a fall in older adulthood may disrupt participation in a myriad of ways. The CDC estimates that every second of every day an older adult falls.<sup>78</sup> People aged 75 and older have the highest rate of TBI related hospitalizations and deaths.<sup>78</sup> One out of 10 falls results in injury causing the older adult to restrict their activities for a day or more.<sup>79</sup> Fear of falling again may further reduce an individual’s confidence in their independence and pursuit of interests. Reduced ability to engage in activities of daily living and social interactions may lead to isolation, depression, and reduced quality of life. This underscores the importance of maintaining participation through person-centered modifications and accommodations.

## **Burden on Care Partners and Families**

Care partners of older adults with TBI report burden and psychological distress.<sup>80</sup> Issues such as slowness, sleep and fatigue disturbances, difficulties with concentration and memory, and neurobehavioral dysregulation can complicate everyday life of TBI survivors and their care partners.<sup>80</sup>

Overall, burden reported by care partners of older adults appears to be less than that of those caring for younger adults.<sup>80</sup> This may be because the consequences of the injury have less marked consequences on lifelong development, and younger care partners may have to manage multiple responsibilities such as caring for children and aging parents, while investing time in building their career and finances.<sup>80</sup> In addition, older care partners may be more accepting of this carer role,<sup>81</sup> as they are already accustomed to some care tasks such as running errands, preparing meals, and accompanying their significant other to appointments.<sup>78</sup>

## **Factors that Impact Outcomes**

There are several personal, injury-related, and systemic factors that can impact the outcomes described above. In general, there has been a consensus that factors beyond age and injury severity alone must be examined to understand outcomes after brain injury in older adults.<sup>25</sup> Indeed, it is particularly important to explore factors that may provide targets for intervention/ treatment to improve outcomes.

## **Personal and Injury Related Factors**

### **Demographic**

Substantial research has focused on demographic factors that may impact outcomes for older adults including age, sex, cognitive reserve, injury severity, and number of injuries. Within those aged 65 years and above, older adults (i.e., the oldest old) have lower odds of favorable cognitive and motor recovery<sup>28, 82</sup>, increased functional impairment,<sup>27,83, 84</sup> and lower long-term functional independence trajectories.<sup>83</sup> In general, there appears to be more favorable outcomes for females than males in the domains of cognition<sup>28</sup> and function.<sup>85</sup> Higher premorbid cognitive reserve, usually inferred by higher education/ higher IQ/ higher occupational complexity,<sup>86</sup> is associated with better outcomes.<sup>46</sup> Greater injury severity is consistently a negative prognostic indicator, being associated with reduced functional independence<sup>27,83,84,87,88</sup> and decreased long-term functional independence trajectories,<sup>85</sup> less favorable discharge destination,<sup>23</sup> and increased cognitive impairments.<sup>35,41</sup> The impact of repeated TBI

exposure has been less well characterized, but preliminary work suggests a negative association with cognitive function.<sup>35</sup>

## **Pre-injury Medical Health and Frailty**

The importance of pre-injury medical health and frailty on outcomes in older adults has been consistently highlighted. Decreased preinjury physical and mental health including higher number of comorbidities, degree of frailty and prior exposure to TBI has been associated with less favorable cognitive recovery,<sup>28,89</sup> functional recovery,<sup>27,53</sup> global outcome,<sup>71,90–92</sup> emotional health,<sup>89</sup> behavioral outcomes,<sup>93</sup> and increased mortality in-hospital<sup>86</sup> and post-discharge.<sup>94</sup> Pre-existing difficulty with activities of daily living and diagnosis of dementia have also been associated with lower long-term functional independence trajectories<sup>85</sup> and global outcomes.<sup>91</sup> The impact of frailty has been particularly emphasized, with some arguing that it may be an even stronger predictor of outcomes than age.<sup>16, 95</sup>

## **Social Determinants of Health**

Several lines of research in older TBI survivors have identified poorer outcomes for those belonging to a racial or ethnic minority group. This includes poorer cognitive and motor recovery,<sup>28, 96</sup> hospital readmissions,<sup>97</sup> and lower long-term functional independence trajectories<sup>83</sup>. There is also evidence that those belonging to a racial or ethnic minority group receive less inpatient therapy and fewer referrals to rehabilitation services.<sup>98, 99</sup>

## **Systemic Factors**

### **Access to Medical Care and Rehabilitation**

There is now considerable evidence that older adults with TBI do not receive equitable access to medical care and rehabilitation.<sup>25,100</sup> Indeed, several studies have shown that older patients have longer delays in obtaining an initial head CT<sup>101</sup>, are less likely to be admitted to the ICU<sup>101–103</sup>, have disproportionately frequent rates of withdrawal of care<sup>16,20, 103</sup>, receive less intensive medical and surgical treatment,<sup>103, 104</sup> and have shorter rehabilitation length of stay resulting in fewer hours of therapies.<sup>30,58</sup> In the absence of clinical management guidelines,<sup>102</sup> medical centers can impose their own rules leading to problematic policies including, for example, strict age cutoffs for aggressive treatments such as neurosurgical intervention.<sup>25,104, 106</sup> Clinician bias may also impact decision-making due to misconceptions about the potential for older adults to have a good recovery.<sup>102</sup> This misconception may have been informed by prior research suggesting that intensive interventions are not worthwhile in severe TBI in

older adults<sup>15, 105</sup> and through a “self-fulfilling prophecy” in their own work. That is, clinicians may believe that due to a patient’s older age their outcomes will be less favorable, and therefore choose to manage their patient conservatively resulting in greater morbidity and mortality.<sup>15,102, 104</sup>

Access to medical intervention and rehabilitation not only improves the odds of survival but also improves long-term clinical outcomes for older adults. This was clearly highlighted in a large U.S. study that showed that after adjusting for sociodemographic and clinical variables, functional outcome at discharge made the greatest contribution in explaining variation in global functioning at 1 year post-injury.<sup>29</sup> Notably, the largest effect sizes were observed among the 60- to 69-year-olds and 70- to 79-years-olds age groups.<sup>29</sup> This suggests that especially for older adults with TBI, maximizing functional improvement during inpatient rehabilitation may be essential to maximizing the potential for long-term recovery.<sup>29</sup>

## **Rehabilitation for Older Adults with TBI**

Several clinicians and academics have highlighted the need for specialized rehabilitation programs for older adults following TBI.<sup>29,107</sup> These programs would involve greater care intensity and duration earlier in the acute recovery phase.<sup>29</sup> Allowing a longer length of stay<sup>29,107</sup> may accommodate the slower trajectory of improvement consistently seen in older adults.<sup>30,50,51</sup> Indeed, longer length of stay has been associated with greater cognitive recovery for older adults during inpatient rehabilitation.<sup>28</sup> Ongoing access to maintenance rehabilitation along with psychological services to enhance engagement may help to sustain optimal functioning over time.<sup>29,107</sup> Emphasis on fall prevention during rehabilitation is critical,<sup>29</sup> along with enhanced discharge planning and earlier post-acute physician follow-up to reduce rates of re-hospitalization.<sup>29</sup> Finally, promotion of healthy lifestyle behaviors is paramount to facilitate longevity and optimize health and well-being.

## **Healthy Aging and Healthy Lifestyle Behaviors**

Adapting healthy lifestyle behaviors can promote healthy aging and reduce risk of cognitive decline and dementia. Core components of a healthy lifestyle include: optimizing emotional well-being, sleep, diet, physical activity, socialization, cognitive activity, and medical health. Substantial evidence from non-TBI studies of older adults shows the promising effects of adopting healthy lifestyles on cognitive function and dementia risk reduction.<sup>108,109</sup> Greater awareness of the importance of healthy lifestyle



is required along with access to interventions and strategies that are accessible for those aging with TBI.

## **Emotional Well-Being**

Emotional well-being includes both treating symptoms of psychological distress (e.g., depression, anxiety) and maintaining positive mental health. There are evidence-based interventions that have been specifically modified for individuals with TBI to improve symptoms of depression and anxiety.<sup>111, 112</sup> These include interventions based on cognitive behavioral therapy, mindfulness, and motivational interviewing.<sup>111, 112</sup>

Strategies to promote positive mental health include: keeping a journal of thoughts and feelings;<sup>113</sup> taking frequent breaks with time set aside to be alone (e.g., listen to music);<sup>113</sup> completing relaxing activities (e.g., mindfulness exercises, muscle relaxation, meditation, breathing exercises);<sup>113,114</sup> creating a gratitude journal.<sup>113,114</sup> Social contact may also have a positive impact on emotional well-being.<sup>115</sup>

## **Sleep**

Sleep is very important for health and well-being.<sup>116</sup> For those with sleep disorders, TBI-specific evidence-based interventions may be appropriate, such as cognitive behavioral therapy<sup>117,118</sup> and positive airway pressure machines for OSA.<sup>119</sup> Even for those without sleep disorders, sleep can be optimized with changes in behavior and environment collectively known as “sleep hygiene.” There are numerous resources available with guidance to promote and maintain good sleep hygiene. Common strategies and tips<sup>116,120,121</sup> include: going to bed and waking up at the same time every day including weekends or when travelling; restricting naps to less than 20-60 minutes per day and avoid napping in the later afternoon and evenings; following a bed time routine (e.g., take a warm bath/shower, drink cup of herbal tea, brush teeth, listen to relaxing music); and creating a restful and relaxing environment in the bedroom—cool, dark, and quiet. Older adults may also consider the following tips for a safe nights sleep: removing rugs and other trip hazards from near the bed and keeping a lamp close to the bed for nocturnal bathroom visits; placing a glass of water next to the bed to reduce the need to get out of bed during the night.<sup>116</sup>

## **Diet**

There has been considerable research effort exploring optimal diets for brain health. Two diet regimens have shown promise in promoting brain health—the Mediterranean diet<sup>122,123</sup> and the Dietary Approach to Stop Hypertension (DASH).<sup>124,125</sup> The Mediterranean diet emphasizes consumption of foods containing neuroprotective compounds such as polyunsaturated fatty acids, B-vitamins, and antioxidants.<sup>122</sup> The



DASH recommends consumption of similar nutrient groups along with low sodium intake as a means of preventing hypertension and cardiovascular risk factors with age.<sup>124</sup> A hybrid of the two, the Mediterranean-DASH Intervention for Neurodegenerative Delay (MIND) diet requires high consumption of nutrient groups with neuroprotective properties<sup>126</sup> and has been associated with cognitive health benefits.<sup>127</sup> For those who may not wish to follow one of these diets, broader recommendations should be considered: organizing the refrigerator or pantry with nutrient-dense foods at eye level (middle shelf) and other foods placed lower or higher; create weekly meal plans; keep nutrient-dense snacks available; drink plenty of water; setting a timer as a reminder to take short breaks when eating to help recognize feelings of fullness.<sup>113</sup>

## **Physical Activity**

Existing guidance for TBI survivors suggests a physical activity goal of 150 minutes of safe, moderate exercise each week (e.g., walking, jogging, swimming, biking) and strength training two days a week.<sup>113</sup> There is also evidence in non-TBI populations to suggest even low-impact stretching and balance exercises can have a positive impact on cognition.<sup>128</sup> However, this structured physical activity may not be achievable for many older adults with TBI. It is important to remember that other activities like gardening, cleaning the house, climbing stairs, and doing laundry are also exercise.<sup>113</sup> The key is to move as much as possible and try not to sit for long periods of time.<sup>113</sup> Finding an activity that is enjoyable and doing it with friends and family can maximize adherence and promote long-term engagement. Physicians and physical therapists may be consulted to provide modifications to exercises and other tips for remaining physical active into older age.<sup>113</sup>

## **Socialization**

Staying socially connected can improve well-being and support cognitive function.<sup>129,130</sup> Social activities may be with friends and family, but individuals may also consider joining a support group in-person or via social media, or becoming involved in their community through volunteering or short courses.<sup>113</sup> Social skills may be impacted after TBI in older adulthood,<sup>131</sup> making socialization more difficult.<sup>132</sup> Social skills training may be sought from speech language therapists. Strategies and tips that can be worked on independently at home include: ask open-ended questions; be aware of body language; take turns in conversation; be mindful of personal space.<sup>133</sup>

## **Cognitive Activity**

It is important to keep cognitively active throughout older adulthood by engaging in mentally challenging activities. For TBI survivors, multi-modal cognitive rehabilitation

can be of great benefit.<sup>134</sup> Activities outside of formal rehabilitation may include: learning a new skill (e.g., learning a new language or a musical instrument, learning about a new technology or software product, creative writing); adopting a new hobby (e.g., games of strategy, quilting); engaging in a short course; high-level reading material; engaging with artistic activities (e.g., attending galleries, theater, museums).<sup>135,136</sup> Selecting enjoyable activities is important to ensure long-term engagement.<sup>135</sup> Engagement can also be optimized by creating an activity schedule and completing cognitive activities in a distraction-free environment.

## Medical Health

Key areas of focus for older adults with TBI to promote medical health are: managing medical conditions,<sup>28,137</sup> reducing poly-pharmacy,<sup>13</sup> reducing alcohol and tobacco intake, and preventing further injuries.<sup>1</sup> Tips for optimal management of medical conditions include: regular and consistent access to primary care services;<sup>95,113</sup> care coordination between providers;<sup>137</sup> using health monitoring tools and technology at home (e.g., blood pressure cuff, phone apps for sleep and physical fitness);<sup>113</sup> using a pill box to manage medications.<sup>113</sup> Alcohol should be avoided or at least reduced after TBI.<sup>138</sup> Alcohol use can increase the risk of falls, have negative interactions with medications, and exacerbate or cause various chronic health problems.<sup>29</sup> Formal help for reducing alcohol intake may be sought from a primary care physician, psychologist or addiction specialist. Self-help groups including Alcoholics Anonymous may also be of benefit. Further tips for reducing alcohol intake include: spending time with people who support the desire to cut back or abstain; setting a specific and actionable goal and tracking progress towards it; manage people, places, or activities in the environment that trigger drinking; find other coping mechanisms to manage stress.<sup>138,139</sup> Older adults are at increased risk of re-injury due to their heightened risk of falls. Strategies to prevent falls include: home modifications (e.g., handrails, grab bars in the bathroom), equipment (e.g., cane or walker), gait and motor rehabilitation, as well as training for balance, strength and flexibility (e.g., tai chi).<sup>138-141</sup> There are several evidence-based fall prevention programs:

- Otago Exercise Program: Strength and balance exercises and a walking program<sup>144</sup>
- Fit & Strong: Flexibility, low-impact aerobics, strength training and health education<sup>144</sup>
- Stepping On: Strength and balance exercises, home hazards, vision, coping after a fall, understanding how to initiate a medication review<sup>144</sup>

- Tai Chi for Arthritis and Fall Prevention: Traditional Tai Chi principles for improving health and wellness. Focus on balance, confidence and muscular strength<sup>144</sup>

## Summary

A substantial number of older adults recover well following TBI.<sup>25</sup> Beyond age, there are several other key prognostic factors that need to be considered including frailty, comorbid health conditions, and access to ongoing rehabilitation services. Rehabilitation modified to meet the needs of older adults will optimize outcomes and promote recovery. Finally, adoption of a healthy lifestyle is encouraged to facilitate more years of fulfilling, satisfying and personally meaningful lives for older adults living with TBI.

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# **Section II: The Aging Network: Partnerships among Government Agencies and Community Organizations**

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## **History of the Aging Network**

While the health care system and government-supported insurance programs address active medical care needs of older adults, it is the aging network—a partnership between federal, state, local, and tribal agencies and organizations—that provides assistance to older Americans and their families nationwide, including those with brain injuries. The aging network provides the many non-medical care services that older adults often need, such as nutritious food, transportation, care coordination, housing, education to address health literacy, among other services addressing social determinants of health.

In 1965, the same year that Medicaid and Medicare were created, Congress passed the Older Americans Act (OAA) in response to concern by policymakers about a lack of community-based social services for older persons. The original legislation established authority for grants to states for community planning and social services, research and development projects, and personnel training in the field of aging. These services were meant to complement the medical services provided by Medicare and Medicaid. The law also established the Administration on Aging (AoA) to administer the newly created grant programs and to serve as the federal focal point on matters concerning older persons.

The goal of the aging network has always been to develop plans to meet the needs of older adults at a national, state, and local level and to ensure that older adults receive the care they need to remain securely and independently in their homes and communities for as long as possible. Agencies within the aging network are tasked with implementing such plans to ensure that older adults can age with dignity and independence.

Although older individuals may receive services under many other federal programs, today the OAA is considered the primary funding vehicle for the organization and delivery of social and nutrition services. The OAA authorizes a wide array of service programs through a national network of 56 state and territorial agencies on aging, area agencies on aging in every community, thousands of service providers, and tribal organizations, as described below and shown in [Figure 1](#). The OAA also includes community service employment programs, through funding from the Department of Labor, for low-income older Americans; training, research, and demonstration activities in the field of aging; and elder rights protection activities for vulnerable older adults.

## Structure of the Aging Network

Established in 2012, the Administration for Community Living (ACL) is one of 11 operating divisions within the U.S. Department of Health and Human Services (HHS). Its mission is to “maximize the independence, well-being, and health of older adults, people with disabilities across the lifespan, and their families and caregivers.”<sup>1</sup> Therefore, all ACL programs are designed based on this principle:

*All people, regardless of age or disability, should be able to live independently and participate fully in their communities. Every person should have the right to make choices and to control the decisions in and about their lives. This right to self-determination includes decisions about their homes and work, as well as all the other daily choices most adults make without a second thought.*<sup>2</sup>

The structure of the aging network and its many partners is as follows:

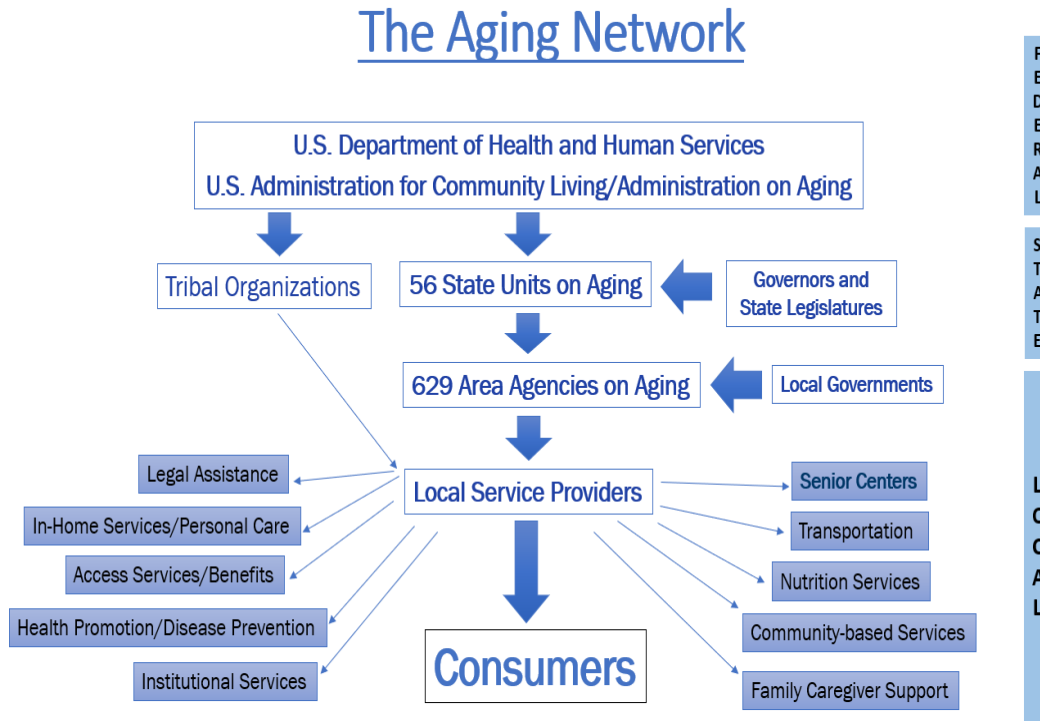
- **Administration on Aging (AoA):** The AoA was established pursuant to the Older Americans Act and is currently an agency within the Administration for Community Living. It is headed by the assistant secretary for aging. The office of American Indians, Alaskan Natives, and Native Hawaiians is also housed at AoA.
- **State Units on Aging (SUA):** Each state is required to create its own plan to show how it will deliver services to older adults. Funding from the federal government is based upon the number of people 60 or older in the state. There are 56 SUAs, including all 50 U.S. states, territories, and Washington, D.C. Many SUAs also serve persons with disabilities, including those with brain injuries. Most SUAs work closely with state Medicaid offices to coordinate home- and community-based services for older adults, persons with disabilities, and caregivers. “State Unit on Aging” is a general term, and the state-specific title and organization of each governmental unit varies and may be called a department, office, bureau, commission, council, or board for the elderly, seniors, aging, older

adults, and/or adults with disabilities. ADvancing States is the national association that represents the nation's 56 state and territorial state units on aging and disabilities and long-term services and supports directors.

- **Area Agencies on Aging (AAA):** AAAs were formed by dividing each state by geographic area. These AAAs provide important services to older adults in their communities and report data to the state about trends and events at the local level. There are 655 AAAs across the country. Some states have only one AAA. Local AAAs can be found by visiting Eldercare.gov or calling 1-800-677-1116. USAging is the national association that represents and supports the national network of Area Agencies on Aging and advocates for the Title VI Native American Aging Programs that help older adults and people with disabilities live with optimal health, well-being, independence, and dignity in their homes and communities.
- **Local providers:** The AAAs work closely with local service providers who provide and coordinate care, make and deliver meals, serve as meal sites, provide transportation, engage older adults in a variety of programs, such as health promotion and disease prevention, and perform other vital tasks. Some AAAs provide these services directly while others contract with local providers to deliver these critical services. Senior centers, nutrition service providers, Meals on Wheels services, transportation providers, senior housing sites, care managers, senior employment services, and many other entities comprise the local Aging Network.
- **Aging and Disability Resource Centers (ADRCs):** Another important component of the aging network are ADRCs, which are also part of the No Wrong Door (NWD) system model. A collaboration between ACL, the Centers for Medicare & Medicaid Services (CMS), and the Veterans Health Administration, the NWD initiative supports states working to streamline access to long-term services and supports for older adults, people with disabilities, and their families. ADRCs raise visibility about the full range of available options; provide objective information, advice, counseling and assistance; empower people to make informed decisions about their long-term services and supports; and help people access public and private programs. ADRCs provide unbiased, reliable information and counseling to people with all levels of income. ADRCs can be a critical service to persons with head injuries who require services and supports to live as independently as possible. Nearly two-thirds of AAAs perform ADRC functions in their communities.<sup>3</sup>

See Figure 1 for a visual depiction of the aging network.

**Figure 1. The Aging Network**



Source: Adapted from Congressional Research Service, Older American Act: overview and funding. Figure 1, page 3. Updated May 6, 2024. <https://crsreports.congress.gov/product/pdf/R/R43414> Accessed July 2024.

## Funding and Titles of the Older Americans Act

Funding from the Older Americans Act flows from the ACL AoA to the SUA to the AAAs and then to the local service providers. Specifically, the AoA allots formula grants to SUAs in all 50 states, the District of Columbia, Puerto Rico, and the U.S. territories. Funds for Title III programs are distributed to each state and its aging network according to a formula based on the state's share of the U.S. population age 60 or older or, in the case of caregiver support programs, age 70 or older. The formula considers the geographical distribution of older individuals, as well as the distribution of older persons

with the greatest economic and social need (with particular attention to low-income, minority older individuals) among specified planning and service areas.

The OAA encompasses multiple Titles, each addressing a particular area of need or service. Titles II-VII have different levels of annual funding as appropriated by Congress each year through the annual budget process.

- Title I is a declaration of the OAA's 10 objectives that adheres to the tradition of ensuring inherent dignity of the older individuals in society. Some of these objectives include adequate income in retirement, the best possible physical and mental health, and obtaining and maintaining housing that fits the person's needs.
- Title II establishes the AoA to carry out the provisions of the Act and establishes AAAs, which operate within a planning and service area (PSA) designated by the state unit on aging.
- Title III established various programs, and funding for those programs, to support older individuals. In order to receive Title III funding, states must satisfy three general criteria:
  - The state must have an established SUA.
  - The state must have an ACL-approved state plan, a document filed in four-year intervals that outlines how the SUA will deliver services in compliance with and furtherance of the OAA.
  - The SUA must establish a system of PSA which receives and utilizes the federally awarded funds for program purposes.

Title III encompasses multiple programs to further the OAA's objectives, the largest of which is the nutrition program, which is comprised of two components: Title IIIC-1, which provides congregate meal services, and Title IIIC-2, which provides home-delivered meals. Additional Title III programs include:

- Supportive Services Program, including Information and Assistance (Title III B)
- Long-Term Care Ombudsman Program, Legal Assistance (Title III B)
- Disease Prevention and Health Promotion Program (Title III D), including funding for falls prevention, chronic disease self-management, medication



management, behavioral health, physical activity, home modification, and other many other programs.

- Family Caregiver Support Programs (serving children and older adults) (Title III E)
- Title IV was added in 1978 to establish additional programs and funding to better understand and meet older adults' needs. The programs include the Senior Medicare Patrol (SMP) program and the Resource Centers on Native American Elders. The SMP program empowers and assists Medicare beneficiaries, their families, and caregivers to prevent, detect, and report health care fraud, errors, and abuse. The Resource Centers on Native American Elders provide research, training, and technical assistance to organizations that serve Native American older adults. Areas of emphasis and training include health, long-term services and supports, elder abuse, mental health, and other issues relevant to older Native American communities.
- Title V authorizes the Community Service Employment grant program to facilitate community service employment and volunteerism opportunities for low-income older adults or those who have poor employment potential. The U.S. Department of Labor administers the Community Service Employment grant program, making it the only OAA program not administered within the HHS.
- Title VI authorizes funds that are awarded to Native American tribal organizations, Native Alaskan organizations, and Native Hawaiian represented nonprofits to provide transportation, home-delivered and congregate nutrition services, service information and referrals, and other home care and caregiver supports. Unlike Title IV, which funds research and technical support to entities that serve Native American communities, Title VI funds provide direct services to Native American and their representative organizations.
- Title VII provides state grants for “vulnerable elder rights protection” programs, including the long-term care ombudsman program and programs dedicated to the prevention of elder abuse, neglect, and exploitation. Title VII also provides funding for elder rights and legal assistance development. Title VII strongly emphasizes coordination among these programs to support the state ombudsman’s role as an advocate and agent for systemwide change.

# Reauthorization of the Older Americans Act

The OAA has been reauthorized and amended numerous times since it was first enacted in 1965. The most recent reauthorization took place during the 116th Congress when both the House and the Senate passed legislation that reauthorized the OAA for a five-year period. On March 25, 2020, President Trump signed the Supporting Older Americans Act of 2020 (P.L. 116-131), which authorized appropriations for OAA programs through FY2024.

As part of the 2020 Reauthorization of the OAA, Congress added some key provisions due to fall-related brain injuries regarding screening, coordination of treatment, rehabilitation and related services, and referral services.. These additions were due to the important recognition that older adults are at high risk of suffering a traumatic brain injury due to a fall. Falls are the leading cause of traumatic brain injuries in older adults. The four relevant sections included as part of the 2020 OAA Reauthorization are:

- **Sec. 201 Definition:** The term “traumatic brain injury” has the meaning given such term in section 393B(d) of the Public Health Service Act (42 U.S.C. 280b–1c(d)), (i.e., an acquired injury to the brain). Such term does not include brain dysfunction caused by congenital or degenerative disorders, nor birth trauma, but may include brain injuries caused by anoxia due to trauma.
- **Sec. 102 Screening, Coordination, and Referral:** The term “disease prevention and health promotion services” means: screening for fall-related traumatic brain injury and other fall-related injuries, coordination of treatment, rehabilitation and related services, and referral services related to such injury or injuries;
- **Sec. 321 State Grants for Supportive Services:** The assistant secretary shall carry out a program for making grants to states under state plans approved under section 307 for any of the following supportive services, including services designed to provide health screening (including mental and behavioral health screening, screening for negative health effects associated with social isolation, falls prevention services screening, and traumatic brain injury screening) to detect or prevent (or both) illnesses and injuries that occur most frequently in older individuals;
- **Sec. 411 - Evaluation, Training, Technical Assistance, Research, Public Awareness:** Conducting activities of national significance to promote quality and continuous improvement in the support provided to family and other informal caregivers of older individuals through activities that include program evaluation,

training, technical assistance, and research, including building public awareness of cognitive impairments, such as Alzheimer's disease and related disorders with neurological and organic brain dysfunction, depression, mental disorders, and traumatic brain injury.

The next Reauthorization of the Older Americans Act is currently underway, as of this writing, and is anticipated to be finalized during the 119<sup>th</sup> Congress, beginning in January 2025.

## **OAA Program Spotlights**

### **Evidence-based Disease Prevention and Health Promotion Services**

Title III-D of the OAA was established in 1987 to provide grants to states and territories for programs that support healthy lifestyles and promote healthy behaviors. The FY 2012 Congressional appropriations law included, for the first time, an evidence-based practice requirement related to Title III-D funds. As a result, states that receive OAA funds under Title III are required to spend those funds on evidence-based programs to improve health and well-being and reduce disease and injury. The implementation of disease prevention and health promotion programs is designed to improve the health of older adults as they reduce the need for more costly medical interventions.

Service activities may include programs related preventing and mitigating the effects of chronic disease (including osteoporosis, hypertension, obesity, diabetes, and cardiovascular disease), falls prevention, physical activity, alcohol and substance abuse reduction, smoking cessation, weight loss and control, stress management, and improved nutrition. Delivered in-person and remotely by AAAs or local service providers, these programs are appropriate for people with head injuries and their caregivers. Evidence-based programs help to manage physical and mental health needs and/or prevent injuries and the onset of new conditions for persons with head injuries.

The ACL-funded [National Chronic Disease Self-Management Education Resource Center](#) and [National Falls Prevention Resource Center](#), based at the National Council on Aging, maintains a [database](#) of evidence-based programs that meet ACL's criteria for evidence-based programs under Title III-D. The database is updated periodically based on the results of an evidence-based program review process.

## **National Family Caregiver Support Program**

Recognizing the critical role families play in the nation's system of long-term services and supports, Congress established the National Family Caregiver Support Program (NFCSP) in 2000 as part of the reauthorization of the OAA. It was the first federal program making it possible for every state and community to provide family caregivers with a flexible base of services and supports to assist them in keeping care recipients in the settings of their choice for as long as possible. The program is a trusted and reliable resource to support the needs of family or other informal caregivers as they lend assistance to aging adults, as well as the needs of grandparents and older relatives caring for minor children or adults with disabilities.

States and territories offer five core services for caregivers, in partnership with AAAs and local service providers:

- Information for caregivers about available services
- Assistance to caregivers in gaining access to services
- Caregiver education/training, individual counseling, and support groups
- Respite care
- Supplemental services

The NFCSP provides grants to states and territories to fund supports that help caregivers of all ages balance caregiving with other responsibilities. This, in turn, helps ensure more adults can remain in their homes and communities. Individuals who are eligible include:

- Adult family members or other informal caregivers age 18 and older providing care to individuals 60 years of age and older, or to individuals of any age with Alzheimer's disease and related disorders
- Older relatives (not parents), age 55 and older, providing care to children under age 18
- Older relatives, including parents, age 55 and older, providing care to adults ages 18–59 with disabilities, such those with a head injury

## Summary

Understanding the structure of the aging network is an important step for state government brain injury programs to improve outcomes for older adults with brain injury. This leads to opportunities for training the network and an understanding of potential resources that might be available for older adults with brain injury. Additionally important is understanding the principles of the Older Adults Act, specifically those that can be used to increase training and screening for brain injury for partners and within the aging network. State brain injury programs can use this legislation to obtain buy-in for screening and better support for older adults with brain injury in their states.

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# Section III: Training Approaches

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## Why Is Training Important?

Training is a necessary component to ensuring that aging network adult health providers at all levels of service are equipped for working with individuals with brain injury. Everyone within a state aging network and all related community providers needs information about brain injury basics in order to best work with individuals with TBI. However, everyone within a system does not have to be an expert in TBI. For example, physicians and nurses might find it useful to have training on current medication recommendations, while psychiatrists, psychologists and other counseling staff are concerned with various therapeutic interventions and their efficacy. Direct service professionals and other general staff across the system mainly need to know what to do for crisis intervention, harm reduction and overall safety. Many professionals serving older adults with brain injury *will* need some level of training to better understand this chronic condition and best practices regarding treatment interventions. The goal is to develop a brain injury-informed workforce by equipping providers with necessary knowledge to identify TBI and interventions that work best in their particular setting and where to find TBI resources in their community for additional expertise and referral.

It is equally important for providers to know that they may already be working with individuals with TBI and are unaware of it. This includes older adults who:

- Do not yet know they have a brain injury.
- Do know, but are unaware of the extent of the challenges they are experiencing related to BI, how it interacts with their behavior, or even how to disclose it.
- Do know, but have not disclosed it due to concerns about becoming ineligible for services.

Knowing that individuals seeking services have a TBI and how best to provide services and how to modify existing modalities will result in better outcomes for individuals with TBI (see [Section V: Modifying Clinical Interventions for TBI](#)).

As indicated in [Section II](#), part of the 2020 Reauthorization of the Older Americans Act includes key provisions related to screening, coordination of treatment, rehabilitation, referral, and related services due to fall-related brain injuries. This legislation indicates a clear need for training on best approaches for screening and services.

The provision of training is often a positive start to establishing a good partnership with state aging networks. Training can increase awareness of issues and highlight the needs for additional support. Training can be a way for a state TBI program to open the door, introducing related issues and revealing the importance of collaboration and available specialized resources. Many state TBI programs already provide general training to community partners. One option is to incorporate practices related to aging and behavioral health into existing TBI training. When possible, embed TBI training into existing aging systems training for new staff to ensure sustainability. Approaches could include:

- In-person training with BI staff trainers or subject matter experts.
- Archived virtual training through a link with TBI staff trainers or subject matter experts.
- Core competencies for new staff—these competencies may already exist within your system or have been drafted by other state TBI programs. One example is the Opioids and Mental Health Competencies, created by several ACL TBI State Partnership Grant Program grantees.
- Continuing education for existing staff—as new practices or trends develop continuing education can be provided to staff that have already been trained in basic approaches by your system. The provision of discipline- or setting-specific continuing education credits can also encourage provider participation.

Staff turnover is a significant factor in many systems, and aging networks are no different. Providing information that can be accessed later is an effective alternative to repeating in-person education. Also, it is important to note that it is more effective when providing training to master's- or doctorate-level staff to use similar practitioners for training. Clinicians want to learn from peers.

## **What Level of Training Should Be Included?**

It might be useful to think of training components in tiers, starting with the most basic information and working toward more complex challenges. Each tier leads to the next.

Basic training applies to all aging network health staff and can be repeated as needed. Intermediate training applies to providers in direct contact with individuals receiving services. Trainers for both basic and intermediate levels should be staff and providers who are well-practiced in brain injury causes, sequelae, compensatory strategies, and community resources. Advanced training applies only to the clinical staff engaged in therapeutic interventions, and trainers should be clinicians who are well-practiced in therapeutic interventions.

## **Basic**

Basic training prepares providers to have an overall awareness and knowledge of how TBI impacts older adults, and it supplies basic supports and strategies to providers through tutorials, either in-person or virtual. Some topics covered in basic training include:

- Definitions of brain injury
- Mechanisms of brain injury
- Severity of brain injury
- Prevalence of brain injury, particularly for older adults
- Prevalence of brain injury and co-occurring behavioral health issues, including mental health, suicide risk and prevention, and opioid and substance use disorders
- Associated challenges of brain injury
- Healthy aging with an existing brain injury
- Falls prevention risks, strategies, and programs
- Simple compensatory strategies and accommodations
- Community TBI resources and links
- National TBI resources and links



## Intermediate

Intermediate training prepares providers with additional knowledge of screening methods and treatment strategies for older adults through tutorial and interactive sessions, either in-person or virtual. In addition to the topics covered in the [Basic](#) training section, these additional topics covered in intermediate training include:

- Screening-tools needs, overview and practice
- Identification of challenges and application of compensatory strategies, case studies and practice
- Introduction to effective intervention modalities
- Detailed review of TBI community-based resources and information
- Referral protocols to community TBI providers
- Systemic safety strategies

## Advanced

Advanced training includes the topics in basic and intermediate, and also prepares clinical providers with tools for treatment within existing aging network settings by clinical subject-matter experts who are well versed in TBI and mental health challenges for older adults through in-person tutorials and interactive sessions. Some topics covered in advanced training include:

- In-depth review of behavioral and addiction treatment approaches and intervention
- Medication management and review
- Treatment modeling, supervision and shadowing
- Systemic crisis intervention and harm reduction strategies

There are several state TBI programs currently providing training to older adult health systems. It is important, however, to customize data and resources for your own state when providing training. Some national and state resources that will be useful are listed here:

- Substance Use/Brain Injury Bridging Project. (2021). Client workbook: Substance use and brain injury (2nd ed.)  
<https://bit.ly/SUBIclientworkbook>
- Lemsky, C. (2021, November). Traumatic brain injury and substance use disorders: Making the connections (P. Stilen & T. Heitkamp, Eds.). SAMHSA Mountain Plains ATTC (HHS Region 8).  
<https://bit.ly/TBISUDtoolkit>
- Substance Abuse and Mental Health Services Administration. (2021). Treating patients with traumatic brain injury (Updated). SAMHSA Advisory. Publication No. PEP21-05-03-001  
<https://bit.ly/TBIadvisoryPatients>
- Corrigan, J. (2019, August). Traumatic brain injury and behavioral health treatment. NASMHPD.  
<https://bit.ly/NASMHPDassessment6>
- Institute for Behavioral Health, The Heller School for Social Policy and Management, Brandeis University. (2022). INROADS.  
<https://bit.ly/INROADSibh>
- TBI Model Systems. (2011). Emotional problems after traumatic brain injury. Model Systems Knowledge Translation Center.  
<https://bit.ly/ModelSystemsTBI>
- American Congress of Rehabilitation Medicine. (2021, December 15). Mental health pocket card for management of patients with posttraumatic stress disorder and mild traumatic brain injury. Archives of Physical Medicine and Rehabilitation, 103(3), 611–615.  
<https://bit.ly/PTSDandmTBI>
- Ohio Valley Center for Brain Injury Prevention and Rehabilitation. (2013). Accommodating the symptoms of TBI.  
<https://bit.ly/OVaccomodatingTBI>
- NSW Agency for Clinical Innovation. (n.d.). Working with people with traumatic brain injury.  
<https://bit.ly/Module10four>
- National Council on Aging and Falls Prevention. <https://bit.ly/NCOAfalls>

- The E4Center of Excellence for Behavioral Health Disparities in Aging resources: <https://bit.ly/cliniciansE4C> and training modules: <https://bit.ly/trainingE4C>
- Utilizing Cross-Sector Partnerships to Reduce Behavioral Health Disparities in Older Adults (2021, September). <https://bit.ly/reducingdisparitiesE4C>

## Where Can I Find Trainers and Existing Training?

The level of training should guide the person providing the training. There are a number of TBI basics available to share with aging network health providers, both virtual training webinars and supporting written resources. A few of those are included in the list above.

For advanced training providers, the section on therapeutic approaches might be useful. Contacting [TBI TARC](#) for subject-matter experts in this area is also a useful option.

## Summary

Training related to BI is critical for everyone working in all levels of older adult health settings. With the right information delivered at the right time, staff can become brain injury informed in their approach to care by learning about some of the key components and needs related to this unique population.

# Section IV: Brain Injury Screening and Assessment: Older Adults

*Kim A. Gorgens, Ph.D., ABPP Professor, University of Denver, Graduate School of Professional Psychology*

## Older Adults Act and Mandate

The Older Americans Act (OAA) was passed into federal law in 1965 and established a nationwide network of services aimed at helping older adults (60+) live independently in their communities. The OAA funds programs like meal delivery and meals at senior centers, transportation, personal care, homemaker services, adult day care, preventive health services, elder abuse/exploitation prevention and legal assistance, and caregiver support.

The OAA was last updated more than 35 years ago, in 1988, and was recently revised to improve program implementation and better support the national network of providers and systems that deliver OAA services. These changes are reflected in the Final Rule, which took effect on March 15, 2024 (see [Appendix A](#)).

Additionally, the OAA Reauthorization of 2020 allows states to use the OAA funding for screening for brain injury. State brain injury programs can leverage this tool to collaborate with state aging agency partners to ensure older adults who sustain brain injury are properly identified and supported.

## An Aging World

According to U.S. census data, 74.6 million Americans were 60 or older in 2020.<sup>1</sup> As of 2024, more than 11,200 Americans turn 65 every day, which is more than 4.1 million people each year. By 2040, an estimated 80.8 million—or one in five Americans—will be 65 or older. By 2050, that number is projected to be almost 90 million.<sup>2</sup> That is 22 percent of the population and up from one in eight in 2000.<sup>3</sup>

Gains in longevity are expected to increase dramatically in the coming decades. For example, some researchers claim that half of females born after 2000 will live to be 100 years old.<sup>4</sup> Older adults can expect to live longer lives now than has ever been true. In 1960, men could expect to live another 15 years when they became eligible for social

security at age 65 and, by 2040, a 65-year-old man is expected to live for another 22 years. The gain for women is less dramatic but still notable at about 4 years difference when comparing 1960 to 2040.<sup>5</sup> Of course, not everyone ages the same. Inequities in health care, education, and housing are directly related to health outcomes and longevity.<sup>6</sup>

## **Brain Injury among Older Adults**

Traumatic brain injury (TBI) is a leading cause of morbidity and mortality in the U.S. Older adults have higher rates of TBI than any other age group. TBI impacts more than 23 million adults ages 40+.<sup>7</sup> In 2017, adults aged 65+ accounted for 38 percent of all TBI-related deaths and 44 percent of all TBI-related hospitalizations in the U.S.<sup>8</sup> Falls are the leading cause of TBI in older adults; a risk conferred by the sensory, motor, and cognitive changes that often accompany aging.

## **Prognosis for Brain Injury Recovery among Older Adults**

Traditionally, older age has been one predictor of poorer outcome after TBI.<sup>9</sup> Mortality rates after severe TBI among patients aged 55+ range from 30 percent to 80 percent and, in larger studies, the likelihood of death was highest after TBI for patients aged 71+.<sup>10</sup> After TBI, older adults recover slowly and have a greater symptom burden with poorer long-term outcomes than younger adults.<sup>8</sup> The convergence of health and disease conditions, treated or otherwise, complicate recovery from TBI.<sup>11</sup>

Cognitive deficits are common after TBI and the severity of those deficits can worsen with more injuries and as people get older. In this way, TBI is associated with dose and severity-dependent cognitive deficits. Compared to people without a history of brain injury, individuals with one or two mild TBIs (mTBIs) demonstrate poorer attention. Persons with three mTBIs have poorer attention and executive function and persons with a history of four or more mTBIs demonstrate poorer attention, processing speed, and working memory than their peers with no mTBI. People with a history of one or more moderate TBIs have greater impairments and are characterized by even poorer attention, executive function, and slower processing speed.<sup>12</sup>

## Cognitive Changes in Older Adulthood

Normal age-related cognitive changes are characterized by subtle declines in specific cognitive domains. This may include slight slowing of processing speed, reduced working memory capacity, and memory lapses like occasional difficulties with word retrieval. While these changes are considered a normal part of the aging process, they are distinct from pathological cognitive impairment, or dementia, which is associated with more significant and progressive cognitive decline.

There are projected to be more than 14 million older adults (65+) with dementia by the year 2060.<sup>13</sup> Dementia is the general term for cognitive impairments that interfere with doing everyday activities. Alzheimer's disease, for example, is the most common type of dementia. A diagnosis of dementia will include deficits in activities of daily living (ADLs) and impairments in instrumental activities of daily living (IADLs) like shopping or paying bills. There is a direct relationship between a decline in cognitive status and deterioration of daily function across the full spectrum of dementia.

Dementia can be difficult to diagnose and often requires a specialist for confirmation of diagnosis. Since there is currently no laboratory test to definitively diagnose dementia, professionals use cognitive tests to assess memory, language, and executive functions and results are compared to a patient's peers or to their own performance to track changes over time.

The risks to develop dementia are multifaceted and include genes, health status, and even brain injury. A single TBI can minimally increase the risk for dementia later in life, but the risk increases with the number of injuries. There are stronger associations between TBI and risk of dementia among women compared to among men and among white as compared to among Black populations.<sup>14</sup>

## Mild Cognitive Impairment (MCI) and TBI

A diagnosis of mild cognitive impairment (MCI), or mild neurocognitive disorder, often precedes a diagnosis of dementia or major neurocognitive disorder. MCI is characterized by similar changes in cognitive function with no major impairment in day-to-day function. TBI is associated with the development of MCI. In fact, one large-scale study reported that a self-reported history of TBI with a loss of consciousness (LOC) more than one year prior, was related to a 1.3-fold increased risk for a diagnosis of MCI even among people with no post-injury cognitive complaints.<sup>15</sup> That study controlled for

age, education, genetic risk, and other health history. In their study, persons with a history of TBI and LOC were diagnosed with MCI about 2.5 years earlier than their peers.

## **The Relationship between TBI and Dementia Later in Life**

There is also a relationship between TBI and risk for dementia. TBI may exacerbate or accelerate some dementia symptoms in older adults and sustaining a TBI earlier in life appears to be associated with earlier onset of some neurodegenerative disorders or dementias. In fact, a history of one TBI is associated with a 1.25 times increased risk of dementia, and a history of two or more TBIs is associated with more than two times the risk of dementia. In research, up to 10 percent of all dementia cases could be attributed to a history of at least one TBI.<sup>16</sup> An older study reported that patients with a history of TBI with a LOC had a significantly higher likelihood of being diagnosed with one specific kind of dementia, fronto-temporal dementia, compared with all other types of dementia combined.<sup>17</sup> In another study, the average age of dementia onset among participants with a history of mTBI was 68.5, which was significantly earlier than was true for the non-TBI group.<sup>18</sup> The age of onset of dementia was even younger for participants with both MCI and mTBI at  $66.5 \pm 1.3$  years compared to  $70.6 \pm 0.3$  for the non-TBI MCI group. That study concluded that a history of TBI may accelerate the age of onset of cognitive impairment by two or more years.

The risk of developing dementia is mediated by gender and race, among other health-related variables. Previous research on dementia and traumatic brain injuries suggests that women are at higher risk than men. Black populations are at a higher risk for dementia compared to people who are white. Among persons with a history of TBI though, the data are mixed. One large study reported that females were more likely to experience dementia as a result of brain injury than males. Further, that study showed that although there is increased dementia risk associated with brain injury among both white and Black participants, white participants were at higher risk for dementia after brain injury compared to Black participants.<sup>16</sup>

## **TBI and Dementia: Intersecting Symptoms**

The current clinical description of individuals with dementia involves impulsivity, depression, suicidality, and a variety of cognitive problems. These are the same

complaints described by persons with persistent post-TBI symptoms. In this way, many of the symptoms of dementia overlap with the typical sequelae of TBI.

## **Disease vs. Injury**

### **WHY should you screen**

Early detection and documentation of cognitive decline can significantly improve the quality of care for older adults. Testing is currently underutilized, as research indicates that up to 81 percent of individuals meeting the diagnostic criteria for dementia have never received an official diagnosis. Similarly, there is no standard of care that warrants follow-up after brain injury in this population. To address this assessment gap, it is recommended that all vulnerable adults, defined as those aged 65+ who are at risk for death or functional decline, undergo annual evaluations to assess their cognitive and functional status.<sup>19</sup> This approach could lead to earlier identification of cognitive issues and enable timely rehabilitation, ultimately enhancing the overall care and well-being of this population. This applies to persons with a brain injury history or with suspected dementing disease.

### **HOW you should screen**

Both unstructured and structured cognitive assessments are recommended as the initial steps in the identification of cognitive impairment and, in some cases, the diagnosis of dementia. Cognitive assessment for persons with TBI or suspected dementia is most robust where it is used in combination with interviews and collateral data.

#### ***Interviews/Observation-History***

The course of brain injury recovery and the progression of dementing disease are very different. Barring other pathology, people recover lost cognitive function after brain injury. Despite any long-term sequelae, there is a general pattern of symptom improvement, even when patients experience the feeling of “reaching a plateau” after several years of recovery. Typically, TBI causes a sudden cognitive deficit that improves and then stabilizes in the months after the injury. Studies have not demonstrated a rapid cognitive decline during the period of time that someone is recovering from brain injury.

The course of dementia is characterized by cognitive decline but is unpredictable and varies greatly between individuals. In fact, research suggest that dementia progresses very differently between *and* within individuals, which makes it difficult to forecast the



trajectory of disease progression.<sup>20</sup> The deterioration of cognitive function does, however, set dementia apart from TBI and can make that exclusion clearer in practice.

### ***Behavior/Activities of Daily Living (ADL)***

The assessment of cognitive function in older adults should incorporate an evaluation of behavior. That might include questions from established frameworks, such as the Behavioral Risk Factor Surveillance System (BRFSS) or similar Health Risk Assessment (HRA) tools. Example questions might include:

- **Memory and Confusion:** “During the past 12 months, have you experienced confusion or memory loss that is happening more often or is getting worse?” This question assesses the frequency and severity of subjective cognitive complaints, which can be indicative of underlying neurological or psychiatric conditions.
- **Activities of Daily Living (ADLs):** “During the past 7 days, did you need help with others to perform everyday activities such as eating, getting dressed, grooming, bathing, walking, or using the toilet?” This question evaluates the individual’s ability to perform basic self-care tasks, which can be impaired in dementia.
- **Instrumental Activities of Daily Living (IADLs):** “During the past 7 days, did you need help from others to take care of things such as laundry and housekeeping, banking, shopping, using the telephone, food preparation, transportation, or taking your own medications?” This question assesses the individual’s capacity to perform more complex activities necessary for independent living, which can also be affected by cognitive decline. <sup>(21,22)</sup>

By incorporating these or similar questions into routine screening assessments, clinicians can gain valuable insights into an older adult’s functional status. Together with cognitive screening, these results can be used to inform appropriate interventions.

### ***Cognitive Tests***

Cognitive screening involves administering brief, standardized assessments designed to detect cognitive impairment. These tools are not diagnostic for TBI or dementia but are designed to identify people who may require further evaluation and to generate compensatory strategies for use in treatment. In this way, the tests provide a snapshot cognitive status and a roadmap for the delivery of care. These tests can also be used to

track cognitive changes over time, which can be particularly useful in making a determination between TBI and dementia.

These instruments typically evaluate several cognitive domains such as memory, attention, language, and executive function. In general, the cognitive domains that are most sensitive to impairment post-TBI are attention and executive function, with approximately double the effect compared with processing speed and working memory.<sup>12</sup> Memory deficits, of course, are the diagnostic hallmark of dementing disease.

Common cognitive screening tests include the Automated Neuropsychological Assessment Metric (ANAM), the Mini-Mental State Examination (MMSE), the Montreal Cognitive Assessment (MoCA), and the Mini-Cog. Importantly, no single tool or instrument is recognized as the best brief assessment for this population or to determine if a full evaluation is needed. A brief list of validated and reliable instruments has been compiled by the Alzheimer’s Association below.

**Table 1: Valid and Reliable Screening Tools**

Abbreviation	Tool Name
<b>6-CIT</b>	6-Item Cognitive Impairment Test
<b>AMT</b>	Abbreviated Mental Test
<b>BOMC</b>	6-item Blessed Orientation-Memory-Concentration Test
<b>CAMCOG</b>	Cambridge Cognitive Examination
<b>CDT</b>	Clock Drawing Test
<b>GPCOG</b>	General Practitioner Assessment of Cognition
<b>MIS</b>	Memory Impairment Screen
<b>MMSE</b>	Mini-Mental State Examination
<b>MoCA</b>	Montreal Cognitive Assessment
<b>RUDAS</b>	Rowland Universal Dementia Assessment
<b>SAS-SI</b>	Short and Sweet Screening Instrument
<b>SBT</b>	Short Blessed Test
<b>SLUMS</b>	St Louis Mental Status
<b>SPMSQ</b>	Short Portable Mental Status Questionnaire
<b>STMS</b>	Short Test of Mental Status
<b>T&amp;C</b>	Time and Change Test

Source: <https://www.alz.org/getmedia/9687d51e-641a-43a1-a96b-b29eb00e72bb/cognitive-assessment-toolkit>

Most of these cognitive screening tests are appropriate for use post-TBI and for dementia screening. That said, some researchers suggest that some of the briefer tests, like the MoCA, lack sensitivity to cognitive impairment post-TBI. Computerized cognitive

assessment instruments, like the ANAM, have been shown to detect impairment in more than 50 percent of people whose performance was normal on the MoCA.<sup>23</sup> As to short tests with demonstrated efficacy, the Clock Drawing test (CDT) is free, simple and quick to administer (less than 5 minutes) and is easy to complete and score. The results of the CDT are relatively independent of language, education, and cultural biases, which makes it ideal for both TBI and dementia.<sup>24</sup>

## **When to Make a Referral?**

Importantly, a self-reported change in daily function combined with poor cognitive screening performance should always prompt a referral for a more comprehensive evaluation including neuropsychological assessment and medical management.

## **Summary**

In the case of dementing disease, early identification and a proactive response are critical. Early detection of dementia allows for timely intervention which can slow the progression of the disease and improve the quality of life for patients and their caregivers. Importantly, early detection can facilitate access to rehabilitation, clinical trials, and/or other disease-modifying therapies that may be most effective in those early stages of dementia. Earlier identification also generates medical record documentation that can afford patients access to those therapies and encourage proactive planning (e.g., legal, financial, and medical decision-making, etc.). Early identification also allows for the assessment of longer-term changes in cognitive and daily function, which are essential components of an informed prognosis about disease progression. Until we have better prevention and treatment strategies, time is the best advantage for patients.

Similarly, the identification of TBI history is critical, particularly among persons with vulnerable brains. The degree to which an injury can be rehabilitated soon after it occurs, improves outcomes all around. Even years after injury, therapies and cognitive rehabilitation can be expected to benefit overall function.

Fortunately, the lifestyle and behavioral therapies designed to promote brain health are appropriate for both injured and demented brains.<sup>25</sup> Post TBI, cognitive rehabilitation can be targeted to domain-specific deficits<sup>12</sup> and therapies can be modified to accommodate changes in cognitive function. After a diagnosis of dementia, modifying the delivery of therapies to account for changes in cognition is an expected standard of care. A screening assessment of cognitive function can be expected to yield detailed

suggestions about how to modify therapies for aging patients, regardless of their health history. A particular focus on strategies for addressing common concerns comorbid to TBI and dementia is imperative. That includes strategies to address chronic pain, sadness and stress, sleep problems, grief, and relationship difficulties.

Ultimately, early detection of brain-related rehabilitation needs, including TBI and dementia, is an investment in the future well-being of patients, families, and professionals. This new standard of comprehensive care can significantly improve the quality of life for, and the care delivered to, aging patients dealing with cognitive decline.

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# Section V: Modifying Clinical Interventions for TBI with Older Adults

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This section will highlight the importance of understanding the unique factors to consider when providing services to older people with TBI. Understanding these factors will help state brain injury program personnel to more effectively partner with clinicians in the field who may be treating older adults for a range of health and mental health conditions to improve outcomes for older adults with TBI. It is imperative when working with any older adult that the clinician understands factors that can be unique to the lives of adults in their later years.

## Introduction

As previous sections have noted, TBI is the number one cause of disability and death in older adults, and the world is currently experiencing largest aging population in the history of our planet.<sup>1</sup> Therefore, it is essential that anyone working with older adults understand the fundamentals of living with a TBI, particularly as normal age-related declines overlap significantly with symptoms of brain injury (see Table 1).

**Table 1: Aging versus TBI**

Age-related factors	TBI-related factors
Mobility	Mobility
Functional loss	Functional loss
Cognitive decline	Cognitive decline
Hearing/vision loss	Hearing/vision loss
Health problems	Health problems

<b>Loss of independence</b>	Loss of independence
<b>Reduced income</b>	Reduced income
<b>Depression</b>	Depression
<b>Social withdrawal</b>	Social withdrawal

TBI has become to be understood as a chronic health condition.<sup>2</sup> This is true whether the individual sustains a mild, moderate, or severe TBI. Those with more moderate to severe TBI may have clear health complications that continue through their lifetime. However, all levels of severity can experience ongoing symptoms (e.g., physical, cognitive, emotional, behavioral) of various severity levels, and these symptoms can worsen if the individual sustains any subsequent TBIs. Work with any older adult should include some discussion of a range preventive care. Falls prevention is one of the largest issues of safety for older adults, as discussed in [Section II](#).

While many people who sustain a moderate or severe TBI (refer to [Section I](#)) will receive acute inpatient services for the physical manifestations of their injury, only a small portion receive acute or post-acute rehabilitation services. Additionally, the majority of those who sustain a mild TBI (or concussion) receive no rehabilitation services. In fact, many TBIs go unreported, even to the individual’s primary health care provider. For those with milder injuries who do receive some rehabilitation services, those services are typically focused on any physical symptoms, with limited to no education that they may notice other symptoms (e.g., cognitive, emotional, behavioral) over time that can also be address in rehabilitation.<sup>3</sup>

Moderate to severe TBIs have dramatic implications for the mortality of the individual and the risk of death within two to five years is 11 times the rate of those of the same age who do not sustain a TBI. Mild TBI may have less immediate risk to morbidity and mortality but should not be confused with having little to no consequence for current and future functioning. To further confuse the complexities of sustaining a TBI in older age, all individuals experience age-related cognitive changes (e.g., attention, short term memory, processing speed, and executive functions) that may have already been present but less notice by the individual (or their friends and family) prior to the TBI.

The takeaway is that that a TBI regardless of the age of injury impacts multiple areas of function generally quantified into physical, cognitive, and emotional/behavioral domains



that can have profound and long-term implications for daily living, especially if not treated. Refer to [Table 2: Typical Symptoms after TBI](#).

**Table 2: Typical Symptoms after TBI**

Physical	Cognitive	Emotional and Behavioral
<b>Headaches</b>	Attention <ul style="list-style-type: none"> <li>• difficulty concentrating</li> <li>• easily distracted</li> <li>• not listening when being spoken to</li> <li>• losing his train of thought</li> </ul>	Depressive <ul style="list-style-type: none"> <li>• moody</li> <li>• hopeless</li> <li>• lonely</li> <li>• sad</li> <li>• lacking confidence</li> <li>• avoiding family/friends</li> <li>• trouble sleeping</li> </ul>
<b>Dizziness</b>	Memory <ul style="list-style-type: none"> <li>• misplacing things</li> <li>• forgetting well-known names</li> <li>• trouble remembering or comprehending what one reads</li> <li>• word finding difficulty</li> <li>• learning and reading slowly</li> <li>• spelling mistakes</li> </ul>	Anxious <ul style="list-style-type: none"> <li>• feeling scared</li> <li>• jumpy</li> <li>• frightened</li> <li>• difficulty being in crowds</li> </ul>
<b>Fatigue</b>	Executive Functioning difficulties <ul style="list-style-type: none"> <li>• making decisions</li> <li>• handling money</li> <li>• making conversation</li> <li>• prioritizing</li> <li>• multitasking</li> <li>• problem solving</li> <li>• performing chores</li> <li>• understanding humor</li> </ul>	Emotion Dysregulation <ul style="list-style-type: none"> <li>• feeling impatient</li> <li>• angry</li> <li>• irritable</li> <li>• argumentative</li> <li>• frustrated</li> <li>• feeling misunderstood</li> </ul>
<b>Light sensitivity</b>		
<b>Sound sensitivity</b>		
<b>Blurred vision</b>		

## Evaluation of Cognitive Functioning in the Older Adult with TBI

For anyone working with an older person who has sustained a TBI, it is essential to assess and evaluate whether there are any cognitive impairments or changes in cognitive functioning to provide or modify appropriate treatments. What type of cognitive impairments are present can be difficult to define because cognitive domains can

overlap. Most people with TBI, especially older adults, define cognitive problems as “memory problems”—or specifically, word-finding problems—yet there are many areas of cognitive function that can interfere with daily living. Therefore, a neuropsychological assessment is recommended when treating older adults with TBI.

Since access to neuropsychological testing can be difficult, clinicians should consider directly asking if there have been any cognitive changes or challenges in daily life and administering a brief cognitive screening measure (e.g., the Montreal Cognitive Assessment (MoCA),<sup>4</sup> Mini-Mental Status Exam (MMSE)).<sup>5</sup>

This information can be invaluable for the clinician to be aware of the cognitive strengths and weaknesses and be able include appropriate strategies for effectively working with the older adult with TBI. If cognitive deficits are determined through these screening instruments, it is important to refer for a comprehensive neuropsychological evaluation. Depending on access to direct cognitive rehabilitation services, typically provided by a rehabilitation psychologist or speech and language pathologist, and occasionally by a neuropsychologist or an occupational therapist, a clinician working with an older adult with TBI can integrate these recommendations into their therapies.

## **Neuropsychological Rehabilitation and Cognitive Rehabilitation**

Many interventions exist to address the challenges faced by people with TBI. While some of these interventions directly target cognition to ameliorate performance on specific cognitive tasks, other treatments are intended to address broader aspects of life that have been negatively affected by TBI, such as psychological and social functioning, participation in vocational and avocational activities, and challenges with loss of identity.<sup>6</sup> Collectively, these interventions fall under the broad category of neuropsychological rehabilitation, a collection of treatments aimed to improve a person’s cognitive, emotional, behavioral, social, and vocational functioning when they experience cognitive impairments due to injury or disease.<sup>7</sup>

The longest and most challenging consequence individuals contend with after TBI are the cognitive changes that occur. With older adults already facing some levels of cognitive decline, the changes experienced after TBI can be difficult to delineate from prior decline or may highlight changes that began prior to the TBI. There are many areas of cognitive functioning, and cognitive rehabilitation is a global term for many types of treatment that address cognitive domains. There are three types of cognitive

rehabilitation interventions that: 1) focus on an individual cognitive domain (e.g., attention, memory), 2) focus on a complex cognitive domain like executive functioning that can encompass many types of skills (e.g., initiation, set shifting, problem solving, decision making, emotional regulation), or 3) integrate metacognitive strategies focused on several cognitive domains. Beyond these cognitive domain(s) of interest, cognitive rehabilitation interventions also can: 1) remediate (or restore) specific deficits, 2) teach compensatory strategies to offset deficits and build on the individual's cognitive strengths, or 3) employ metacognitive strategies that one can learn and apply across different situations.

As cognitive rehabilitation interventions may focus on a single or multiple cognitive domains, neuropsychological rehabilitation interventions can target cognitive, emotional, social, and functional domains singularly or as a comprehensive treatment approach. Cicerone et al.<sup>8</sup> have conducted the most comprehensive systematic reviews of neuropsychological rehabilitation interventions in people with brain injuries, and they have identified comprehensive-holistic programs as the best evidence-based clinical practice standard of care. Comprehensive-holistic programs are exemplars of neuropsychological rehabilitation. They incorporate an organized set of interventions that target cognitive impairments with interventions delivered individually or in group modality and focused on: increasing self-awareness of the impact of cognitive deficits, improving interpersonal and emotional functioning, and enhancing psychological coping mechanisms.<sup>8</sup>

## **Clinicians working with Older Adults with TBI**

Many times, older adults with TBI who are in need of services may not have access to a brain injury specialist. These adults may be seen by clinicians who have little experience with brain injuries. It is possible to successfully work with such an individual if there is a clear understanding of their cognitive strengths and weaknesses and how the clinician can modify their own treatment methods to accommodate these cognitive concerns. Additionally, it is always important to be aware of physical, emotional, and behavioral changes when working with older adults. Therefore, regular evaluations of level of functioning in these domains, along with consistent updates from people in older adults' support system who have regular access to them, are needed.

## **Factors to consider when delivering treatment to older people with TBI**

### ***1. Impaired self-awareness***

Older adults with TBI may present with deficits in self-awareness, which could range from poor expectation of consequences (e.g., unable to predict that a certain maladaptive behavior will cause further problems) to anosognosia (i.e., lack of awareness that their mental or physical functions are impaired and disrupt their daily functioning). It is important for clinicians to assess the level of self-awareness through standard measures or collateral interviews with caregivers and/or other providers to evaluate appropriate modifications to treatments. Additionally, it is not uncommon that as self-awareness increases, psychological issues may be exacerbated as the person becomes cognizant of the challenges and losses that have incurred because of the TBI.

### ***2. Physical Health***

When receiving therapy for mental health, it is also important to address the whole person. Physical health is also important to overall well-being. Many physical changes that occur through the aging process may need some behavioral modifications to assure the individual is functioning at the highest level possible. Having a doctor simply tell the aging person with TBI to sleep better, eat healthier, exercise, etc., does not ensure that the person understands how to make changes to behavior, is able to engage in those changes, or can sustain the necessary changes. Behavioral activation is a key element in most interventions related to TBI as well as related to aging. For clinicians working with these older adults with TBI, it is fundamental to monitor the whole person: brain, body, and emotional states.

**Table 3: Areas to Monitor in Older Adults with TBI**

<b>Medication Management</b>	Using properly (e.g., taking on time, using pill box). Involvement of caregivers.
<b>Alcohol use</b>	Limit or remove alcohol (e.g., lots of research on how even a couple of drinks a week are difficult on an aging body).
<b>Smoking</b>	Limit or stop all smoking, including marijuana.
<b>Health Monitoring</b>	Recognition of co-existing age-related health issues. Regular visits to primary care, but also baseline and monitoring of many specialists (cardiology, neurology, pulmonology, gastroenterology, etc.).
<b>Driving</b>	As processing speed, reaction time, and vision decline, and formal evaluation is recommended.
<b>Balance and coordination</b>	Neurological screen and engage in balance and core-building exercises.
<b>Diet</b>	Basic information on necessary dietary changes that facilitate good health in older adults.
<b>Sleep</b>	Monitor number of hours at night, any naps and how long, middle-of-night wakings, or early awakening. Sleep logs are helpful or referral to sleep specialist, especially if suspect sleep apnea.
<b>Physical Activity</b>	Review this regularly; encourage tracking apps for counting step, monitoring how much they get up. There are many exercises online for older adults through AARP or on YouTube. Refer for physical therapy evaluation especially if there is pain and or fear related to moving. Also ensure that their environment is safe and accessible.
<b>Fall Prevention</b>	Strategies to prevent falls and ensure home safety.
<b>Pain Management</b>	Consideration of chronic pain prevalent in older adults. Monitor and discuss pain issues and management.
<b>Social Activity</b>	Monitor and facilitate list of activities to engage in despite any limitations post TBI.
<b>Communication (slow, difficult to comprehend)</b>	Cognitive screening or full neuropsychological evaluation.
<b>Family and Social Support</b>	Clear involvement of family, friends, community and preventing social isolation.

### ***3. Emotion Regulation***

Older adults TBI often face challenges with emotion regulation, manifesting as increased irritability, difficulty managing stress, mood swings, and heightened emotional sensitivity. These issues may stem from the damage to brain areas involved in emotional processing and control, as well as from the overall impact of the injury on the older adult's mental and physical health. Including training in emotion regulation when working with older adults with TBI is an effective approach to helping with cognitive

impairments by improving executive functions and, by extension, the ability to reach broader treatment goals including safety, independence, daily functioning, and quality of life. Emotion dysregulation has been linked to the development and maintenance of a wide range of psychiatric problems. Without effective emotion regulation skills or strategies, the intensity and duration of negative feelings may become unmanageable and interfere with other areas of daily functioning, and lead to reduced self-efficacy and low self-esteem, thus having a negative impact on a person's self-worth and identity. As a person learns and utilizes emotion regulation skills and strategies, they can enhance positive affective states, which have been associated with positive health outcomes, by their own volition.<sup>9</sup>

#### **4. Telehealth**

The use of telehealth is changing the ways in which health care is delivered. While employing technology was expanding prior to the global shutdown due to COVID-19, this type of intervention was not widely used within neuropsychological rehabilitation interventions until 2020. Nevertheless, people with disabilities and older adults, often have a very difficult time gaining access to specialized services due to location or lack of transportation. Currently most specialized treatment occurs in major medical and rehabilitation centers, which are often located in or near major metropolitan areas, leaving millions of individuals outside the catchment areas. Furthermore, most rural areas provide limited transportation options, and the number of specialized professionals in these areas is not sufficient to cover the needs of all individuals requiring rehabilitation. In addition, the physical and cognitive impairments that people with TBI typically experience can make traveling difficult and cost prohibitive. Telerehabilitation is a promising solution for decreasing the health disparities and increasing access to care globally.<sup>10</sup>

## **Modifying existing interventions**

Different TBI-related cognitive deficits can interfere with both the process and outcome of cognitive rehabilitation interventions. All clinicians must be aware of the areas of decline and how they specifically manifest in the older adult with TBI. Shown in Table 4 are challenges related to brain injury and recommendations on how to modify the provider's approach to accommodate for the impairment.

The overarching principles of neuropsychology rehabilitation emphasize that each person's strengths and needs are different. Additionally, everyone has the potential to improve their weaknesses and maintain their self-determination. However, below are

several key areas that effective in working with older adults with TBI. These adjustments acknowledge the unique challenges faced by older adults with TBI, ensuring that interventions are tailored to their specific needs and circumstances. It is important for clinicians and the older adults' support system to maintain consistency and daily routines, which have a profound positive impact on facilitating memory and other cognitive functions. Family and social support networks should be brought into treatments to ensure that everyone understands the goals and best practices for achieving the best outcomes possible for the older adult with TBI.

## **Summary**

While there are many areas to consider when working with an older adult with TBI, there are new or adapted strategies and interventions that can help with addressing these issues. It is important to collaborate with your state health systems on what might work best and for which settings.



Table 3: Challenges Related to Brain Injury and Recommendations

Area of Consideration	Challenges	Recommendations
<b>Cognition Impairments</b>		
	Understanding the variety of cognitive domains, and how they are affected by TBI	Break down tasks into smaller steps, use written instructions, and provide memory aids like calendars and reminders.
<b>Memory</b>	Remembering appointments. Missing appointments is disruptive for continuity of care and can be frustrating for providers.	Use memory aids like calendars, alarms, sticky notes, and notebooks. Train and encourage how to use these aids and offer consistent routines. Repeat all information frequently. Explore strategies to reduce forgetting.
	Remembering content of sessions.	<p>Break down information into manageable chunks. Summarize the session (e.g., bulleted list, handouts, workbooks). Assist with entering information in journal/workbook at the end of the session. Review prior session and homework at the beginning of the next session.</p> <p>Use consistent routines to aid memory with regular breaks to account for potential fatigue.</p>
	Difficulty remembering content or insights gained during sessions. Thus, problems persist requiring extended duration of treatment.	Simplify instructions and provide memory aids (e.g., calendars, reminders, to-do lists). Break down tasks into smaller steps and use written instructions.
	Forgetting homework assignments or not understanding what the assignment required, developing a lack of skill transfer and	Clearly explain homework assignments, ensure that they are assigned consistently, as opposed to periodically (e.g., every session), and review in the following session.

Area of Consideration	Challenges	Recommendations
	<p>generalization.</p>	<p>Have the person write down the instructions somewhere that increases the probability that they will locate the information between sessions (e.g., the session journal, their calendar, a to-do list, a homework notebook).</p> <p>If possible, send email or text reminder ahead of time, checking progress on the homework.</p>
<p><b>Attention &amp; Concentration</b></p>	<p>Challenges staying focused. Older people with TBI may drift in and out of the session.</p> <p>Inattention or mental fatigue could make session difficult to follow, remember, or remain engaged.</p> <p>Difficulties with sustained attention making it difficult to stay focused for prolonged periods during the sessions.</p>	<p>Minimize distractions. Create a quiet environment.</p> <p>Use short, focused sessions with regular breaks to account for potential fatigue. Make the sessions shorter, and periodically check in with the client to ensure they remain focused.</p>
	<p>Being easily distracted (e.g., by sounds, movements) that can interfere with focus during sessions.</p>	<p>Hold sessions in a less visually “busy” setting (e.g., have client face wall art instead of a busy bookshelf or window).</p> <p>Reduce the amount of ambient noise or sounds that can be distracting.</p>
<p><b>Processing Speed (pacing)</b></p>	<p>Slow rate of comprehension. Reduced processing speed may interfere with how quickly one can understand a complex concept or learn a skill.</p>	<p>Engage in slower and more deliberate speech. Allow for sufficient time to process information and respond. Avoid rushing through exercises or discussions.</p>

Area of Consideration	Challenges	Recommendations
		Use multiple modalities to present information and repeat concepts and instructions.
	Slow rate of responding due to slow processing speed, requiring more time to access information from long-term memory, organize thoughts and ideas and formulate a response. Clinician could misinterpret that the client is more impaired or less engaged than is accurate.	<p>Allow more time for sessions.</p> <p>Allow clients ample time to respond to a question or to describe an event or experience.</p> <p>Indicate that there is no pressure to provide a response quickly.</p>
<b><i>Executive Functioning</i></b>	<p>Difficulty making decisions or problem solving.</p> <p>They may present as overthinking a problem or, conversely, avoiding a task or abandoning a goal.</p>	<p>Help the client clarify the decision to be made.</p> <p>Facilitate decision-making by using strategies like a “pros and cons” analysis.</p> <p>Engage in an evidence-based problem-solving approach. Help the client generate viable choices.</p>
	<p>Difficulty initiating behavior (e.g., daily tasks, homework assignments).</p> <p>Difficulty planning or organizing oneself or activities</p>	<p>Make sessions more structured (e.g., set up Q&amp;A format).</p> <p>Encourage notetaking and review throughout the week. Ask family or friends to help with routine building and reminding of daily tasks.</p> <p>Set up motivators that encourage clients to complete tasks.</p>
<b><i>Communication</i></b>	Difficulty initiating behavior (e.g., conversations, daily tasks, homework	Speak slowly and clearly; use visual aids and gestures; confirm understanding regularly; consider speech therapy.

Area of Consideration	Challenges	Recommendations
	assignments).	Ensure understanding is confirmed frequently
<b>Emotional and Behavioral changes</b>		
	<p>Get easily overwhelmed and experience cognitive “flooding” even in the presence of minimal stressors.</p> <p>May lead to difficulties in accomplishing daily tasks because this distress.</p>	<p>Focus on a small number of topics during a session. Be patient and empathetic.</p> <p>Acknowledge feelings and provide emotional support, recognizing that aging can bring about emotional and psychological changes.</p> <p>Teach relaxation and mindfulness techniques.</p>
	<p>Alexithymia, a neurological impairment where a person with TBI is unable to recognize, process, or be aware of their own affective responses.</p> <p>In addition, they may misread or ignore emotional cues of others.</p>	<p>Be cautious not to interpret lack of emotional awareness as a psychiatric symptom (e.g., anhedonia) or as an attempt of denial.</p> <p>Obtain information about one’s emotional state without expecting accurate labeling of their emotions. Focus on increasing emotional awareness.</p>
	Irritability	Implement behavioral strategies.
	Inappropriate humor or lack or confusion around humor	Focus on increasing emotional awareness
	Social Isolation	Encourage participation in social activities; facilitate support groups; involve family and friends in therapy.
	Decline in independence of daily activities	Teach adaptive techniques for daily tasks; use assistive technology; promote gradual independence.

Area of Consideration	Challenges	Recommendations
<b>Sensory Sensitivities</b>		
	<p>Photosensitivity is common after TBI, especially mild TBI, causing sensitivity to bright lights.</p>	<p>Adjust the lighting in the room or encourage the person to wear photoprotective gear, such as sunglasses or visors.</p>
	<p>Double vision</p>	<p>Refer for neuro-ophthalmology.</p>
	<p>Decreased vision</p>	<p>Ensure good lighting</p>
	<p>Decreased or sensitivity with hearing</p>	<p>Avoid bright lights and loud noises; create a calm, quiet, and soothing environment.</p>
<b>Physical limitations</b>		
<b><i>Fatigue</i></b>	<p>Both physical and cognitive fatigue can interfere with treatment.</p> <p>The physical effort of traveling to the treatment setting may affect attendance and participation.</p> <p>It is not uncommon for people with TBI to feel fatigued for several days after a day of strenuous physical or mental activity, this could simply be traveling to sessions.</p>	<p>Schedule activities during peak energy times; allow for rest periods; promote good sleep hygiene.</p> <p>Keep sessions shorter, if necessary.</p> <p>Give breaks.</p> <p>Help clients manage their activity level to prevent the onset of debilitating fatigue.</p> <p>Schedule manageable treatment-related activities between sessions</p>
<b><i>Mobility and Accessibility</i></b>		<p>Adapt physical spaces and exercises. Use chairs with armrests, avoid exercises that require quick movements or balance challenges, and ensure the space is wheelchair</p>

Area of Consideration	Challenges	Recommendations
		accessible if needed
		<p>Adapt exercises to individual capabilities; use assistive devices; ensure accessibility and safety in the environment.</p> <p>Incorporate balance training and physical therapy; ensure a safe home environment; use mobility aids if necessary</p>
		Conduct home safety assessments; educate on fall prevention strategies; use medical alert systems.
<b>Health Monitoring</b>		
		<p>Regularly assess physical and cognitive health</p> <p>Monitor for changes in health status and collaborate with other health care providers as needed</p>
<b>Medication Management</b>		
		Use pill organizers; provide clear instructions; involve caregivers in medication monitoring; use automated reminders.
<b>Age-related health issues</b>		
		Monitor for co-existing age-related health issues like arthritis, cardiovascular diseases, and sensory impairments; integrate care with other health care providers.
<b>Pain Management</b>		
		Employ non-pharmacological pain management techniques

Area of Consideration	Challenges	Recommendations
		such as physical therapy, relaxation exercises, and massage.

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# Section VI: Medication Management and Pharmacotherapy Considerations

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## Introduction

The basic tenets of medication management in adults with traumatic brain injury (TBI) largely parallel those of geriatric medicine. Recommendations to:

- “Start low and go slow;” minimize polypharmacy
- Consider the impact of altered physiology and comorbid medical conditions
- Review medication lists frequently with an eye toward deprescribing

All have their origins in geriatric medicine and serve as guiding principles for providers treating older adults and individuals with TBI alike. When caring for older adults with TBI, adherence to these basic principles takes on the utmost importance, as the unique sets of challenges faced by each population respectively interact to produce complex clinical scenarios for which guidelines related to TBI or geriatric medicine alone may be of limited utility.

This section reviews special considerations for medication management in older adults with TBI. Beginning from the shared framework and key principles common to clinical care of both older adults and those with TBI, we discuss the key features of an approach to medication management that takes the vulnerabilities of both populations into account. It is important to note that these vulnerabilities are not merely additive. Rather, they are synergistic: advancing age influences the course of TBI recovery and nature of posttraumatic symptoms, while TBI increasingly has been shown to have long-reaching impact capable of altering the normal aging process across the lifespan.

The challenges facing health care providers treating older adults with TBI are substantial, but they are not insurmountable: using the common principles as a starting point—and returning to them along the way as an overarching framework—the nuances

relevant to pharmacotherapy for older adults and individuals with TBI can be incorporated into a cohesive treatment plan that optimizes quality of life, enhances functional ability, and mitigates disability to the extent possible for this most vulnerable patient population.

Navigating the complex landscape associated with TBI in older age can present many obstacles, potential pitfalls, and frustrating setbacks necessitating revised treatment plans. The aim of this section is to lay out a map for health care providers accompanying their patients into this challenging terrain. You may not get it right the first time (or the second, or the third), but the key to success lies in having a systematic approach to which you can return and try again. If you are reading this guide, you are either already exactly the provider your older patient with TBI needs, or someone advocating for an optimized approach.

## **Defining our population(s): Aging with a TBI versus TBI sustained in older adulthood**

Public health messaging and media attention have substantially raised societal awareness of TBI in recent years, but the emphasis on sport- and military-associated injuries belies the fact that it is older adults who experience the highest rates of TBI-associated emergency department visits, hospitalizations, and deaths.<sup>1</sup> At the same time, the advent of more nuanced diagnostic assessments and therapeutic interventions for acute TBI of all severities across the lifespan has increased the number of individuals surviving to older adulthood with a history of prior TBI. The population of older adults with TBI, then, must be understood as referring to two distinct but related groups: individuals who experienced incident TBI in older adulthood; and those who are aging in the context of a TBI sustained earlier in life.<sup>2</sup> These groups share many features, but they are not identical. Injury mechanisms, predisposing risk factors, and physiological sequelae of TBI in older adults differ substantially from those commonly described in TBI literature, which draws primarily from research conducted in younger populations.<sup>1</sup> In order to evaluate and treat specific posttraumatic symptoms effectively in older adults, it is important to understand the temporal context of TBI within a given individual's lifetime, as this may substantially shape the diagnostic and therapeutic considerations that follow.

# The pharmacology of aging: General considerations

The normal aging process involves a number of systemic physiologic changes relevant to pharmacotherapy decision-making in older adults with and without TBI. These changes have direct implications for older adult *pharmacokinetics*, the mechanisms by which a given drug is absorbed, distributed, metabolized, and excreted; and for *pharmacodynamics*, the effects of a given drug on the body.

## Physiology of aging: Pharmacokinetics

Aging affects the absorption, distribution, metabolism, and excretion of medications to varying degrees. Absorption of orally administered medications may be limited by age-related reductions of intestinal blood flow, gut motility, and gastric acid secretion.<sup>3</sup> Once absorbed, a given drug's bioavailability may be greater or lesser in older adults as compared to the general population. Serum albumin levels decline with age, increasing the free fraction of protein-binding medications such as phenytoin; and age-related shifts in body composition toward greater body fat and lesser total body water increase the bioavailability of hydrophilic agents (e.g., alcohol, levodopa) and decrease that of lipophilic ones (e.g., diazepam).<sup>4</sup> Medications that undergo extensive first-pass metabolism (e.g., amitriptyline, propranolol, morphine) become more bioavailable as the efficiency of this process declines with age, while drugs that require enzymatic conversion from prodrug to active metabolite (e.g., ACE inhibitors) become less so.<sup>3</sup>

Drug metabolism is further slowed by age-associated decreases in liver size and hepatic blood flow and enzymatic activity. Reduced renal function, common among older adults largely in association with the chronic medical conditions prevalent in this population, can impede the elimination of many drugs; of greatest concern are medications with predominantly renal excretion such as lithium (which is cleared entirely by the kidneys) and levetiracetam. Collectively, these reductions in drug metabolism and elimination place older adults at substantially increased risk of experiencing supratherapeutic (or, in some cases, subtherapeutic) drug levels with greater vulnerability to drug-drug interactions, influenced to a variable and somewhat unpredictable extent by alterations in absorption and drug distribution.

## Physiology of aging: Pharmacodynamics

The physiologic changes of aging—especially those of the renal, cardiovascular, and central nervous systems—can influence a drug's therapeutic benefits as well as its

adverse effects. Renal concentrating ability and sensitivity to anti-diuretic hormone (ADH) decline with age along with the thirst mechanism necessary for maintaining fluid homeostasis, resulting in increased incidence of water and electrolyte imbalances in older adults.<sup>5,6</sup> Hyponatremia is by far the most common of these, with an estimated prevalence of up to 30 percent of older populations, and prescription medications are recognized as a major cause.<sup>7</sup> Thiazide and thiazide-like diuretics, which directly alter water and sodium excretion, are common offenders; other high-risk medications include antipsychotics, selective serotonin reuptake inhibitors (SSRIs), tricyclic antidepressants (TCAs), proton pump inhibitors (PPIs), and antiseizure medications (ASMs), all of which can cause hyponatremia by inducing a syndrome of inappropriate anti-diuretic hormone secretion (SIADH).<sup>7</sup> Mounting evidence indicates that even mild chronic hyponatremia is not without consequences. Hyponatremia in older adults is associated with cognitive impairment, gait disturbances, and decreased bone density; with increased rates of falls and fractures, independent of osteoporosis; and with worse outcomes following fall-related injuries.<sup>5</sup>

In the aging cardiovascular system, reduced baroreceptor and beta-adrenergic receptor sensitivity promote postural (aka orthostatic) hypotension and contribute to differential impact of antihypertensive medications, enhancing the blood pressure-lowering effects of calcium channel blockers and blunting the response to beta-blockers.<sup>4</sup> Age-related arterial stiffening, commonly linked to hypertension, is additionally associated with impaired autonomic postural reactivity and orthostatic hypotension independent of comorbid hypertension.<sup>8</sup> Postural hypotension in older adults is of particular concern given its potential to lead to syncope and falls, and medications are important contributors. Chief among these are SSRIs, serotonin-norepinephrine reuptake inhibitors (SNRIs), TCAs, calcium channel blockers, and benzodiazepines.<sup>8</sup>

The pharmacodynamic changes associated with aging in the central nervous system (CNS) reflect the combined impact of altered drug concentrations at the receptor site and differential responsiveness of the receptor itself.<sup>3</sup> Systemic pharmacokinetic changes account for only some of this variation in drug concentration. Blood-brain barrier permeability increases with age, allowing drugs to enter the brain more readily in older adults than in younger persons. The loss of select neuronal populations that occurs even in normal aging—and is dramatically increased in neurodegenerative disorders—heightens sensitivity to adverse effects of medications acting on these neurons' receptors. Most significantly, the number of dopaminergic neurons and D2 receptors declines with age, as does the number of cholinergic neurons and receptors; drugs that act on these systems thus can have disproportionate impact, as indicated by

older adults' increased incidence of adverse effects with antipsychotics and anticholinergic medications.<sup>3</sup> Age-related changes in the structure and function of benzodiazepine receptors likely underlie older adults' heightened sensitivity to benzodiazepines, which exceeds that which would be expected to result from increased drug concentrations alone.<sup>4</sup>

## **Medical comorbidities and the issue of polypharmacy**

Normal aging is thus associated with numerous physiologic changes that, collectively, influence the expected response to drug therapy in older adults and can substantially alter the risk-benefit calculus central to all prescribing practices. Added to this is the increasing prevalence of multimorbidity in aging populations, as individuals with multiple medical conditions are commonly prescribed multiple medications to treat them. The potential for untoward effects and interactions increases exponentially as more drugs are prescribed. Rates of drug-drug interactions have been estimated to approach 13 percent in persons taking two medications and as high as 80 percent in those taking five or more.<sup>6</sup> Polypharmacy, the simultaneous use of multiple medications by a single individual, dramatically increases the likelihood of adverse events. Beyond the interactions of intentionally prescribed drugs, which may produce unwanted synergistic effects, increasing medication burden is associated with increased risk of prescribing errors.<sup>9</sup> Polypharmacy has been associated with a host of undesirable outcomes, most notably including cognitive impairment, falls, and increased mortality.<sup>9</sup>

## **Aging physiology, pharmacotherapy, and fall risk**

While the physiologic changes, medical comorbidities, and medication utilization of older adults can result in a broad range of downstream consequences for health and well-being, the relationship of these features to fall risk is particularly relevant for the current discussion, since the vast majority of older adults with incident TBI are injured in falls. Polypharmacy and gait and balance disturbances are among the strongest predictors.<sup>10</sup> Reduced visual acuity, common in older adults, also contributes to increased falls. Persons with dementia are at high risk of falls, and community-dwelling older adults with more subtle cognitive dysfunction (especially inattention and executive dysfunction) also fall more often than cognitively intact older adults.<sup>10</sup> The increased risk of falling associated with hyponatremia may be mediated in part by use of antidepressant medications, but untreated depression is itself an independent risk factor for falling in older adults.<sup>11,12</sup> Orthostatic hypotension, another strong predictor of falls, can be missed in individuals with delayed presentations (i.e., >3 minutes following position change), who may experience no preceding symptoms of cerebral

hypoperfusion and report only falling.<sup>8</sup> Both depression and orthostatic hypotension were found to be risk factors for unexplained falls in community-dwelling older adults in one prospective study.<sup>13</sup>

The physiologic alterations, medical comorbidities, and prescribing complexities common among older adults with TBI largely map onto those of older adults who fall, with some additional considerations. The features that determine whether or not a given fall will result in TBI have yet to be fully clarified, but they likely reflect unique vulnerabilities of this population. In one study of adults over age 60 hospitalized for fall-related injuries, patients with TBI were older, more likely to have fallen backward, and more likely to report falling due to dizziness as compared to age-matched peers whose falls caused only soft tissue injuries.<sup>14</sup> Regular alcohol use was a risk factor for TBI in men, while Parkinson's disease increased odds of TBI in women; and falls resulting in TBI were more likely to occur while getting into/out of bed, toileting, or negotiating stairs.<sup>14</sup>

Older adults who sustain fall-related TBIs likely cluster toward the more chronically ill end of the fall-risk spectrum, with pre-injury limitations of balance and mobility which are significant enough that basic activities present hazards. In line with this, older adults with TBI have been shown to be more impaired in their activities of daily living (ADLs) and have increased health care utilization in the period prior to TBI as compared to non-injured peers.<sup>11,1</sup> Older adults taking oral anticoagulant medications may be at elevated risk of falling as a function of chronic medical illness, and the presence of anticoagulation substantially increases risk of intracranial bleeding and associated mortality for a given injury.<sup>15</sup>

## **The impact of aging on TBI**

### **Aging after TBI**

The long-term impact of TBI sustained earlier in life on health and well-being across the lifespan has garnered increasing attention in recent years. Previously viewed as a static condition, TBI is now understood as a chronic process in which acute injury triggers a secondary cascade of damaging neurochemical events that may extend well beyond the time and locus of initial impact. Importantly, TBI may alter the course of normal age-related cognitive changes. Beyond the cognitive and neurobehavioral symptoms that can appear acutely after TBI and persist to varying degrees, some individuals with TBI go on to develop premature age-related progressive cognitive decline.<sup>2</sup> Survivors of TBI experience accelerated rates of cerebral cortical atrophy and loss of white matter tract

integrity as compared to those seen in healthy aging.<sup>16</sup> Most concerning, survivors of TBI appear to develop Alzheimer disease (AD) and other dementias at higher rates, and with earlier onset, than the general population, with this risk increasing in parallel with injury severity.<sup>17,18</sup>

The exact nature of the relationship between TBI and dementia remains unclear, but chronic posttraumatic disturbances of neuroendocrine and neuroimmune function may play key roles. Posttraumatic neuroendocrine dysfunction can influence age-related hormonal shifts, especially of sex hormone production and thyroid and growth hormone regulation, resulting in downstream impact on a broad range of processes including energy metabolism, autonomic reactivity, immune function, and neuroplasticity and neural repair.<sup>16</sup> Compounding this, persistent upregulation of immune inflammatory mechanisms after TBI likely interacts with age-related declines in the capacity of neural tissue to mitigate the effects of oxidative stress, resulting in progressive accumulation of toxic free radicals that interfere with neuronal cell function and ultimately lead to cell death.

Sleep has increasingly been appreciated in recent years as an independent risk factor for cognitive decline in healthy older adults, and its importance may be compounded in TBI. Among its numerous benefits, sleep facilitates the activity of the glymphatic system responsible for clearing the brain of protein waste products, including the pathologic amyloid and tau aggregates implicated in Alzheimer disease (AD).<sup>19</sup> Sleep architecture is altered in both normal aging and TBI, and the combined impact of age-related and posttraumatic changes to sleep duration and quality may have substantial ramifications for older adults with TBI.

## **Older adults with incident TBI**

The sequelae of TBI sustained in older adulthood are similar to those of TBI in younger individuals with additional influences from demographic and other clinical features unique to the older population. TBI in older adults more often involves women and falls, usually from standing height or less, in contrast to the male predominance and frequency of motor vehicle accidents common in younger persons.<sup>1</sup> Age-related loss of brain volume creates increased space between the brain and the skull, allowing for increased movement of the brain inside the skull, and aging of cerebral vasculature confers increased risk of bleeding after a given injury.<sup>20</sup> Older adults thus less commonly present with the diffuse axonal injury characteristic of high-speed collision injuries and more often develop subdual hematomas and coup/contrecoup contusions.<sup>20</sup> The focal nature of these lesions increases risk of posttraumatic seizure. Older adults

are at elevated risk of posttraumatic seizures and epilepsy in both the acute and chronic period.<sup>6</sup>

While substance use disorders are somewhat less prevalent in older TBI populations as compared to younger cohorts, chronic medical conditions are much more common.<sup>21</sup> Older adults with TBI report significantly more health problems than uninjured peers of comparable age, and a majority of older adults with TBI have at least one chronic medical condition at the time of injury, supporting the view of these post-injury comorbidities as continuations of high pre-injury illness burden.<sup>11</sup> Baseline cerebrovascular disease and depression in adults over age 65 predict subsequent TBI. Importantly, TBI is itself a risk factor for TBI; in one large prospective study, older adults who reported a history of TBI at the time of enrollment were at increased risk of subsequent re-injury, with prior TBI accounting for nearly 20 percent of the study population's overall TBI risk.<sup>22</sup>

## **Prescribing for older adults with TBI**

The range of posttraumatic symptoms for which an older person with TBI may receive medical care spans all body systems and varies tremendously by individual. Among the most troubling of these are disturbances of cognition, mood, and behavior. Specific recommendations for medication management of these issues are covered in a previous [ACL Behavioral Health Guide](#) and need not be reiterated here; the detailed biopsychosocial history, careful consideration of comorbidities and medication effects, and rational approach to symptom-targeted pharmacotherapy hold equally true in the subpopulation of older individuals with TBI.

Where the approach to prescribing for older adults with TBI differs with regard to the age-related physiologic changes, specific medical comorbidities, and altered sensitivity to medication effects reviewed above must remain front of mind throughout the evaluation and management process. The presence and nature of pre-injury chronic medical conditions is essential to ascertain: it is highly likely that one or more of these is present, and it is also likely that these conditions or the medications prescribed to treat them may have contributed significantly to the risk of TBI. Clarification of pre-injury cognitive and motor function; gait and balance disturbances; psychiatric symptomatology; and medication use including prescriptions, over-the-counter drugs, and herbal supplements can provide valuable information to inform future injury prevention measures and place current symptoms in context.



Because cognitive impairment is a risk factor for falls and TBI in older adults, the evaluation of older individuals presenting with posttraumatic cognitive symptoms must include history obtained from a spouse, family member, or other collateral informant familiar with the patient's pre-injury cognitive function. The association between even subtle cognitive impairments and falls in older adults is important to keep in mind, as it is not uncommon for family members of older adults with posttraumatic cognitive symptoms to report their perception that the injured individual was entirely cognitively intact prior to the injury. In these cases, it can be helpful to inquire about details of the person's pre-injury activities, especially work and (if applicable) reason for retirement; hobbies/socializing and any changes in engagement with them; and independence with activities such as paying bills, preparing meals, and using technology.

In some cases, posttraumatic cognitive impairment in older adults is genuinely new and attributable to the injury; often, however, subtle cognitive changes can be identified retrospectively via careful history-taking. Posttraumatic cognitive impairment in these latter individuals may best be understood as an unmasking of a previously subclinical neurocognitive disorder, with likely causal effect from the injury itself as well as from the stress associated with hospitalization and disruption of normal routines. As in TBI generally, these individuals may initially recover quite well, assuming the absence of other risk factors for poor outcomes, but should receive ongoing monitoring for incipient cognitive decline suggestive of a neurodegenerative process. In light of recent developments in the Alzheimer disease (AD) landscape, with lecanemab and donanemab now offering the first meaningful possibilities of disease-modifying treatment, the emergence of progressive posttraumatic cognitive decline should prompt early diagnostic consideration of AD with further investigation of cerebral amyloid-beta burden as appropriate.

The presence and nature of preexisting depression, which is common among older adults and a specific risk factor for both falls and TBI, is also important to explore. Untreated depression can impair cognition and lead to decreased engagement with physical activity and socialization, which may hamper rehabilitation efforts. Treated depression can also impair cognition and increase fall risk and fall-related injuries as a function of antidepressant medications. SSRIs, the most commonly prescribed antidepressants in older adults, have consistently been shown to be associated with higher rates of hyponatremia, falls, and bone fractures.<sup>12</sup> They have also, to a lesser extent, been implicated as risk factors for intracerebral hemorrhage.<sup>23</sup> A 2018 study of antidepressant use in a large Medicare TBI population found a small increase in the incidence of intracerebral hemorrhage with SSRIs, but not SNRIs, as compared to

TCA<sup>24</sup> However, while these effects exist at the population level, the action of a specific drug in a given individual is far less predictable, and the importance of treating clinically significant depression frequently outweighs potential risks. SSRIs remain the preferred first-line therapy for depressive symptoms in adults with TBI, with comorbidity-associated risks influencing decision-making on a case-by-case basis. It is worth remembering that depression itself can be fatal if left untreated: in 2018 to 2019, 36 percent of TBI-related deaths were suicides, with the highest rate seen in adults 75 years and older.<sup>20</sup> Clear communication about risks and benefits and engagement in shared decision-making are essential for success. Pre-injury psychotropic regimens should be examined closely for agents which may have contributed to the injury and consideration given to deprescribing unnecessary medications or switching to a potentially less adverse one.

The management of posttraumatic epilepsy in older adults with TBI is another area of great clinical relevance. Older age is a risk factor for posttraumatic epilepsy; posttraumatic seizures are linked with post-injury cognitive impairment, as are antiseizure medications.<sup>25</sup> Previously the standard of care for posttraumatic seizure prophylaxis, phenytoin's narrow therapeutic window and potential for toxicity make it challenging to use in older and younger adults alike. Levetiracetam, now the most commonly used agent for early posttraumatic antiseizure prophylaxis, is primarily renally cleared and must be adjusted for renal impairment. Levetiracetam is well tolerated by many, but it can have significant negative impact on mood in some patients, and it can cause sedation in older adults especially at higher doses. Carbamazepine, which has relatively strong evidentiary support for the management of posttraumatic irritability and aggression, can cause SIADH with resultant hyponatremia as well as sedation and dizziness; it should be used with caution in older adults. Valproic acid, another antiseizure medication with mood-stabilizing benefit, similarly carries risk of sedation and gait instability in older adults. Additionally, valproic acid therapy is associated with increased serum ammonia levels, which are asymptomatic in most cases, but in some instances can cause encephalopathy. Serum ammonia levels need not be obtained routinely in all older adults prescribed valproic acid, but they may be informative in those who develop new or fluctuating cognitive impairment.

## Summary

The above clinical scenarios represent just a few of the numerous complexities associated with TBI in older adults. To navigate this challenging and continuously

evolving terrain, the basic principles of good prescribing practices in both geriatric medicine and TBI care provide an overarching guide:

- Start low and go slow
- Less is more: minimize polypharmacy
- Consider age-related physiologic changes and medical comorbidities
- Review clinical progress and medication lists frequently; don't be afraid to deprescribe

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# Appendix A: Key provisions of the 2024 Older Americans Act Final Rule

## Key provisions of the 2024 Older Americans Act Final Rule

The updated regulations reinforce and clarify policies and expectations, promote appropriate stewardship of OAA resources, and incorporate lessons learned during the COVID-19 pandemic. For example, the final rule:

- Clarifies requirements for state and area plans on aging and details requirements for coordination among tribal, state and local programs.
- Improves consistency of definitions and operations between state and tribal OAA programs.
- Clarifies and strengthens provisions for meeting OAA requirements for prioritizing people with the greatest social and economic needs.
- Specifies the broad range of people who can receive services, how funds can be used, fiscal requirements, and other requirements that apply across programs.
- Clarifies required state and local agency policies and procedures. For example, the final rule establishes expectations regarding conflicts of interest.
- Requires state agencies to establish flexible and streamlined processes for area agencies to receive approval for contracts and commercial relationships.
- Includes guidance for the National Family Caregiver Support Program and the Native American Caregiver Support Program, which were authorized since the last update.
- Addresses emergency preparedness and response, incorporating lessons from the COVID-19 pandemic.
- Establishes expectations for legal assistance and activities to prevent elder abuse.
- Clarifies the role of the aging network in defending against the imposition of guardianship and in promoting alternatives.
- Updates definitions, modernizes requirements, and clarifies flexibilities within the OAA nutrition programs. For example, the rule allows for continuation of innovations developed during the pandemic, such as providing carry-out meals through the congregate meals program, in certain circumstances.

*You can read or download the [entire final rule](#) on the *Federal Register* website.*