

CHAPTER 9 MEDICAL CONDITIONS, FUNCTIONAL DEFICITS, AND MEDICATIONS THAT MAY AFFECT DRIVING SAFETY

KEY POINTS

- Many medical conditions, functional deficits, and/or medications may potentially impair driving.
- Treat the underlying medical condition and/or functional deficit to improve the condition/impairment or limit progression.
- If the functional deficit is due to an identifiable offending agent (e.g., medication with potentially driver-impairing [PDI] effects), remove the offending agent or reduce the dose, if possible.
- Advise the older adult about the risks to his or her driving safety, consider referral for assessment of driving performance, recommend driving restrictions or driving cessation as needed, and document the discussion in the health record.

This chapter contains reference tables of medical conditions, functional deficits, and medications that may impair driving skills, with associated consensus recommendations. Whenever scientific evidence supports the recommendations, it is included. These recommendations apply only to drivers of private motor vehicles and should not be applied to commercial drivers. Although many of the listed medical conditions are more prevalent in the older population, the recommendations apply to all drivers with medical impairments, regardless of age.

The medical conditions were chosen for their relevance to clinical practice and/or because there is some evidence-based literature indicating an association with driving impairment. Interested clinicians are referred to reviews that provide details regarding individual conditions or deficits, as well as guidelines from other countries, including Australia, Canada, Ireland, and the United Kingdom.¹⁻⁸

Although these recommendations are based on scientific evidence whenever possible, their use per se has not yet been proved to reduce crash

risk.* However, increasing evidence suggests that interventions for some medical conditions (e.g., treating obstructive sleep apnea, performing cataract surgery, discontinuing a benzodiazepine) and functional deficits (e.g., improving information processing speed, physical ability), combined with classroom and on-road training may lower crash risk or enhance/maintain driving performance. As such, these recommendations are provided as a means to help raise awareness of which drivers might be at increased risk, suggest options for intervention, and guide the decision-making process. When evidence is not available, the recommendations are based on consensus recommendations and best clinical judgment. They are not intended to substitute for the individual clinician's judgment.

HOW TO USE THIS CHAPTER

Clinicians may consult this chapter for questions on specific medical conditions, functional deficits (e.g., deficits in vision, cognition, or motor function), and/or medications that may have an effect on driving safety. If an older adult presents with any of these issues, clinicians may base further assessment and

*Note: Although scientific evidence links certain medical conditions and levels of functional impairment with crash risk, more research is needed to establish that driving restrictions based on these medical conditions and levels of functional impairment significantly reduce crash risk.

interventions for driving safety on the guidelines presented here.

General Recommendations

- Treat the underlying medical condition and/or functional deficit to improve the condition/impairment or limit progression.
- If the functional deficit is due to an identifiable offending agent (e.g., medication with PDI effects), remove the offending agent or reduce the dose, if possible.
- If the functional deficit can be addressed through compensation or modification (e.g., hand controls, left foot accelerator), refer for a comprehensive driving evaluation.
- Advise the older adult about the risks to his or her driving safety, consider referral for assessment of driving performance, recommend driving restrictions or driving cessation as needed, and document the discussion in the health record.
- For acute or episodic illnesses (e.g., seizure disorder and/or diabetes with hypoglycemia), clinical judgment and subspecialist input is recommended, in addition to following specific state statutes.

If further evaluation is required and desirable, or the conditions and/or functional deficits are not medically correctable, the older adult should be referred to a driver rehabilitation specialist (DRS) for a driving evaluation (including on-road assessment). The DRS may prescribe adaptive equipment and training on how to use it (see Chapter 5).

Clinicians should advise older adults against driving if they report symptoms that are irreversible, for which no safe compensatory techniques/equipment are available, and are incompatible with safe driving (e.g., visual changes, syncope or presyncope, vertigo, etc.). If these symptoms continue despite

extensive medical evaluation and treatment, such individuals should be strongly urged to seek alternative forms of transportation, including taxis, rides from family and friends, and medical transportation services.

In the hospital and the emergency department, driving should be routinely addressed before the older adult's discharge whenever appropriate, especially in the presence of new functional deficits or when prescribing new medications. Even for the older adult whose symptoms or treatment clearly precludes driving, it should not be assumed that the person is aware that he or she should not drive. The clinician should counsel the older adult regarding driving, discuss a future plan (e.g., resumption of driving on resolution of symptoms, driver rehabilitation on stabilization of symptoms, reassessment by the primary clinician or relevant specialist before driving resumption), and document the discussion in the health record.

An older adult's driving purposes may range from being responsible for taking grandchildren to day care to driving for a vocation (e.g., a salesperson who drives throughout a region). Such differences may influence the extent of the interventions or advice in regard to an evaluation. For example, more restriction or a performance-based road test may be more aggressively pursued for an older adult who frequently drives long distances over unfamiliar roads versus for one who drives short, familiar routes.

REFERENCE TABLES OF MEDICAL CONDITIONS, FUNCTIONAL DEFICITS, AND MEDICATIONS THAT MAY AFFECT DRIVING SAFETY

Various medical conditions and/or functional deficits are covered in the following sections (with corresponding tables). Conditions treated with medications with PDI effects are listed at the end

of the discussion for that condition and cross-referenced to Section 13 (on medications) for more information.

Section 1: Vision and Hearing Loss

Section 2: Cardiovascular Disorders

Section 3: Cerebrovascular Disorders

Section 4: Neurologic Disorders

Section 5: Psychiatric Disorders

Section 6: Metabolic Disorders

Section 7: Musculoskeletal Disorders

Section 8: Peripheral Vascular Disorders

Section 9: Renal Disorders

Section 10: Respiratory and Sleep Disorders

Section 11: Effects of Anesthesia and Surgery

Section 12: Cancer

Section 13: Medications

SECTION 1: VISION AND HEARING LOSS

Vision is the primary sense used in driving (versus hearing and proprioception) and is responsible for 95% of driving-related sensory inputs.⁹ Age- and disease-related changes of the eye and brain may affect visual acuity, visual fields, night vision, contrast sensitivity, and other aspects of vision. External obstruction of view (e.g., blepharoptosis) should not be overlooked, because it may significantly limit visual fields. The literature on eye disease suggests that driving impairment is likely mediated by impairment in contrast sensitivity,¹⁰ visual fields,¹¹ or visual processing speed.

Whenever possible, vision deficits should be managed and corrected. Interventions for common eye diseases such as age-related macular degeneration,¹² glaucoma,¹³ and cataracts¹⁴ have the potential to improve or stabilize the condition, and in some cases these interventions have been

noted to reduce crash risk.¹⁵ Older adults with persistent vision deficits may potentially reduce their effect on driving safety by restricting travel to low-risk areas and conditions, such as familiar surroundings, low-speed areas, non-rush hour traffic, daytime, and good weather conditions. This has been noted for certain eye diseases, such as glaucoma.¹⁶ Bioptic driving is allowed in 44 states, although requirements vary.¹⁷ Bioptic driving is a method of driving in which a small telescopic system is used to improve a person's far vision for some visually impaired individuals and might be considered for some drivers. The recommendations below are subject to each state's licensing requirements. For resources to locate Internet listings for current individual state laws, see Chapter 8.

Sensory Deprivation

1. Visual acuity
 - a. Cataracts
 - b. Retinopathy (diabetic or hypertensive)
 - c. Keratoconus
 - d. Macular degeneration
 - e. Nystagmus
 - f. Telescopic lens
2. Visual field
 - a. Glaucoma
 - b. Hemianopia/quadrantanopia
 - c. Monocular vision
 - d. Ptosis or upper lid redundancy
 - e. Retinitis pigmentosa
3. Contrast sensitivity
4. Defective color vision
5. Poor night vision and glare recovery
6. Diplopia
7. Hearing loss

Table 9.1 - Sensory Deprivation

Visual acuity

Many states require far visual acuity of 20/40 for licensure. State driver licensing agencies are urged to base their visual acuity requirements on the most current data, as appropriate. Referral to an ophthalmologist is recommended to optimize refraction and because common causes for visual impairment (cataracts, macular degeneration, glaucoma) can improve and/or stabilize with treatment.

Visual acuity may be measured with both eyes open or with the best eye open, as the individual prefers. The older adult should wear any corrective lenses usually worn for driving.

Older adults with decreased far visual acuity may potentially lessen its effect on driving safety by restricting driving to low-risk areas and conditions (e.g., familiar surroundings, non-rush hour traffic, low-speed areas, daytime, and good weather conditions).

For best-corrected far visual acuity less than 20/70, clinicians should recommend an on-road assessment performed by a DRS (where permitted and available) to evaluate the older adult's performance in the actual driving task.

For best-corrected far visual acuity less than 20/100, clinicians should recommend the older adult not drive unless safe driving ability can be demonstrated in an on-road assessment performed by a DRS (where permitted and available). See also Telescopic lens, below.

Cataracts

No restrictions if standards for visual acuity and visual fields are met, either with or without cataract removal.

Individuals who require increased illumination or who experience difficulty with glare recovery should avoid driving at night and under low-light conditions, such as during adverse weather.

Diabetic or hypertensive retinopathy

No restrictions if standards for visual acuity and visual fields are met. Annual eye examinations are recommended for diabetic individuals.

Keratoconus

Individuals with severe keratoconus correctable with hard contact lenses should drive only when the lenses are in place. If lenses cannot be tolerated, individuals with severe keratoconus should not drive even if they meet standards for visual acuity, because their acuity dramatically declines outside their foveal vision, rendering their peripheral vision useless.

Macular degeneration

No restrictions if standards for visual acuity and visual fields are met. Older adults who experience difficulty with glare recovery should avoid driving at night. Individuals with the neovascular "wet" form may require frequent assessment because of the rapid progression of the disease.

Nystagmus

No restrictions if standards for visual acuity and visual fields are met.

Telescopic lens

A bioptic telescope is an optical telescope mounted on the lens of eyeglasses. During normal use, the wearer can view the environment through the regular lens.

When extra magnification is needed, a slight downward tilt of the head brings the object of interest into the view of the telescope.¹⁸

Telescopic lens (cont.) The specialist who prescribes a telescopic lens should ensure that the older adult is properly trained in its use.

It has not been established whether telescopes enhance the safety of low-vision drivers. The American Academy of Ophthalmology's Policy Statement, Vision Requirements for Driving (approved by Board of Trustees, October 2001) states:

"More than half the states allow drivers to use bioptic telescopes mounted on glasses, through which they spot traffic lights and highway signs. It has not yet been demonstrated whether the estimated 2,500 bioptic drivers in the United States drive more safely with their telescopes than they would without them. The ability to drive safely using bioptic telescopes should be demonstrated in a road test in all cases."

A road test should be administered only in those states that permit the use of bioptic telescopes in driving.

Visual field

Although an adequate visual field is acknowledged to be important for safe driving, there is no conclusive evidence to define what is meant by "adequate" nor is there any consistent standard as to how visual fields are tested. Visual field requirements vary between states, with many states requiring a visual field of 100 degrees or more in the horizontal plane, and other states having a lesser requirement or none at all.¹⁸

If the primary care clinician has any reason to suspect a visual field defect (e.g., through personal report, medical history, or confrontation testing), he or she should refer the older adult to an ophthalmologist or optometrist for further evaluation. Both the primary care clinician and specialist should be aware of and adhere to their state's visual field requirements, if any.

For binocular visual field at or near the state minimum requirement or of questionable adequacy (as deemed by clinical judgment), a comprehensive driving evaluation (including on-road assessment) performed by a DRS is strongly recommended. Through driving rehabilitation, older adults may learn how to compensate for decreased visual fields, although not hemineglect.

In addition, the DRS may prescribe enlarged side and rearview mirrors as needed and train the older adult in their use.

Glaucoma No restrictions if standards for visual acuity and visual fields are met. Continued follow-up with an ophthalmologist and monitoring of visual fields and intraocular pressure are recommended.

*Hemianopia/
quadrantanopia* Clinicians may choose to refer older adults to a DRS for assessment and rehabilitation. With or without rehabilitation, older adults should drive only if they demonstrate safe driving ability in an on-road assessment performed by a DRS.

Monocular vision Older adults with acquired monocular vision may need time to adjust to the lack of depth perception and reduction in total visual field. This period of adjustment varies among individuals, but it is reasonable to recommend temporary driving cessation for several weeks.

Monocular vision (cont.) After this period, there are no restrictions if standards for visual acuity and visual fields are met. After individuals start driving again, they should be advised to assess their comfort level by driving in familiar, traffic-free areas before advancing to areas of heavy traffic. Again, use of larger mirrors and evaluation and training by a DRS are encouraged.

Ptosis or lid redundancy, blepharospasm Individuals with fixed ptosis or lid redundancy may drive without restrictions if their eyelids do not obscure the visual axis of either eye and they are able to meet standards for visual acuity and visual fields without holding their head in an extreme position. Blepharospasms should be controlled so there is no interference with vision.

Retinitis pigmentosa No restrictions if standards for visual acuity and visual fields are met.
Older adults who require increased illumination or who experience difficulty adapting to changes in light should not drive at night or under low-light conditions, such as during storms.

Contrast sensitivity Contrast sensitivity is a measure of an individual's ability to perceive visual stimuli that differ in contrast and spatial frequency. Contrast sensitivity tends to decline with age; accordingly, deficits in contrast sensitivity are much greater in older adults than in their younger counterparts.²

Among older drivers, binocular measures of contrast sensitivity have been found to be a valid predictor of crash risk in individuals with cataracts.¹⁹ However, there are presently no standardized cut-off points for contrast sensitivity and safe driving, and it is not routinely measured in eye examinations.

Older adults can be educated about driving conditions to avoid if they have poor contrast sensitivity (e.g., dawn, dusk, fog).

Defective color vision No restrictions if standards for visual acuity and visual fields are met.

Deficits in color vision are common (especially in men) and usually mild.

There appears to be no correlation between defective color vision and crash rates.²⁰ Some states require prospective drivers to undergo color vision screening, and many of these states require screening for commercial drivers only.¹⁸

Despite reported difficulties with color vision discrimination while driving (difficulty distinguishing color of traffic signals, confusing traffic lights with street lights, and difficulty detecting brake lights), it is unlikely that color vision impairments represent a significant driving hazard.² Standardization of traffic signal positions allows color blind individuals to interpret traffic signals correctly based on position. Clinicians may wish to advise older adults that the order of signals in the less commonly used horizontal placement of left to right is red, yellow, green.

Poor night vision If the older adult reports poor visibility at night, clinicians should recommend ophthalmologic and/or optometric evaluation. If the evaluation does not reveal a treatable cause for poor night vision, clinicians should recommend that the older adult not drive at night or under other low-light conditions, such as during storms or at dusk.

Diplopia

Individuals with double vision in the central aspect of vision (20 degrees above and below, left and right of fixation) should not drive. Those with uncorrected diplopia should be referred to an ophthalmologist or optometrist for further assessment to determine if the defect can be corrected with prisms or a patch and meet standards for driving. There should be a 3-month adjustment period, after which specialists can determine if adequate adjustment has occurred.⁶

Hearing loss

No restrictions.

Relatively few studies have examined the relationship between hearing impairment and risk of motor vehicle crash. Of these, none have shown a significant relationship between hearing impairment and risk of crash.² However, one study suggested that a combination of hearing and vision deficits might increase crash risk.²¹

SECTION 2: CARDIOVASCULAR DISORDERS

1. Unstable coronary syndrome (unstable angina or myocardial infarction)
2. Cardiac rhythm abnormalities that may cause a sudden, unpredictable loss of consciousness
 - a. Atrial flutter/fibrillation with bradycardia or rapid ventricular response
 - b. Paroxysmal supraventricular tachycardia, including Wolf-Parkinson-White syndrome
 - c. Prolonged, nonsustained ventricular tachycardia
 - d. Sustained ventricular tachycardia
 - e. Cardiac arrest
 - f. High-grade atrioventricular block
 - g. Sick sinus syndrome/sinus bradycardia/sinus exit block/sinus arrest
3. Cardiac disease resulting from structural or functional abnormalities
 - a. Congestive heart failure with low output syndrome
 - b. Hypertrophic obstructive cardiomyopathy
 - c. Valvular disease (especially aortic stenosis)

4. Time-limited restrictions: cardiac procedures
 - a. Percutaneous transluminal coronary angioplasty
 - b. Pacemaker insertion or revision
 - c. Cardiac surgery involving median sternotomy
 - d. Coronary artery bypass graft
 - e. Valve repair or replacement
 - f. Heart transplant
5. Internal cardioverter defibrillator (ICD)

Although the data are still unclear in regard to a definitive relationship between crash risk and cardiovascular diseases, one study noted a modest increase in total crash risk and at-fault risk for older adults with cardiac disease.²² For older adults with known cardiac disease, clinicians should strongly and repeatedly caution such individuals to seek help immediately on experiencing any symptoms that may indicate an unstable cardiac situation, including prolonged chest discomfort, acute shortness of breath, syncope, presyncope, palpitations, lightheadedness, etc. Under no circumstances should the older adult drive while experiencing these symptoms, even to seek help.

Table 9.2 - Cardiovascular Disorders

Unstable coronary syndrome (unstable angina or myocardial infarction)	<p>Older adults should not drive if they experience symptoms at rest or at the wheel.</p> <p>Individuals may resume driving when they have been stable and asymptomatic for 1–4 weeks, as determined by a cardiologist, after treatment of the underlying coronary disease. Driving may usually resume within 1 week after successful revascularization by percutaneous transluminal coronary angioplasty and by 4 weeks after coronary artery bypass grafting (CABG).²³</p> <p>See also recommendations for CABG below (4.c in this section).</p>
Cardiac conditions that may cause a sudden, unpredictable loss of consciousness	<p>A main consideration in determining medical fitness to drive for older adults with cardiac conditions is the risk of presyncope or syncope due to a slow or rapid rhythm abnormality.²⁴ For older adults with a known arrhythmia, clinicians should identify and treat the underlying cause of arrhythmia, if possible, and recommend temporary driving cessation until symptoms have been controlled.</p>
<i>Atrial flutter/fibrillation with bradycardia or rapid ventricular response</i>	<p>No further restrictions once heart rate and symptoms have been controlled.</p>
<i>Paroxysmal supraventricular tachycardia, including Wolf-Parkinson-White syndrome</i>	<p>No restrictions if the older adult is asymptomatic during documented episodes.</p> <p>Older adults with a history of symptomatic tachycardia may resume driving after they have been asymptomatic for 6 months on antiarrhythmic therapy.</p> <p>Individuals who undergo radiofrequency ablation may resume driving after 6 months if there is no recurrence of symptoms, or sooner if no preexcitation or arrhythmias are induced on repeat electrophysiologic testing.</p>
<i>Prolonged, nonsustained ventricular tachycardia (VT)</i>	<p>No restrictions if the older adult is asymptomatic during documented episodes.</p> <p>Individuals with symptomatic VT may resume driving after 3 months if they are on antiarrhythmic therapy (with or without an ICD) guided by invasive electrophysiologic testing, and VT is noninducible at repeat electrophysiologic testing. They may resume driving after 6 months without arrhythmia events if they are on empiric antiarrhythmic therapy (with or without an ICD), or have an ICD alone without additional antiarrhythmic therapy.²⁵</p>

Sustained ventricular tachycardia (VT) Older adults may resume driving after 3 months if they are on antiarrhythmic therapy (with or without an ICD) guided by invasive electrophysiologic testing, and VT is noninducible at repeat electrophysiologic testing.

Individuals may resume driving after 6 months without arrhythmia events if they are on empiric antiarrhythmic therapy (with or without an ICD), or have an ICD alone without additional antiarrhythmic therapy.²⁵

Long-distance and/or sustained high-speed driving is not recommended. Older adults with VT should avoid the use of cruise control.²⁵

Post-cardiac arrest See the recommendations for sustained VT (above).

For individuals who experience a seizure in the setting of cardiac arrest, see the recommendations for seizure disorder in Section 4, Neurologic Diseases.

If clinically significant cognitive changes persist after the older adult's physical recovery, cognitive testing is recommended before the older adult is permitted to resume driving. In addition, on-road testing performed by a DRS may be useful in assessing an older adult's fitness to drive.

High-grade atrioventricular block For symptomatic block managed with pacemaker implantation, see pacemaker recommendations in this section.

For symptomatic block corrected without a pacemaker (e.g., by withdrawal of medications that caused the block), older adults may resume driving after they have been asymptomatic for 4 weeks and ECG documentation shows resolution of the block.

Sick sinus syndrome/sinus bradycardia/sinus exit block/sinus arrest No restrictions if the older adult is asymptomatic. Regular medical follow-up is recommended to monitor progression.

For symptomatic disease managed with pacemaker implantation, see pacemaker recommendations in this section.

Clinicians should be alert to possible cognitive deficits due to chronic cerebral ischemia. Clinicians may refer individuals with clinically significant cognitive changes to a DRS for an evaluation of driver safety, including on-road assessment.

Cardiac disease resulting from structural or functional abnormalities A main consideration in determining medical fitness to drive for older adults with abnormalities of cardiac structure or function is the risk of presyncope or syncope due to low cardiac output, and of cognitive deficits due to chronic cerebral ischemia.

Older adults who experience presyncope, syncope, extreme fatigue, or dyspnea at rest or at the wheel should cease driving.

Cognitive testing is recommended for those individuals with a history of cognitive impairment that may impair the older adult's driving ability. Clinicians may refer individuals with clinically apparent cognitive changes to a DRS for a comprehensive driving evaluation.¹

<i>Congestive heart failure with low output syndrome</i>	<p>Older adults should not drive if they experience symptoms at rest or while operating a motor vehicle.</p> <p>Clinicians should reassess older adults for driving fitness every 6 months to 2 years as needed, depending on clinical course and control of symptoms. Individuals with functional class III congestive heart failure (marked limitation of activity but no symptoms at rest, working capacity 2 to 4 metabolic equivalents (METS) should be reassessed at least every 6 months.</p>
<i>Hypertrophic obstructive cardiomyopathy</i>	<p>Older adults who experience syncope or presyncope should not drive until they have been successfully treated.</p>
<i>Valvular disease (especially aortic stenosis)</i>	<p>Older adults who experience syncope or presyncope or unstable angina should not drive until the underlying disease is corrected.</p>
Time-limited restrictions: cardiac procedures	<p>Driving restrictions for the following cardiac procedures are based on the older adult's recovery from both the procedure itself and the underlying disease for which the procedure was performed.</p>
<i>Percutaneous transluminal coronary angioplasty (PTCA)</i>	<p>Older adults may resume driving 48 hours to 1 week after successful PTCA and/or stenting procedures, depending on their baseline condition and course of recovery from the procedure and underlying coronary disease.^{25,26}</p>
<i>Pacemaker insertion or revision</i>	<p>Older adults may resume driving 1 week after pacemaker implantation if no longer experiencing presyncope or syncope:</p> <ol style="list-style-type: none"> a. ECG shows normal sensing and capture, and b. Pacemaker performs within manufacturer's specifications.²⁶
<i>Cardiac surgery involving median sternotomy</i>	<p>Driving may usually resume 4 weeks after coronary artery bypass grafting (CABG) and/or valve replacement surgery, and within 8 weeks after heart transplant, depending on resolution of cardiac symptoms and the individual's course of recovery. In the absence of complications during or after surgery, the main limitation to driving is the risk of sternal disruption after median sternotomy.</p> <p>If cognitive changes persist after the older adult's physical recovery, cognitive testing is recommended before the individual is permitted to resume driving. In addition, on-road testing performed by a DRS may be useful in assessing the older adult's fitness to drive.</p>
Internal cardioverter defibrillator (ICD)	<p>See the recommendations for non-sustained and sustained ventricular tachycardia (2.c and 2.d in this section). If the device is used for primary, rather than secondary, prevention, driving may resume in 1 week if the older adult is subsequently symptomatic.²⁷</p>

SECTION 3: CEREBROVASCULAR DISORDERS

1. Post intracranial surgery
2. Stroke
3. Transient ischemic attacks
4. Subarachnoid hemorrhage
5. Vascular malformation
6. Syncope

Strokes and other insults to the cerebrovascular system may cause a wide variety of symptoms, including sensory deficits (e.g., numbness or loss of sensation), motor deficits (e.g., weakness), and cognitive impairment (e.g., memory, hemispatial inattention). These symptoms range from mild to severe and may resolve almost immediately or persist for years. Because each person is affected uniquely, the clinician must take into account the individual older adult's constellation of symptoms, severity of symptoms, course of recovery, and baseline function when making recommendations concerning driving. Studies have indicated that a substantial number of community-dwelling stroke patients continue to drive a car.²⁸ However, most stroke patients may not receive any type of formal driving evaluation but simply resume driving.²⁹ If present, the larger a homonymous visual field defect, the greater the likelihood of losing one's license. Unfortunately, many individuals may not be aware of this deficit.³⁰

Driving should always be discussed before the older adult's discharge from the hospital or rehabilitation center and the discussion documented in the health record.

Older adults with residual neurologic deficits who wish to resume driving should be referred to a DRS whenever possible. Although the time frame for

this evaluation depends on the severity and extent of the deficits, many evaluations for cognitive and motor defects are performed between 3 and 6 months. Once symptoms have stabilized, the DRS should assess the older adult for fitness-to-drive through a comprehensive driving evaluation that includes clinical and on-road components. After assessment, the DRS may recommend compensatory techniques and/or adaptive devices (e.g., wide rearview mirror, spinner knob for steering wheel, left foot accelerator) and provide training in their use. Even individuals with mild deficits should undergo driver evaluation before resuming driving, if possible. Research indicates that a post-stroke determination of driving safety made on a medical basis alone may be inadequate.³¹ Several studies note associations with impairment on road tests with measures of perception, visual selective attention, mental speed, working memory, executive function, and complex visual-perception/attention information.³²⁻³⁴

For older adults whose symptoms clearly preclude driving, it should not be assumed that the individual is aware that he or she should not drive. In such cases, the clinician should counsel the older adult on driving cessation and document the discussion in the health record. Recovery from stroke may take up to a year and even though the older adult may not be able to drive within the first 3–6 months, it is possible that he or she may improve after a year to have the potential to drive.³⁵⁻³⁷

Table 9.3 - Cerebrovascular Disorders

Post intracranial surgery	Older adults should not drive until symptoms of the disease and/or surgery have stabilized or resolved. See also stroke recommendations below (Section 3.2).
Stroke	<p>Older adults with acute, severe motor, sensory, or cognitive deficits should not drive. Depending on the severity of residual symptoms and the degree of recovery, this restriction may be permanent or temporary.</p> <p>On the individual's discharge from the hospital or rehabilitation center, clinicians may recommend temporary driving cessation until further neurologic recovery has occurred. Once neurologic symptoms have stabilized, clinicians should refer appropriate individuals with residual sensory loss, cognitive impairment, visual field defects, and/or motor deficits to a DRS for driver assessment and rehabilitation. The DRS may prescribe vehicle adaptive devices and train the older adult in their use.</p> <p>Older adults with neglect or inattention should be counseled not to drive until symptoms have resolved and/or safe driving ability has been demonstrated through assessment by a DRS. All individuals with moderate to severe residual hemiparesis should undergo driver assessment before resumption of driving. Even if symptoms improve to the extent that they are mild or completely resolved, older adults should still undergo a comprehensive driving evaluation, if available, because reaction time may continue to be affected and other comorbid conditions could further increase risk.</p> <p>Individuals with aphasia who demonstrate safe driving ability may fail in their efforts to renew their license because of difficulties with the written examination. In these cases, the clinician should urge the licensing authority to make reasonable accommodations for the older adult's language deficit. A DRS may be able to determine whether the deficit is expressive in nature and thus may allow for interpretation of written (e.g., traffic signs) stimuli. However, traffic signs may still be interpreted based on color, shape, and symbol recognition.</p> <p>Older adults with residual cognitive deficits should be assessed and treated as described in Section 4 on Dementia. Periodic reevaluation of these individuals is recommended, because some may recover sufficiently over time or with appropriate intervention to permit safe driving.</p>
Transient ischemic attacks (TIA)	Older adults who have experienced a single TIA or recurrent TIAs should not drive until they have undergone medical assessment and appropriate treatment.
Subarachnoid hemorrhage	Older adults should not drive until symptoms have stabilized or resolved. Driving may resume after medical assessment and, if deemed necessary by the clinician, driver evaluation, including on-road assessment, performed by a DRS.
Vascular malformation	If a brain aneurysm or arteriovenous malformation is detected, the older adult should not drive until he or she has been assessed by a neurosurgeon. The individual may resume driving if the risk of a bleed is small, an embolization procedure has been successfully completed, and/or the individual is free of other medical contraindications to driving (e.g., uncontrolled seizures or significant perceptual or cognitive impairments).

Syncope

Although the cause of syncope is often not identified, neurocardiogenic (or reflex mediated), orthostatic, and cardiac arrhythmia are among the most common causes when one can be found.^{38,39} In a case-control study of patients evaluated for syncope, neurally mediated and cardiac arrhythmia were the most common causes when one could be identified. Long-term survival and likelihood of recurrence were similar for those who had syncope while driving versus those who did not.⁴⁰

See Section 2 for causes of cardiac syncope.

Driving restrictions for neurally mediated syncope should be based on the severity of the presenting event and the anticipated likelihood of recurrence. No driving restrictions are necessary for individuals with infrequent syncope that occurs with warning and with clear precipitating causes. Older adults with severe syncope may resume driving after adequate control of the arrhythmia has been documented and/or pacemaker follow-up criteria have been met (see 4 in Section 2).⁴¹ For individuals who continue to experience unpredictable symptoms after treatment with medications and pacemaker insertion, driving cessation is recommended.

SECTION 4: NEUROLOGIC DISORDERS

1. Brain tumor
2. Closed head injury
3. Dementia
4. Migraine and other recurrent headache syndromes
5. Movement disorders
6. Multiple sclerosis
7. Paraplegia and quadriplegia
8. Parkinson disease
9. Peripheral neuropathy
10. Seizure disorder
 - a. Single unprovoked seizure
 - b. Withdrawal or change of anticonvulsant drug therapy
11. Sleep disorders
 - a. Narcolepsy
 - b. Sleep apnea
12. Stroke
13. Tourette syndrome
14. Vertigo

Dementia deserves special emphasis, because it presents a significant challenge to driving safety. As the disease progresses, individuals will ultimately lose the ability to drive safely. In addition, older adults with dementia often lack insight into their deficits and, therefore, may be more likely than drivers with visual or motor deficits (who tend to self-restrict their driving to accommodate their declining abilities) to drive even when it is unsafe. In this case, it becomes the responsibility of family members and other caregivers to protect the safety of older adult drivers with dementia by enforcing driving cessation when this becomes necessary.

Several reviews on this topic may be of interest to clinicians.⁴²⁻⁴⁵ Fitness-to-drive studies in older adults with dementia indicate that 90% may be able to pass a road test in the very mild stages of the disease (clinical dementia rating of 0.5), whereas 40% may fail at a mild level of cognitive impairment (clinical dementia rating of 1.0).⁴⁶ Furthermore, most older adults with Alzheimer disease will eventually fail subsequent road tests when followed longitudinally, indicating that repeat testing at 6–12 months should be strongly considered.⁴⁷ However, there is uncertainty about

prospective risk, at least in the near term. In one longitudinal study, some mildly demented drivers not only passed a performance-based road test but also had an acceptable crash risk prospectively.⁴⁸ A recent systematic review found a small body of literature with inconsistent results for crash risk in dementia but more consistent demonstration of worse driving performance with increasing cognitive impairment.⁴⁹ Although in-office evaluation may not replace an on-road assessment,⁵⁰ classification rates may improve as evidence mounts for measures of relevant cognitive and other abilities.⁵¹⁻⁵² In addition, a dementia and driving curriculum modeled after an earlier version of this guide has been shown to improve knowledge, attitudes, confidence, and behaviors for health professionals who deal with older adults with dementia.⁵³

Although it is optimal to initiate discussions of driving safety with older adults and caregivers before driving becomes unsafe, dementia may be undetected and undiagnosed until late in the course of the disease. Initially, caregivers and clinicians may assume that the older adult's decline in cognitive function is a part of the "normal" aging process. Clinicians may also hesitate to screen for and diagnose dementia, because they feel that it is futile and that nothing can be done to improve the older adult's situation or slow disease progression. In addition, clinicians may be concerned about

the amount of time required to effectively diagnose dementia and educate older adults and caregivers.⁵⁴ However, some individuals are able to achieve cognitive stability, at least for a time, with cholinesterase inhibitors or N-methyl-D-aspartate (NMDA) receptor antagonists. In addition, older adults are now being diagnosed on the "cusp" of the disease in the very early stages. A diagnosis of dementia by itself should not preclude driving but should prompt a discussion about meeting transportation needs and eventual driving cessation.

Clinician reluctance to screen for dementia is unfortunate, because early diagnosis is the first step in promoting the driving safety of these individuals and allowing them to maintain out-of-home mobility regardless of driving status. The second step is intervention, which includes medications to slow or stabilize the course of the disease, counseling to prepare the older adult and caregivers for eventual driving cessation, and serial assessment of the individual's driving abilities. When assessment shows that driving may pose a substantial safety risk to the older adult, driving cessation is a necessary third step, along with consideration of other transportation options that allow the individual to maintain out-of-home mobility. With early planning, older adults and their caregivers can make a more seamless transition from driving to non-driving status.

Table 9.4 - Neurologic Disorders

Brain tumor	<p>Driving recommendations should be based on the type of tumor, its location and rate of growth, type of treatment, presence of seizures, and presence of cognitive or perceptual impairments. Because of the progressive nature of some tumors, serial evaluations of the individual's fitness to drive may be needed.</p> <p>See also the stroke recommendations in Section 3.2.</p> <p>If the older adult experiences seizure(s), see the seizure disorder recommendations below (4.10 in this section).</p>
Closed head injury	<p>Older adults should not drive until symptoms or signs have stabilized or resolved.</p> <p>For individuals whose symptoms or signs resolve, driving may resume after medical assessment and, if deemed necessary by the clinician, a comprehensive driving evaluation (clinical and on road) performed by a DRS.</p> <p>Older adults with residual neurologic or cognitive deficits should be managed as described in Section 3.</p> <p>If the individual experiences seizure(s), see the seizure disorder recommendations below.</p>
Dementia	<p>The following recommendations are adapted from the Canadian Consensus Conference on Dementia and the Alzheimer's Association Policy Statement on Driving and Dementia (approved September 2011):</p> <ul style="list-style-type: none"> • A diagnosis of dementia is not, on its own, a sufficient reason to withdraw driving privileges. A significant number of drivers with dementia are found to be competent to drive in the early stages of their illness.⁵⁵ Therefore, the determining factor in withdrawing driving privileges should be the individual's driving ability. When the individual poses a heightened risk to self or others, driving privileges must be withheld. • Clinicians should consider the risks associated with driving for all of their patients with dementia, and they are encouraged to address the issue of driving safety with these older adults and their caregivers as early in the process as possible. When appropriate, older adults should be included in decisions about current or future driving restrictions and cessation; for older adults whose decision-making capacity is impaired, clinicians and caregivers must decide in the best interests of the patient. • Clinicians are recommended to perform a focused medical assessment that includes a history of any new impaired driving behaviors (e.g., new motor vehicle crashes, moving violations) from a family member or caregiver and an evaluation of cognitive abilities, including attention, executive function, information processing speed, judgment, memory, and visuospatial abilities. Clinicians should be aware that older adults with a progressive dementia who are initially believed to be safe to drive will require serial assessment, and they should familiarize themselves with their state reporting laws and procedures for dementia (if any). (See Chapter 8 for resources for state reporting laws.) • If concern exists that an older adult with dementia has impaired driving ability, and the individual would like to continue driving, a formal assessment of driving skills should be administered. One type of assessment is a comprehensive driving evaluation (clinical and on

road) performed by a DRS.

Clinicians should encourage older adults with progressive dementia and their caregivers to begin planning early in the clinical course for eventual cessation of driving privileges by exploring alternative transportation options and developing a plan for how to maintain out-of-home mobility and activity participation.

Migraine and other recurrent headache syndromes

Individuals with recurrent severe headaches should be cautioned against driving when experiencing neurologic manifestations (e.g., visual disturbances or dizziness), when distracted by pain, and while on any PDI medication. Individuals without a typical aura preceding the acute attack may be at higher risk.

PDI medications: barbiturates, narcotics, narcotic-like analgesics (see Section 13)

Movement disorders (eg, parkinsonism, dyskinesias)

If the clinician elicits complaints of interference with driving tasks or is concerned that the older adult's symptoms compromise his or her driving safety, referral to a DRS for a comprehensive driving evaluation (clinical and on road) is recommended.

Multiple sclerosis

Driving recommendations should be based on the type of symptoms and level of symptom involvement. Clinicians should be alert to deficits that may be subtle (e.g., muscle weakness, sensory loss, fatigue, cognitive or perceptual deficits, symptoms of optic neuritis) but have a strong potential to impair driving performance.

A comprehensive driving evaluation (clinical and on road) performed by a DRS may be useful in determining the ability to drive safely. Additionally, the DRS can recommend modification to the vehicle (e.g., hand controls, low-effort steering) that can extend the time for continued driving despite motor symptoms. Serial evaluations may be required as the individual's symptoms evolve or progress.

Paraplegia and quadriplegia

Referral to a DRS is necessary if the individual wishes to resume driving and/or requires a vehicle modified to accommodate him or her as a passenger. The DRS can recommend an appropriate vehicle and prescribe vehicle adaptive devices (e.g., low-resistance power steering and hand controls) and train the individual in their use. In addition, the DRS can assist the individual with ability to access the vehicle, including opening and closing car doors, transfer to the car seat, and independent wheelchair stowage, through vehicle adaptations and training. With spinal cord injury, referral should be fairly early in the process so caregivers can have the time needed to secure an appropriate vehicle, because not all vehicles are adaptable for this level of impairment.⁵⁶

Driving should be restricted until the individual demonstrates safe driving ability in the adapted vehicle.

Parkinson disease

Older adults with Parkinson disease may be at increased risk of driving difficulties because of motor, visual, and cognitive dysfunction.⁵⁷ Clinicians should base their driving recommendations on the level of motor, visual, and cognitive symptom involvement; the individual's response to treatment; and presence and extent of any medication adverse effects. (See Section 13 for specific recommendations on antiparkinsonian medications.) Serial physical and cognitive evaluations are recommended every 6–12 months because of the progressive nature of the disease.

If the clinician is concerned that dementia, vision, and/or motor impairments may affect the older adult's driving skills, a comprehensive driving evaluation (clinical and on road) performed by a DRS may be useful in determining the individual's fitness to drive.

The following recommendations were affirmed at the AOTA/NHTSA Expert Summit (March 2012) specific to Parkinson disease:⁵⁸

1. Drivers with Parkinson disease who have mild motor disability as measured by low scores on the Unified Parkinson Disease Rating Scale (UPDRS) Part 3, and no or few risk factors (antiparkinsonian drugs, >75 years old) may be fit to drive. Individuals who fit this profile and those who are newly diagnosed with Parkinson disease are recommended to:

- Plan a baseline comprehensive driving evaluation by a medically trained DRS
- Because of the progressive nature of the disease, the individual should also:
 - Consider annual comprehensive driving evaluations.
 - Start planning for eventual driving cessation.
 - Seek consultation to develop a plan for use of alternative transportation options.
 - Start conversations with the family about retirement from driving.

2. For those with severe motor impairment and high disease severity (high UPDRS Part 3 scores) and multiple risk factors (e.g., decreased information processing speed, the highest risk score on the Useful Field of View, scoring 180 seconds or more on the Trails B, impaired contrast sensitivity, and scoring >7 seconds on the Rapid Pace Walk), recommendations include:

- Cessation of driving
- Reporting to the licensing agency as required/allowed by the jurisdiction
- Addressing transportation options for the individual and caregiver through consultation or support services

3. Research is in progress to provide better guidelines for the middle group (i.e., those individuals with mild to moderate motor disability and few to several risk factors).

Recommendations for this group include:

- Strongly recommending a comprehensive driving evaluation by a medically trained DRS to provide opportunities for rehabilitation (e.g., behind-the-wheel training, compensatory strategies, adaptive devices, driving restrictions, and/or self-regulation)
- Providing strategies to address transitioning to non-driving (e.g., start conversations about driving retirement, caregiver involvement in driving retirement, consultation, and/or referral for counseling)
- Developing a mobility plan for driving cessation

Peripheral neuropathy

Lower extremity deficits in sensation and proprioception may be exceedingly dangerous for driving, because the driver may be unable to control the foot pedals. If deficits in sensation and proprioception are identified, referral to a DRS is recommended. The DRS may prescribe vehicle adaptive devices (e.g., hand controls in place of the foot pedals) and train the individual in their use.

Seizure disorder

The recommendations below (in this section only) are adapted from the Consensus Statements on Driver Licensing in Epilepsy, developed and agreed on in March 1992 by the American Academy of Neurology, American Epilepsy Society, and Epilepsy Foundation of America.⁵⁹ These recommendations are subject to each state's licensing requirements and reporting laws.

A patient with seizure disorder should not drive until he or she has been seizure-free for 3 months. This recommendation appears consistent with available data.⁶⁰

This 3-month interval may be lengthened or shortened based on the following favorable and unfavorable modifiers.

Favorable modifiers:

- Seizures occurred during medically directed medication changes
- Patient experiences only simple partial seizures that do not interfere with consciousness and/or motor control
- Seizures have consistent and prolonged aura, giving enough warning to refrain from driving
- There is an established pattern of purely nocturnal seizures
- Seizures are secondary to acute metabolic or toxic states that are not likely to recur
- Seizures were caused by sleep deprivation, and sleep deprivation is unlikely to recur
- Seizures are related to reversible acute illness

Unfavorable modifiers:

- Noncompliance with medication or medical visits and/or lack of credibility
- Alcohol and/or drug abuse in the past 3 months
- Increased number of seizures in the past year
- Impaired driving record
- Structural brain lesion
- Non-correctable brain functional or metabolic condition
- Frequent seizures after seizure-free interval
- Prior crashes due to seizures in the past 5 years
- Single unprovoked seizure
- Vagal nerve stimulator implant for seizure control with extended adjustment period
- Three or more antiepileptic drugs necessary to achieve seizure control

Single unprovoked seizure

The patient should not drive until he or she has been seizure-free for 3 months.

This time period may be shortened with clinician approval. Predictors of recurrent seizures that may preclude shortening of this time period include:

- The seizure was focal in origin.
- Focal or neurologic deficits predated the seizure.
- The seizure was associated with chronic diffuse brain dysfunction.
- The patient has a positive family history for epilepsy.

Generalized spike waves or focal spikes are present on EEG recordings.

Withdrawal or change of anticonvulsant drug therapy The patient should temporarily cease driving during the time of medication withdrawal or change because of the risk of recurrent seizure and PDI effects of the medication.

If the risk of recurrent seizure during medication withdrawal or change is significant, the patient should cease driving during this time and for at least 3 months thereafter.

If the patient experiences a seizure after medication withdrawal or change, he or she should not drive for 1 month after resuming a previously effective medication regimen. Alternatively, the patient should not drive for 6 months if he or she refuses to resume this medication regimen but is seizure-free during this period.

Sleep disorders

Narcolepsy The older adult should cease driving once diagnosed but may resume driving after treatment when he or she no longer suffers excessive daytime drowsiness or cataplexy. Clinicians may consider using scoring tools such as the Epworth Sleepiness Scale to assess the individual's level of daytime drowsiness.⁶¹

Sleep apnea See Section 10.

Stroke See Section 3.

Tourette syndrome In evaluating the older adult's fitness to drive, clinicians should consider any comorbid disorders (including attention deficit hyperactivity disorder, learning disabilities, and anxiety disorder) in addition to the individual's motor tics. (For specific recommendations on these disorders, see Section 5, Psychiatric Disorders).

If the clinician is concerned that the older adult's symptoms compromise his or her driving safety, referral to a DRS for a comprehensive driving evaluation (clinical and on road) is recommended.

PDI medications: antipsychotics (see Section 13 for more information on medication adverse effects)

Vertigo Older adults with acute vertigo should not drive until symptoms have fully resolved. Under no circumstances should the individual drive to seek medical attention.

Older adults with a chronic vertiginous disorder are strongly recommended to undergo on-road assessment performed by a DRS before resuming driving.

PDI medications: antivertigo agents (anticholinergic)

SECTION 5: PSYCHIATRIC DISORDERS

1. Affective disorders
 - a. Depression
 - b. Bipolar disorder
2. Anxiety disorders
3. Psychotic illness
 - a. Acute episodes
 - b. Chronic illness
4. Personality disorders
5. Substance abuse
6. Attention deficit disorder/attention deficit hyperactivity disorder
7. Tourette syndrome

Older adults in the acute phase of a psychiatric illness need to be aware that driving skills could be affected. In general, driving is safe when the condition is stable, although adverse effects from medications and compliance with the medication regimen may need to be taken into consideration. (For recommendations on medications and driving, see Section 13, Medications.)

Psychiatrists may wish to consult the American Psychiatric Association's Position Statement on the Role of Psychiatrists in Assessing Driving Ability.⁶²

Table 9.5 - Psychiatric Disorders

Affective disorders	<p>Clinicians should advise older adults not to drive during the acute phase of illness.</p> <p><i>PDI medications:</i> antidepressants (see Section 13 for information on differences among antidepressants)</p>
<i>Depression</i>	<p>No restrictions if condition is mild and stable. Clinicians should always specifically ask about suicidal ideation and cognitive and motor symptoms.</p> <p>Older adults should not drive if they are actively suicidal or experiencing significant mental or physical slowness, agitation, psychosis, impaired attention, and/or impaired concentration. Individuals should be counseled not to drive themselves to seek medical attention.</p>
<i>Bipolar disorder</i>	<p>No restrictions if condition is stable.</p> <p>Older adults should not drive if they are actively suicidal, depressed as in 1.a (above) or in an acute phase of mania. Individuals should be counseled not to drive themselves to seek medical attention.</p>
Anxiety disorders	<p>Older adults should not drive during episodes of severe anxiety. Otherwise, there are no restrictions if the condition is stable.</p> <p><i>PDI medications:</i> benzodiazepines (see Section 13)</p>

Psychotic illness Clinicians should advise older adults not to drive during the acute phase(s) of illness.
PDI medications: antipsychotics, benzodiazepines
Acute episodes: Older adults should not drive during acute episodes of psychosis. Individuals with acute psychosis should be counseled not to drive themselves to seek medical attention.
Chronic illness: No restrictions if the condition is stable.

Personality disorders No restrictions unless the older adult has a history of driving violations and his or her psychiatric review is unfavorable. This includes, but is not limited to, uncontrolled, erratic, violent, aggressive, or irresponsible behavior.
Because of the high comorbidity of substance abuse with personality disorders, clinicians are urged to be alert to substance abuse in these individuals and counsel them accordingly (see recommendations for substance abuse below).

Substance abuse Driving while intoxicated is illegal and highly dangerous to the driver, passengers, and other road users. Impaired driving is the most common crime in the United States, and it is responsible for thousands of traffic deaths each year.
Alcohol is not the only cause of impaired driving. Substances including, but not limited to, marijuana, cocaine, amphetamines (including amphetamine analogues), opiates, and benzodiazepines may also impair driving skills. Clinicians should query about prescription and/or nonprescription medication abuse as potential additional agents.
Clinicians should follow up all positive screens with appropriate interventions, including brief interventions or referral to support groups, counseling, and substance abuse treatment centers. Clinicians should strongly urge substance abusers to temporarily cease driving while they seek treatment, and to refrain from driving while under the influence of intoxicating substances. A non-judgmental and supportive attitude and frequent follow-up may aid substance abusers in their efforts to achieve and maintain sobriety.
Clinicians should also familiarize themselves with any state laws or regulations regarding detaining intoxicated individuals who have driven to the hospital or clinic until they are legally unimpaired.

Attention deficit disorder/attention deficit hyperactivity disorder A review noted increased risk of driving behaviors and a positive effect of stimulant medications on driving performance.⁶³ Clinicians should educate older adults about the increased risk associated with the disease and the potential benefits of treatment.

Tourette syndrome See Section 4.

SECTION 6: METABOLIC DISORDERS

1. Diabetes mellitus
 - a. Insulin dependent diabetes mellitus (IDDM)
 - b. Non-insulin dependent diabetes mellitus (NIDDM)
2. Hypothyroidism
3. Hyperthyroidism

Older adults in the acute phase of a metabolic disorder (e.g., diabetes, Cushing disease, Addison disease, hyperfunction of the adrenal medulla,

thyroid disorders) may experience signs and symptoms incompatible with safe driving. Clinicians should advise these individuals to refrain from driving (including driving to seek medical attention) until the symptoms have abated.

Data suggest that older adults with diabetes may be at increased risk of impaired driving, but the literature is not consistent in this area. Concern has been raised that the trend in the medical profession has been toward tighter control of blood glucose levels, which could result in hypoglycemia and possibly increased crash risk.

Table 9.6 - Metabolic Disorders

Diabetes mellitus

<i>Insulin dependent diabetes mellitus (IDDM)</i>	<p>No restrictions if the older adult demonstrates satisfactory control of his or her diabetes, recognizes the warning symptoms of hypoglycemia, and meets required visual standards.</p> <p>The major concern is lack of awareness of hypoglycemia.</p> <p>Several studies have noted that individuals with type 1 IDDM had impaired driving performance during episodes of hypoglycemia and were unaware of their low blood glucose at the time of driving assessment.^{64,65}</p> <p>It is apparent from these studies that many drivers did not take appropriate action even when they recognized the symptoms of hypoglycemia. Individuals with diabetes who use insulin should be evaluated for hypoglycemia and should consider checking their blood sugar before driving or on prolonged trips. This is especially the case for individuals who have exhibited lack of awareness of hypoglycemia (e.g., documented blood glucose below 60 mg/dL without symptoms).</p> <p>Older adults should be counseled not to drive during acute hypoglycemic or hyperglycemic episodes. In addition, older adults are advised to keep candy or glucose tablets within reach in their car at all times, in the event of a hypoglycemic attack. A 2012 American Diabetes Association position statement highlights important considerations in identification and management for individuals with diabetes at potential risk of driving difficulties.⁶⁶</p> <p>For peripheral neuropathy, see Section 4.</p> <p>Older adults who experience recurrent hypoglycemic or hyperglycemic attacks should not drive until they have been free of significant hypoglycemic or hyperglycemic attacks for 3 months.</p>
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Non-insulin dependent mellitus (NIDDM) Older adults who are managed by lifestyle changes and/or oral medications have no *diabetes* restrictions unless they develop relevant conditions (e.g., diabetic retinopathy).

If the clinician prescribes an oral medication that has a significant potential to cause hypoglycemia, he or she should counsel the individual as for IDDM above. Oral medications may also increase the likelihood of hypoglycemia, which should be managed as in 1.a in this section.

Hypothyroidism Older adults who experience symptoms (e.g., cognitive impairment, drowsiness, fatigue) that may compromise safe driving should be counseled not to drive until their hypothyroidism has been satisfactorily treated. If residual cognitive deficits are apparent despite treatment, a comprehensive driving evaluation (clinical and on road) performed by a DRS may be useful in determining the individual's ability to drive safely.

Hyperthyroidism Older adults who experience symptoms (e.g., anxiety, tachycardia, palpitations) should be counseled not to drive until their hyperthyroidism has been satisfactorily treated and symptoms have resolved.

SECTION 7: MUSCULOSKELETAL DISORDERS

1. Arthritis
2. Foot abnormalities
3. Limitation of cervical movement
4. Limitation of thoracic and lumbar spine
5. Loss of extremities or loss of use of extremities
6. Muscle disorders
7. Orthopedic procedures/surgeries
 - a. Amputation
 - b. Anterior cruciate ligament reconstruction
 - c. Limb fractures and treatment involving splints and casts
 - d. Rotator cuff repair (open or arthroscopic)
 - e. Shoulder reconstruction
 - f. Total hip replacement
 - g. Total knee arthroplasty

Pain, decreased motor strength, and compromised range of motion associated with musculoskeletal disorders can affect an individual's ability to drive. Clinicians should encourage older adults with musculoskeletal disorders to drive a vehicle with power steering and automatic transmission. Such vehicles require the least amount of motor ability for operation among all standard vehicles. If the clinician is concerned that the individual's musculoskeletal disorders impair his or her driving performance, referral to a DRS for a comprehensive driving evaluation (clinical and on road) is also recommended. In addition to assessing the older adult's driving skills, the DRS can prescribe compensatory techniques and adaptive devices and train the individual in their use.

Older adults with musculoskeletal disorders typically have problems with using the seat belt and ignition key, adjusting mirrors and seats, steering, transferring in and out of the car, driving in reverse, and using controls such as the foot pedals.⁶⁷ Driving

impairment has been correlated with the inability to reach above the shoulder.⁶⁸ Older adults with physical frailty or disabilities may be at increased risk of a crash^{69,70} and are more likely to be injured.⁷¹ Presence of foot abnormalities, walking less than one block a day, and impaired left knee flexion have been associated with adverse driving events.⁷¹ In one study, older participants involved in a crash were more likely to have difficulty walking one-quarter mile than controls; increased crash risk for drivers with a history of falls was also noted.⁷² A recent systematic review and meta-analysis found an association between fall history and crash risk.⁷³

An examination of medically impaired drivers in Utah found an increased crash risk for drivers with musculoskeletal disorders but not for those with muscle or motor weakness.⁷⁴ In a Canadian longitudinal study, self-reported arthritis/rheumatism and back pain were associated with motor vehicle injuries.⁷⁵

Conversely, individuals with a specific diagnosis of osteoarthritis were no more at risk of a crash than controls in one study.⁷⁶ Also reassuring was a study noting no increase in crash risk of drivers with cars that had been adapted for their musculoskeletal

restrictions.⁷⁷ Improvements in relevant physical abilities and driving performance have been noted with a physical conditioning program.⁷⁸

Older drivers are at increased risk of death and serious injury in motor vehicle crashes, in part because of age-related fragility.⁷⁹⁻⁸¹ Therefore, clinicians should advise older adults to avoid driving in potentially risky situations, such as making unprotected left turns, and driving in unfamiliar areas or on suburban highways.⁸²

In sum, clinicians can play a role in diagnosing, managing, and referring older adults with musculoskeletal disorders, thereby helping to maintain driving privileges and improve traffic safety.

Rehabilitative therapies such as physical or occupational therapy and/or a consistent regimen of physical activity may improve the older adult's ability to drive and overall level of physical fitness.

Whenever possible, the use of narcotics, barbiturates, and muscle relaxants should be avoided or minimized in those individuals with musculoskeletal disorders who wish to continue driving. See Section 13 for recommendations on specific classes of medications.

Table 9.7 - Musculoskeletal Disorders

Arthritis

If symptoms of arthritis compromise the older adult's driving safety, referral to a physical or occupational therapist for rehabilitative therapy and/or to a DRS for a comprehensive driving evaluation (clinical and on road) is recommended. The DRS may prescribe vehicle adaptive devices and train the individual in their use.

See below for specific recommendations on limitation of cervical movement or limitation of the thoracic or lumbar spine.

Foot abnormalities

Foot abnormalities (e.g., bunions, hammer toes, long toenails, calluses) that affect the older adult's dorsiflexion, plantar flexion, and/or contact with vehicle foot pedals should be addressed and treated, if possible. Consideration should be given to referral to a podiatrist. Older adults may also be referred to a DRS, who can prescribe vehicle adaptive devices and train the individual in their use.

Limitation of cervical movement Some loss of head and neck movement is acceptable if the older adult has sufficient combined rotation and peripheral vision to accomplish driving tasks (e.g., turning, crossing intersections, parking, backing up) safely. The clinician may also refer the older adult to a physical or occupational therapist for rehabilitative therapy, and/or to a DRS, who can prescribe wide-angled mirrors and train the individual in their use.

Limitation of thoracic or lumbar spine Older adults with marked deformity, who wear braces or body casts, or who have painfully restricted motion in their thoracic or lumbar regions should be referred to a DRS. The DRS can prescribe vehicle adaptive devices such as raised seats and wide-angled mirrors and train the individual in their use. The DRS can also prescribe seat belt adaptations as needed to improve the older adult's safety and comfort and to ensure that the individual is seated at least 10 inches from the vehicle air bags.

Older adults with acute spinal fractures, including compression fractures, should not drive until the fracture has been stabilized and painful symptoms cease to interfere with control of the motor vehicle. These types of fractures can be extremely painful and may require large doses of narcotics for control of pain, which also can increase risk.

For paraplegia or quadriplegia, see Section 4.

Loss of extremities or loss of use of extremities For older adults who have lost (or lost the use) of one or more extremities, referral to a DRS is highly recommended. The DRS can prescribe vehicle adaptive devices and/or adaptations to limb prostheses, and train the individual in their use. For example, those who have loss of the right lower extremity may be able to use a left foot accelerator.

For those with an absent, amputated or non-functioning hand, a spinner knob may be recommended.

The use of artificial limbs on vehicle foot pedals is unsafe because of the lack of sensory feedback (i.e., pressure and proprioception). For these individuals, specialized hand controls in place of pedals are required.

Driving should be restricted until the older adult demonstrates safe driving ability (with the use of adaptive devices, as needed).

Muscle disorders If the clinician is concerned that the older adult's symptoms compromise his or her driving safety, referral to a DRS for a comprehensive driving evaluation (clinical and on road) is recommended. If needed, the DRS may prescribe vehicle adaptive devices and train the individual in their use.

Orthopedic procedures/surgeries

Amputation See Loss of extremities (above).

Anterior cruciate (ACL) reconstruction Individuals should not drive for 4 weeks after right ACL reconstruction. If the older *ligament* adult drives a vehicle with manual transmission, he or she should not drive for 4 weeks after right or left ACL reconstruction.⁸³

<i>Limb fractures and treatment involving splints and casts</i>	<p>No restrictions if the fracture or splint/cast does not interfere with driving tasks.</p> <p>If the fracture or splint/cast interferes with driving tasks for any reason, such as the lack of sensory feedback (i.e., pressure and proprioception), the older adult may resume driving after the fracture heals or the splint/cast is removed, after demonstration of the necessary strength and range of motion.</p>
<i>Rotator cuff repair (open or arthroscopic)</i>	<p>Individuals should not drive for 4–6 weeks after rotator cuff repair. If the older adult's vehicle does not have power steering, the waiting period may be much longer.</p> <p>Clinicians should counsel individuals to wear their seat belts properly (over the shoulder, rather than under the arm) whenever they are in a vehicle as a driver or passenger.</p>
<i>Shoulder reconstruction</i>	<p>Individuals should not drive for 4–6 weeks after shoulder reconstruction. If the older adult's vehicle does not have power steering, the waiting period may be much longer.</p> <p>Clinicians should counsel individuals to wear their seat belts properly (over the shoulder, rather than under the arm) whenever they are in a vehicle as a driver or passenger.</p>
<i>Total hip replacement</i>	<p>Individuals should not drive for at least 4 weeks after right total hip replacement.</p> <p>If the older adult drives a vehicle with manual transmission, he or she should not drive for at least 4 weeks after right or left total hip replacement.</p> <p>Clinicians should counsel older adults to take special care when transferring into vehicles and positioning themselves in bucket seats and/or low vehicles, either of which may result in hip flexion greater than 90 degrees. Clinicians should also counsel individuals that reaction time may not return to baseline until 8 weeks after the surgery, and that they should exercise extra caution while driving during this period.⁸⁴ A recent study found that reaction time recovered in 2–4 weeks and postulated that new techniques may have contributed to the improvement.⁸⁵</p>
<i>Total knee arthroplasty (TKA)</i>	<p>Individuals should not drive for 3–4 weeks after right TKA. If the older adult drives a vehicle with manual transmission, he or she should not drive for 3–4 weeks after right or left TKA.</p> <p>The clinician should also counsel individuals that reaction time may not fully return to baseline until 8 weeks after the surgery and that extra caution should be exercised while driving during this period.^{86–91}</p>

SECTION 8: PERIPHERAL VASCULAR DISORDERS

1. Aortic aneurysm
2. Deep vein thrombosis
3. Peripheral arterial aneurysm

Table 9.8 - Peripheral Vascular Disorders

Aortic aneurysm	No restrictions to driving unless other disqualifying conditions are present. Individuals whose aneurysm appears to be at the stage of imminent rupture based on size, location, and/or recent change should not drive until the aneurysm has been repaired, if possible.
Deep vein thrombosis (DVT)	Older adults with acute DVT may resume driving when their international normalized ratio (INR) is therapeutic (or the risk of embolism is otherwise appropriately treated), and they can demonstrate adequate ankle dorsiflexion. Clinicians should advise individuals with a history of DVT to take frequent "mobilization breaks" when driving long distances.
Peripheral arterial aneurysm	No restrictions unless other disqualifying conditions are present. Older adults whose aneurysm appears to be at the stage of imminent rupture based on size, location, and/or recent change should not drive until the aneurysm has been repaired, if possible.

SECTION 9: RENAL DISORDERS

1. Chronic renal failure
2. Time-limited restrictions: renal transplant

Table 9.9 - Renal Disorders

Chronic renal failure	No restrictions unless the older adult experiences symptoms incompatible with safe driving (e.g., cognitive impairment, impaired psychomotor function, seizures, extreme fatigue from anemia). If the clinician is concerned that the individual's symptoms compromise his or her driving safety, referral to a DRS for a comprehensive driving evaluation (clinical and on road) is recommended. Many older adults with renal failure requiring hemodialysis can drive without restriction. However, management of renal failure requires that the older adult be compliant with substantial nutrition and fluid restrictions, frequent medical evaluations, and regular hemodialysis treatments. Individuals with a history of noncompliance should be advised against driving. Furthermore, certain medications used to treat adverse effects of hemodialysis may be substantially impairing (e.g., diphenhydramine for dialysis-associated pruritus), and dialysis itself may result in hypotension, confusion, or agitation in many people. These effects may require that older adults avoid driving in the immediate post-dialysis period.
Renal transplant	Older adults may resume driving 4 weeks after successful renal transplant on the recommendation of the physician.

SECTION 10: RESPIRATORY AND SLEEP DISORDERS

1. Asthma
2. Chronic obstructive pulmonary disease (COPD)
3. Sleep apnea

“Drowsy driving” or driving with fatigue or sleepiness is a common cause of a motor vehicle crash, and some estimate that more than 100,000 crashes a year may be attributed to this problem.

Crash risk increases with diminishing sleep.⁹² Sleep disorder crash risk may be increased further by medication use, such as narcotics or antihistamines.⁹³ Individuals with sleep apnea have been noted to have as high as a 7-fold increased crash risk compared with controls depending on the study.⁹⁴ Individuals with these disorders may also be at increased risk of injurious crashes.⁹⁵ This topic has been extensively reviewed elsewhere.¹ Obstructive sleep apnea is one of the few medical conditions for which treatment has been shown to return crash risk to baseline levels.⁹⁶ In addition, recent studies indicate a high prevalence of sleep disorders or daytime sleepiness in older adults⁹⁷ and in individuals with diabetes.⁹⁸ However, in the case of older adults, the effect on driving safety is unclear.⁹⁹

Table 9.10 - Respiratory and Sleep Disorders

Asthma	No restrictions. Older adults should be counseled not to drive during acute asthma attacks, or while suffering transient adverse effects (if any) from asthma medications.
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Chronic obstructive pulmonary disease (COPD)	No restrictions if symptoms are well controlled, and the older adult does not experience any significant adverse effects from the condition or medication.
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The older adult should not drive if he or she suffers dyspnea at rest or at the wheel (even with the use of supplemental oxygen), excessive fatigue, or significant cognitive impairment. If the older adult requires supplemental oxygen to maintain a hemoglobin saturation of $\geq 90\%$, he or she should be counseled to use the oxygen at all times while driving. Because of the often tenuous oxygenation status of these individuals, they should also be counseled to avoid driving when they have other respiratory symptoms that may indicate concomitant illness or exacerbation of COPD (e.g., new cough, increased sputum production, change in sputum color, fever).

The following recommendations were affirmed at the AOTA/NHTSA Expert Summit (March 2012) specific to COPD:⁵⁶

- When an individual has COPD, a referral for a driving evaluation is indicated if any of the following conditions are present: (1) cognitive decline is evident with either psychometric testing or while performing other ADLs (e.g., impaired attention,

fatigue, hypersomnolence); (2) concern is raised about driving safety through direct observation, family concern, or driving incidents; (3) the individual has difficulty maintaining oxygen saturation of at least 90% at rest; (4) when the individual experiences dyspnea at rest or while behind the wheel; and (5) when the individual's motor vehicle needs modification for loading a powered mobility device (wheelchair or scooter) or oxygen containers need to be secured in the vehicle.

- When an individual has COPD, the DRS should monitor oxygen saturation while driving to measure the effects of driving tasks on oxygen levels in the blood. This information can be used to verify the need to drive with oxygen to improve cognition, as well as heart and other organ functioning. Pulse oximetry is also an effective tool to demonstrate the effects that energy conservation (vehicle features, arm position, etc.) and breathing techniques have while driving.
- When an individual has COPD, the DRS can provide guidance on overall driving skills and safety, including driving limits and compensatory techniques, as well as assistance with loading devices for power mobility devices, and oxygen storage.
- Community mobility should be addressed with every occupational therapy patient as part of the initial evaluation and most importantly as part of discharge planning.

Because COPD is often progressive, periodic reevaluation for symptoms and oxygenation status is recommended.

If the clinician is concerned that the older adult's symptoms compromise his or her driving safety, referral to a DRS for a comprehensive driving evaluation (clinical and on road) is recommended. The individual's oxygen saturation may be measured during the course of the on-road assessment to provide additional information for management.

Sleep apnea

Older adults with excessive daytime sleepiness, loud snoring (particularly if accompanied by witnessed apneic events), large neck circumference (≥ 16 inches in women, ≥ 17 inches in men), increased body mass index (>35 kg/m²), and/or hypertension that requires two or more medications should be considered at risk of obstructive sleep apnea, and formal sleep study evaluation should be considered, especially in any individual who reports having fallen asleep while driving a vehicle. A person diagnosed with sleep apnea (apnea/hypopnea index ≥ 5) who has fallen asleep while driving, or a person with severe obstructive sleep apnea (apnea/hypopnea index of ≥ 30) should be counseled to refrain from driving until he or she is receiving effective treatment (via a positive airway pressure device) after a formal sleep study to confirm the diagnosis. If these individuals undergo other treatments (surgery, oral appliances), they should be advised to have a post-treatment sleep study to confirm effectiveness. Clinicians should counsel older adults prescribed positive airway pressure devices that they should not drive if they do not use the device unless a formal sleep study confirms resolution of their obstructive sleep apnea (e.g., after substantial weight loss).

SECTION 11: EFFECTS OF ANESTHESIA AND SURGERY

1. Abdominal, back, and chest surgery
2. Anesthesia
 - a. General
 - b. Local
 - c. Epidural
 - d. Spinal
3. Neurosurgery
4. Orthopedic surgery

Clinicians should be alert to peri- and postoperative risk factors that may affect the older adult's cognitive function after surgery, or restrictions on limb movement or joint range of motion that place the individual at risk of impaired driving performance. Risk factors include:

- Preexisting cognitive impairment
- Duration of surgery
- Age (>60 years old)
- Altered mental status after surgery
- Presence of multiple comorbidities
- Emergency surgery

If the clinician is concerned that residual visual, cognitive, or motor deficits after surgery may impair

the older adult's driving performance, referral to a DRS for a comprehensive driving evaluation (clinical and on road) is highly recommended.

Clinicians should counsel older adults who undergo surgery—both inpatient and outpatient—not to drive themselves home after the procedure. Although they may feel capable of driving, their driving skills may be affected by pain, physical restrictions, anesthesia, cognitive impairment, and/or analgesics. (For specific recommendations on musculoskeletal restrictions and narcotic analgesics, see Sections 7 and 13, respectively.)

In counseling older adults about their return to driving after a surgical procedure, clinicians may find it useful to ask whether the individual's car has power steering and automatic transmission. Advice can then be tailored accordingly.

As older adults resume driving, they should be counseled to assess their comfort level in familiar, traffic-free areas before driving in heavy traffic. Those who feel uncomfortable driving in certain situations should avoid these situations until their confidence level has returned.

Older adults should never resume driving before they feel ready to do so and have received approval from the clinician.

Table 9.11 - Effects of Anesthesia and Surgery

Abdominal, back, chest and surgery	Older adults may resume driving after demonstrating the needed strength and range of motion. See Section 2 for recommendations for surgeries involving median sternotomy.
Anesthesia	Because anesthetic agents and adjunctive compounds (such as benzodiazepines) may be administered in combination, older adults should not resume driving until the motor and cognitive effects from all anesthetic agents have subsided.
<i>General</i>	Both the surgeon and anesthesiologist should advise older adults against driving for at least 24 hours after a general anesthetic has been administered. Longer periods of driving cessation may be recommended depending on the procedure performed and the presence of complications.
<i>Local</i>	If the anesthetized region is necessary for driving tasks, the older adult should not drive until he or she has recovered full strength and sensation (barring pain).
<i>Epidural</i>	Older adults may resume driving after recovering full strength and sensation (barring pain) in the affected areas.
<i>Spinal</i>	Older adults may resume driving after recovering full strength and sensation (barring pain) in the affected areas.
Neurosurgery	See recommendations for post-intracranial surgery in Section 3.
Orthopedic surgery	See recommendations for orthopedic procedures/surgeries in Section 7.

SECTION 12: CANCER

Table 9.12 - Cancer

Cancer	Older adults who experience significant motor weakness or cognitive impairments from the cancer itself, metastases, cachexia, anemia, radiation therapy, and/or chemotherapy, which can cause cognitive impairment and/or neuropathy, should cease driving until their condition improves and stabilizes. Many medications prescribed to relieve the adverse effects of cancer treatment (e.g., antiemetics for nausea) may impair driving performance. Clinicians should counsel older adults accordingly. (See Section 13 for recommendations for specific medications.)
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SECTION 13: MEDICATIONS

1. Anticholinergics
2. Anticonvulsants
3. Antidepressants
4. Antiemetics
5. Antihistamines
6. Antiparkinsonian agents
7. Antipsychotics
8. Benzodiazepines and nonbenzodiazepine hypnotics
9. Muscle relaxants
10. Narcotic analgesics

As described in the previous sections of this chapter, medications may promote safe driving in older adults through adequate management of medical conditions and better physical functioning. However, many commonly used prescription and over-the-counter medications may impair driving by adversely affecting the cognitive, visual, and/or motor abilities needed for safe driving. In general, any drug with a prominent effect on the central nervous system (CNS) has the potential to impair an individual's ability to operate a motor vehicle. The level of impairment varies from person to person and between different medications within the same therapeutic class.

Expert panels convened by NHTSA to develop a list of safe and unsafe drugs with regard to driving were not able to develop a conclusive list and were only able to comment on the potential impact of various medications.¹⁰⁰ This difficulty stems from inconsistent research findings, lack of a standardized protocol for assessing the potential for medications to impair driving, and the difficulty in distinguishing the impact of the medical condition from the impact of the medication itself that is used to treat the medical condition on driving safety.¹⁰⁰ For studies that have

taken into account both the medical condition and the medications used to treat the condition, the impact of the medical condition on crash risk is much stronger than that of the medication.¹⁰⁰ Thus, this section discusses PDI medications based on information from observational studies examining risk of crashes; from experimental studies assessing driving performance, as tested in different actual driving tests or driving simulator tests; and/or from the known adverse effect profile of the medication. Some PDI medications are included based on adverse-effect profile alone, because research evidence is not available delineating risk of traffic crashes.

The most common PDI medications include the anticholinergics, anticonvulsants, antidepressants, antiemetics, antihistamines, antipsychotics, barbiturates, benzodiazepines/hypnotics, muscle relaxants, and narcotic analgesics.¹⁰¹⁻¹⁰³ Of these medication classes, sedative/hypnotics (e.g., benzodiazepines, zolpidem) have been subject to the most scrutiny, and studies have consistently found higher risk of traffic crashes associated with their use in older adults.¹⁰²⁻¹⁰⁵ Increased risk of traffic crashes is especially prominent when medications are newly initiated.¹⁰⁴⁻¹⁰⁶

Older adults often take multiple medications concurrently, with approximately 36% using five or more prescription medications.¹⁰⁷ Furthermore, older adults often take multiple CNS-active medications, with 25% taking two or more classes.¹⁰⁸ Crash risk is likely to increase with use of multiple PDI medications¹⁰⁹ or concomitant use with alcohol. Table 9.13 summarizes the common PDI medications and the specific adverse effects (cognitive, visual, and motor abilities) that may contribute to impaired driving. Adverse effects on cognition include fatigue, sedation/sleepiness, light-headedness, dizziness, or global cognitive impairment (e.g., impaired judgment, attention, psychomotor speed). Medications that cause tremor, dyskinesias,

or extrapyramidal symptoms may impair motor ability needed for driving. A history of falls has been associated with an increased crash risk, and medications with CNS effects are known risk factors for falls. Medications that cause drowsiness, euphoria, and/or anterograde amnesia may also diminish insight, and older adults may experience impairment without being aware of it (e.g., benzodiazepines, narcotics, antihistamines).¹¹⁰⁻¹¹³

This list of medications is not exhaustive. Other medication classes, such as oral hypoglycemics and antihypertensives, may cause dizziness or impaired cognition if the individual is hypoglycemic or blood pressure is too low, respectively. Furthermore, any medication adverse effect (e.g., nausea) that reduces the ability to concentrate could potentially impair driving.

Table 9.13 - Potentially Driver-Impairing (PDI) Medications

Medication Class	PDI Symptom
Anticholinergics	Sedation, blurred vision, impaired cognition
Anticonvulsants	Sedation, impaired cognition
Antidepressants	
<i>Tricyclics (tertiary more impairing than secondary)</i>	Sedation, blurred vision, impaired cognition, tremor, heart palpitations
<i>Selective serotonin reuptake inhibitors (SSRIs)</i>	Impaired concentration, lightheadedness, tremor
Others	
<i>Duloxetine</i>	Sedation
<i>Mirtazapine</i>	Sedation
<i>Bupropion</i>	Insomnia (leading to next day somnolence)
Antihistamines (first generation and cetirizine)	Sedation, blurred vision, impaired cognition
Antiparkinson agents	All classes may cause sedation.
<i>Dopamine agonists, levodopa, Anticholinergics</i>	Medication-specific adverse events: sleep-attacks (most likely with dopamine agonists), dyskinesias (most likely with levodopa)
Antipsychotics	Sedation, blurred vision, impaired cognition, extrapyramidal symptoms, (to varying extent among agents)
Benzodiazepines/sedatives	Sedation, clumsiness, dizziness, impaired vision, impaired cognition
Muscle relaxants	Sedation, blurred vision, impaired cognition
Opioid analgesics	Sedation, lightheadedness, impaired vision
Other agents	
Antihypertensives	Dizziness (low blood pressure) CNS effects (guanfacine, reserpine, methyldopa, clonidine)
Hypoglycemics	Symptoms of hypoglycemia (shakiness, impaired concentration, lightheadedness)
Indomethacin	CNS effects

Clinicians should be aware of the PDI risk and attempt to use the safest class of medication when possible. It is difficult to know whether increased risk of impaired driving is associated with the drug (e.g., antidepressant), the disease itself (e.g., depression, which may independently impair attention, judgment), or a drug-drug interaction.¹⁰² Because of age-related changes in pharmacokinetics (e.g., reduced renal function) and pharmacodynamics, older adults may begin to have adverse effects to medications that they have tolerated well for many years, which may make it difficult to ascertain the cause of new PDI symptoms.

ALCOHOL INTERACTION WITH MEDICATIONS

As little as one serving of alcohol (1.25 oz. 80-proof liquor, 12 oz. beer, 5 oz. wine) has the potential to impair driving ability in many individuals. Because of age-related changes in body composition (e.g., increased body fat and decreased lean muscle mass), the same weight-adjusted amount of alcohol (hydrophilic) is likely to result in higher blood levels of alcohol and functional impairment in advanced age. In many cases, older adults may be impaired without being aware of it. Furthermore, alcohol can potentiate the CNS effects of PDI medications to produce profound and dangerous levels of impairment. Clinicians should always warn older adults against drinking and driving, and against combining alcohol and their CNS-active medications.

MARIJUANA USE

Prevalence of marijuana use is low in older adults, at 1.3-2%.^{114,115} However, with the increased acceptance of medicinal cannabis and legalization of marijuana for recreational use, it is likely this prevalence of marijuana use will increase. In

experimental studies conducted in younger individuals, marijuana is associated with negative effects on driving ability, including an increase in lane weaving, poor reaction time, and altered attention to the road.¹¹⁶⁻¹¹⁸

Although not well studied, the potential exists for medications that are strong inhibitors of CYP3A4 and CYP2C9 enzymes in the liver to result in higher concentrations of marijuana components in the blood. Moderate-strength evidence from a recent meta-analysis of 21 multinational observational studies suggests that acute cannabis intoxication is associated with a moderate increase in collision risk (odds ratio, 1.35 [CI, 1.15 to 1.61]).¹¹⁹

GENERAL PRESCRIBING PRINCIPLES

It may not be possible to avoid use of PDI medications in older adults; however, several general prescribing principles can be considered to minimize risk.

1. Whenever possible, clinicians should select non-impairing medications.
2. When prescribing new medications, clinicians should always consider the individual's existing regimen of prescription and nonprescription medications and consider risk of additive PDI medications. Combinations of drugs may affect drug metabolism and excretion, and produce additive or synergistic interactions to impair driving ability.
3. Clinicians should add new medications at the lowest dosage possible, counsel the older adult to be alert to any impairing effects, and adjust the dosages as needed to achieve therapeutic effects while minimizing driving impairment. For individuals on multiple PDI medications, it is wise to start with low doses of each and gradually increase the dosage of each one at a time to minimize substantial undesirable effects.

4. Older adults should be regularly assessed for PDI symptoms during follow-up visits.
5. If medication therapy is initiated while the older adult is hospitalized, the impact of adverse effects on driving performance should be discussed before discharge.
6. These precautions and discussions should be documented in the health record.
7. If there is a question of cognitive or motor impairment, whether or not due to medications, the clinician should consider referral to a DRS for a driver evaluation (potentially including on-road assessment).

COUNSELING CONSIDERATIONS

The following counseling points are important to consider when a new PDI medication is started, or the dosage of an existing PDI medication is increased.

1. Inform the older adult and caregivers about the specific effects of the medication, so that they know

what to expect and can self-monitor for adverse events that may affect driving.

2. Advise the older adult and caregivers to take the first few doses in a safe environment to determine the presence and extent of any adverse effects. Individuals should be advised not to drive during the initial phase of PDI dosage adjustment(s) if they experience drowsiness, lightheadedness, or other undesirable effects that may impair driving performance.
3. Inform the older adult and caregivers that some medications that cause drowsiness, euphoria, and/or anterograde amnesia may also diminish insight (benzodiazepines, antihistamines, narcotics), and that the individual may experience impairment without being aware of it.
4. Discourage the use of alcohol while driving and inform the older adult and caregivers about the potential for exacerbation of the PDI effects of certain medications with concomitant alcohol use.

Table 9.14 - Medications

Refer to Table 9.13 for a full list of the PDI symptoms for each of the medication classes discussed below.

Anticholinergics

Many prescription and over-the-counter medications have anticholinergic effects (see reference for a full list).¹²⁰ These include several medication classes such as antidepressants (e.g., tricyclic antidepressants and paroxetine), medications for overactive bladder (e.g., oxybutynin, tolterodine, trospium, darifenacin), first-generation antihistamines used for allergies, insomnia, and/or vertigo (e.g., chlorpheniramine, dimenhydrinate, diphenhydramine, doxylamine), skeletal muscle relaxants (e.g., cyclobenzaprine), gastrointestinal antispasmodics (e.g., belladonna alkaloids, atropine, hyoscyamine), certain antipsychotics (e.g., chlorpromazine, clozapine, olanzapine), and antiparkinsonian agents (e.g., trihexyphenidyl). In most cases, therapeutic alternatives to anticholinergic medications are available.

Subtle deficits in attention, memory, and reasoning may occur with therapeutic dosages of anticholinergic drugs without signs of overt toxicity. Delirium can also occur in older adults.

Table 9.14 - Medications/cont.**Anticonvulsants**

Older adults should temporarily cease driving during the time of medication initiation, withdrawal, or dosage change because of the risk of recurrent seizure and/or potential medication effects that may impair driving performance. If there is significant risk of recurrent seizure during medication withdrawal or change, the older adult should not drive during this time and for at least 3 months thereafter.

Many anticonvulsants (e.g., valproic acid, carbamazepine, gabapentin, lamotrigine, topiramate) are also used as mood stabilizers for treatment of bipolar disorder, for agitation in dementia, as sedating agents for anxiety, and to treat pain syndromes. These agents may be used as an adjunct to antidepressants, antipsychotics, and/or anxiolytics.

By themselves, anticonvulsants may be mildly impairing, but when combined with other PDI medications, the effects on psychomotor performance may be enhanced. Furthermore, some anticonvulsants are primarily eliminated by the kidneys and increased CNS adverse effects may be observed with renal impairment. Thus, dose reductions are recommended when estimated creatinine clearance is <60 mL/min for pregabalin and gabapentin and <80 mL/min for levetiracetam.¹²⁰

Antidepressants

In general, increased crash risk has been associated with many classes of antidepressants, even though the magnitude and extent of PDI adverse events vary between them. In general, the selective serotonin reuptake inhibitors (SSRIs) are first-line agents for depression and anxiety disorders because of their good tolerability, including a lower risk of CNS depressant adverse effects. Tricyclic antidepressants with high anticholinergic effects are not advised for those who wish to continue driving. Mirtazapine, a more sedating antidepressant, is typically taken only at night to avoid excessive daytime sedation. Duloxetine, a serotonin-norepinephrine reuptake inhibitor used for depression, chronic pain, fibromyalgia, and anxiety disorders, may also cause sedation and other CNS effects.

Selective serotonin-reuptake inhibitors (SSRIs)

SSRIs are commonly prescribed agents to treat depression and anxiety. Paroxetine is unique in that it has anticholinergic effects, so may be more likely than the other SSRIs (e.g., sertraline, citalopram) to impair driving. Although adverse effects tend to be mild and well tolerated, clinicians should counsel older adults to be alert to the potential of SSRIs to affect driving performance. Special mention is made of the serotonin syndrome, wherein mental status changes, autonomic hyperactivity, and neuromuscular adverse effects are observed due to excessive amounts of the drug, taking multiple drugs that increase serotonin, or a drug-drug interaction.

Tricyclic antidepressants (TCAs)

Better tolerated agents have replaced TCAs for depression; however, they are still used to manage sleep, menopausal symptoms, neuropathic pain, incontinence, and migraines. The tertiary tricyclic antidepressants (amitriptyline, doxepin, imipramine) have strong anticholinergic effects and may impair driving. If a TCA is needed, nortriptyline and desipramine have lower anticholinergic effects and are preferred but are still not recommended for use in older adults.¹²⁰

See Anticholinergics in this section.

Antiemetics

Numerous classes of drugs (some of which include anticholinergics, antihistamines, antipsychotics, cannabinoids, and benzodiazepines) are used for their antiemetic effect. For more information, see Anticholinergics, Antihistamines, and Benzodiazepines in this section.

Antihistamines

The first-generation antihistamines (e.g., diphenhydramine, chlorpheniramine) have pronounced CNS effects and impair psychomotor performance, simulated driving, and on-road driving.¹⁰² In contrast, most second-generation antihistamines (i.e., nonsedating) do not produce these types of impairments when taken in recommended doses, except for cetirizine. Nonsedating antihistamines (e.g., loratadine, fexofenadine) are preferred if an antihistamine is needed for allergy treatment; however, even these agents may cause impairments if taken in higher than recommended doses.

See Anticholinergics in this section.

Antiparkinson agents

The mainstay of treatment for Parkinson disease is levodopa, dopamine agonists (e.g., pramipexole, ropinirole), amantadine, and anticholinergics (e.g., trihexyphenidyl). Individuals with Parkinson disease are already at risk of excessive daytime somnolence, but treatment with these medications can further contribute to this symptom. Individuals taking antiparkinsonian agents have reported sudden, unexpected lapses of attention and falling asleep, known as "sleep attacks." The risk of sleep attacks seems greatest with use of dopamine agonists, but may occur with any therapy.^{121,122}

Antipsychotics

Most, if not all, antipsychotic medications have a strong potential to impair driving performance through cognitive, visual, and motor effects. Most antipsychotics used in the outpatient setting are second-generation (atypical) antipsychotics. Second-generation antipsychotics have varying degrees of anticholinergic and sedative effects, with clozapine having the most pronounced effects. These agents also cause varying degrees of extrapyramidal effects that may impair psychomotor performance, with risperidone, lurasidone, and ziprasidone having the most pronounced effects.

Benzodiazepines and nonbenzodiazepine hypnotics

Studies have demonstrated impairments in vision, attention, motor coordination, and driving performance with benzodiazepine use. Evening doses of long-acting benzodiazepines (e.g., flurazepam, diazepam) markedly impair psychomotor function the following day, while comparable doses of short-acting benzodiazepines produce a lesser impairment.¹⁰² Zolpidem, eszopiclone, and zaleplon are nonbenzodiazepine hypnotics. Zolpidem has been associated with driving at night without recollection the next morning and increased crash risk.¹⁰⁴ Women and older adults have higher blood concentrations of zolpidem; therefore, the maximum dose is lower for these patient groups (5 mg of regular release zolpidem). Less information exists about eszopiclone, but it has a duration of action similar to that of zolpidem, so the same cautions should apply. Zaleplon has a short half-life and is used for sleep-onset difficulties and is unlikely to impair next day driving. Trazodone, an antidepressant often used as a sedative, has been associated with increased crash risk.¹⁰⁴

In general, it is recommended to avoid benzodiazepines and nonbenzodiazepine hypnotics in older adults because of the risk of several adverse health outcomes, including increased risk of car crashes.¹²⁰ However, if hypnotics are needed, evening doses of short-acting hypnotics

Table 9.14 - Medications/cont.

are preferred with periodic attempts to discontinue therapy. Individuals taking hypnotics should allow enough time to sleep after the dose (approximately 8 hours) before driving. Older adults who take daytime doses of benzodiazepines (for anxiety) should be advised of the potential for impairment, even in the absence of subjective symptoms.

Muscle relaxants Most skeletal muscle relaxants (e.g., carisoprodol and cyclobenzaprine) have significant CNS effects. Long-term use should be avoided.

Narcotics analgesics Tolerance may develop to many of the CNS effects of narcotic analgesics, but the visual impairment may persist. Impaired driving with narcotics may be most prominent with initial therapy or with dose increases. Meperidine may have a higher risk of neurotoxicity compared with other narcotics, and in general should be avoided in older adults.¹²⁰

Individuals should be monitored for frequency of use, tolerance, and dependence. Clinicians should always be alert to signs of abuse. (For more information, see the recommendations for substance abuse in Section 5.)

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