

Chapter 9

**Medical Conditions and
Medications That May
Impair Driving**

This chapter contains a reference list of medical conditions and medications that may impair driving skills, and consensus recommendations for each one. 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, these recommendations apply to drivers of all ages.

The listed medical conditions were chosen for their relevance to clinical practice. Although the corresponding recommendations are based on scientific evidence whenever possible, please note that use of these recommendations has not been proven to reduce crash risk.** As such, these recommendations are provided to assist physicians in the decision-making process. They are not intended for use as formal practice guidelines, nor as a substitute for the physician's clinical judgment.

How to Use This Chapter

Physicians may consult this chapter if they have questions regarding specific medical conditions or medications. If a patient presents with a particular medical condition and related functional deficits (eg, deficits in vision, cognition, or motor function) that may affect his/her driving safety, the physician may base his/her interventions for driving safety on this chapter's recommendations. Many of the recommendations fall under one or more of the following categories:

- Treat the underlying medical condition to correct functional deficits and prevent further functional decline;
- If the functional deficit is due to an offending agent (eg, medication with impairing side effects), remove the

offending agent or attenuate its effects, if possible;

- Advise the patient on risks to his/her driving safety, and recommend driving restrictions or driving cessation as needed;
- If further evaluation is required to determine whether the patient is safe to drive, refer the patient to a driver rehabilitation specialist (DRS) for a driver evaluation (including on-road assessment) whenever possible;
- If the patient's functional deficits are not medically correctable, refer the patient to a DRS whenever possible. The DRS may prescribe adaptive techniques and devices to compensate for these deficits, and train the patient in their use. (See Chapter 5 for further discussion of driver rehabilitation services.)

Physicians who receive telephone consults from patients should advise patients against driving—even to seek medical attention—if they report symptoms that are incompatible with safe driving (eg, visual changes, syncope or pre-syncope, vertigo, and severe pain). Such patients should be strongly urged to seek alternative forms of transportation, including cab rides, rides from family and friends, and medical transportation services.

In the inpatient setting, driving should be addressed prior to the patient's discharge whenever appropriate. Even for the patient whose symptoms clearly preclude driving, it should not be assumed that the patient is aware that he/she should not drive. The physician should counsel the patient regarding driving and discuss a future plan (eg, resumption of driving upon resolution of symptoms, driver rehabilitation upon stabilization of symptoms, permanent driving cessation, etc.).

Medical Conditions and Medications That May Impair Driving

Section 1.....	150
Vision	
Section 2.....	154
Cardiovascular Diseases	
Section 3.....	158
Cerebrovascular Diseases	
Section 4.....	160
Neurologic Diseases	
Section 5.....	165
Medications	
Section 6.....	170
Psychiatric Diseases	
Section 7.....	172
Metabolic Diseases	
Section 8.....	173
Musculoskeletal Disabilities	
Section 9.....	176
Peripheral Vascular Diseases	
Section 10.....	177
Renal Disease	
Section 11.....	178
Respiratory Diseases	
Section 12.....	179
Effects of Anesthesia and Surgery	
Section 13.....	181
Miscellaneous Conditions	

* Commercial drivers have additional responsibilities regarding public safety, and their medical qualification is governed by federal and state regulations.

** 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.

Section 1: Vision

1. Visual acuity
 - a. Cataracts
 - b. Diabetic retinopathy
 - c. Keratoconus
 - d. Macular degeneration
 - e. Nystagmus
 - f. Telescopic lens
2. Visual field
 - a. Glaucoma
 - b. Hemianopia/quadrantanopia
 - c. Monocular vision
 - d. Ptosis
 - e. Retinitis pigmentosa

3. Contrast sensitivity
4. Defective color vision
5. Poor night vision

Vision is the primary sense utilized in driving, and is responsible for 95% of driving-related inputs.¹ 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 (eg, blepharoptosis) should not be overlooked, as it may significantly limit visual fields.

Whenever possible, vision deficits should be managed and corrected. In some situations, patients with persistent vision deficits may reduce their impact 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.

Section 1: Vision

Visual acuity

Please note that visual acuity licensing requirements vary from state to state. (See Chapter 8 for a state-by-state reference list of licensing requirements.) Many states require far visual acuity of 20/40 for licensure; however, recent studies indicate that there may be no basis for this requirement.² State driver licensing agencies are urged to base their visual acuity requirements on the most current data, as appropriate.

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

Patients with decreased far visual acuity may lessen its impact on driving safety by restricting driving to low-risk areas and conditions (eg, familiar surroundings, non-rush hour traffic, low speed areas, daytime, and good weather conditions).

For best-corrected far visual acuity less than 20/70, the physician should recommend an on-road assessment performed by a driver rehabilitation specialist (where it is permitted and available) to evaluate the patient's performance in the actual driving task.

For best-corrected far visual acuity less than 20/100, the physician should recommend that the patient not drive unless safe driving ability can be demonstrated in an on-road assessment, where permitted and available. (See also recommendations for Telescopic lenses.)

Cataracts

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

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

Diabetic retinopathy

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

Keratoconus

Patients with severe keratoconus correctable with hard contact lenses should drive only when the lenses are in place. If lenses cannot be tolerated, patients with severe keratoconus should not drive even if they meet standards for visual acuity, as 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.

Patients who experience difficulty with glare recovery should avoid driving at night. Patients with the neovascular “wet” form of the disease may require frequent assessment due to 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.³ The specialist who prescribes a telescopic lens should ensure that the patient is properly trained in its use.

It has not been established whether telescopes enhance the safety of low-vision drivers. As stated in the American Academy of Ophthalmology’s Policy Statement, *Vision Requirements for Driving*:

“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.”²

Please note that licensing requirements regarding the use of bioptic telescopes vary from state to state. A road test should be administered only in those states that permit the use of bioptic telescopes in driving.

Visual field

While it is acknowledged that an adequate visual field is important for safe driving, there is no conclusive evidence to define what is meant by “adequate.” As a result, visual field requirements vary between states, with many states requiring a visual field of 100 degrees or more along the horizontal plane, and other states having a lesser requirement or none at all.³ (See Chapter 8 for a state-by-state reference list of visual field requirements.)

If the primary care physician has any reason to suspect a visual field deficit (eg, through patient report, medical history, or confrontation testing), he/she should refer the patient to an ophthalmologist or optometrist for further evaluation. The primary care physician and specialist should be aware of their particular state’s visual field requirements, if any, and adhere to them.

For binocular visual field at or near the state minimum requirement or of questionable adequacy (as deemed by clinical judgement), a driver evaluation (including on-road assessment) performed by a driver rehabilitation specialist is strongly recommended. Through driving rehabilitation, the patient may learn to compensate for decreased visual fields. In addition, the driver rehabilitation specialist may prescribe enlarged side and rear view mirrors as needed and train the patient in their use.

Glaucoma

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

Hemianopia/quadrantanopia

The physician may choose to refer the patient to a driver rehabilitation specialist for assessment and rehabilitation. With or without rehabilitation, the patient should drive only if he/she demonstrates safe driving ability in an on-road assessment performed by a driver rehabilitation specialist.

Please note that licensing requirements regarding hemianopia and quadrantanopia vary from state to state. A road test should be administered only in those states that do not prohibit individuals with hemianopia or quadrantanopia from driving.

Monocular vision

Patients 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 between individuals, but it is reasonable to recommend temporary driving cessation for several weeks.

Following this period, there are no restrictions if standards for visual acuity and visual fields are met. Upon resumption of driving, patients should be advised to assess their comfort level by driving in familiar, traffic-free areas before advancing to heavy traffic.

Ptosis

Individuals with fixed ptosis 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.

Retinitis pigmentosa

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

Patients 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 individuals compared to their younger counterparts.⁴

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

Due to its usefulness in predicting crash risk, it is strongly recommended that standardized contrast sensitivity scales be developed, validated, and utilized in the clinical and driver licensing settings.

Defective color vision

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

Deficits in color vision are common (especially in the male population) and usually mild. In an extensive review of the literature on color vision and driving, the majority of studies found no association between color vision deficits and increased crash rates.⁵ Only 19 states require prospective drivers to undergo color vision screening, and most of these states require screening for commercial drivers only.³

Despite reported difficulties with color vision discrimination while driving (eg, difficulty distinguishing the color of traffic signals, confusing traffic lights with street lights, and difficulty detecting brake lights), it is unlikely that color vision impairments represent a driving hazard.⁴ With the standardization of traffic signal positions, color blind individuals are able to interpret traffic signals correctly because they can identify the traffic signal by its position. Physicians may wish to advise patients that the order of signals in the less commonly used horizontal placement is (from left to right) red, yellow, green.

Poor night vision

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

Section 2: Cardiovascular Diseases

1. Unstable coronary syndrome (unstable angina or myocardial infarction)
2. Cardiac conditions that may cause a sudden, unpredictable loss of consciousness
 - a. Atrial flutter/fibrillation with bradycardia or rapid ventricular response
 - b. Paroxysmal supraventricular tachycardia (PSVT), including Wolf-Parkinson-White (WPW) syndrome
 - c. Prolonged, nonsustained ventricular tachycardia (VT)
 - d. Sustained ventricular tachycardia (VT)
 - e. Cardiac arrest
 - f. High grade atrio-ventricular (AV) 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 (CHF) 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 (PTCA)
 - b. Pacemaker insertion or revision
 - c. Cardiac surgery involving median sternotomy
 - Coronary artery bypass graft (CABG)
 - Valve repair or replacement
 - Heart transplant
5. Internal cardioverter defibrillator (ICD)

For the patient with known cardiac disease, the physician should strongly and repeatedly caution the patient to seek help immediately upon experiencing any symptoms—including prolonged chest discomfort, acute shortness of breath, syncope, and pre-syncope—that may indicate an unstable cardiac situation. Under no circumstances should the patient drive to seek help.

While hypertension is not included in this section, physicians should always be alert to any potential impairment in driving skills resulting from hypertensive end-organ damage or anti-hypertensive medications.

Section 2: Cardiovascular Diseases

Unstable coronary syndrome (unstable angina or myocardial infarction)

Patients should not drive if they experience symptoms at rest or at the wheel.

Patients may resume driving when they have been stable and asymptomatic for one to four weeks, as determined by the cardiologist, following treatment of the underlying coronary disease. Driving may usually resume within one week after successful revascularization by percutaneous transluminal coronary angioplasty (PTCA) and by four weeks after coronary artery bypass grafting (CABG).⁶ (See also recommendations for CABG.)

Cardiac conditions that may cause a sudden, unpredictable loss of consciousness

The main consideration in determining medical fitness to drive for patients with cardiac conditions is the risk of pre-syncope or syncope due to a brady- or tachyarrhythmia.⁷ For the patient with a known arrhythmia, the physician should identify and treat the underlying cause of arrhythmia, if possible, and recommend temporary driving cessation until control of symptoms has been achieved.

*Atrial flutter/fibrillation with bradycardia
or rapid ventricular response*

No further restrictions once control of heart rate and symptoms has been achieved.

Paroxysmal supraventricular tachycardia (PSVT), including Wolf-Parkinson-White (WPW) syndrome

No restrictions if the patient is asymptomatic during documented episodes.

Patients with a history of symptomatic tachycardia may resume driving after they have been asymptomatic for six months on antiarrhythmic therapy.

Patients who undergo radio frequency ablation may resume driving after six months if there is no recurrence of symptoms, or sooner if no pre-excitation or arrhythmias are induced at repeat electrophysiologic testing (EP).

Prolonged, nonsustained ventricular tachycardia (VT)

No restrictions if the patient is asymptomatic during documented episodes.

Patients with symptomatic VT may resume driving after three months if they are on antiarrhythmic therapy—with or without an internal cardioverter defibrillator (ICD)—guided by invasive electrophysiologic (EP) testing, and VT is noninducible at repeat EP testing. They may resume driving after six months without arrhythmic events if they are on empiric antiarrhythmic therapy (with or without an ICD), or have an ICD alone without additional antiarrhythmic therapy.⁸

Sustained ventricular tachycardia (VT)

Patients may resume driving after three months if they are on antiarrhythmic therapy (with or without an ICD) guided by invasive electrophysiologic (EP) testing, and VT is noninducible at repeat EP testing.

Patients may resume driving after six months without arrhythmic events if they are on empiric antiarrhythmic therapy (with or without an ICD), or have an ICD alone without additional antiarrhythmic therapy.⁸

When long-distance or sustained high-speed travel is anticipated, patients should be encouraged to have an adult companion perform the driving. Patients should avoid the use of cruise-control.⁸

Cardiac arrest

Please refer to the recommendations for sustained ventricular tachycardia.

If the patient experiences a seizure, please refer to the recommendations for seizure in Section 4.

If clinically significant cognitive changes persist following the patient's physical recovery, cognitive testing is recommended before the patient is permitted to resume driving. In addition, driver evaluation (including on-road assessment) performed by a driver rehabilitation specialist may be useful in assessing the patient's fitness to drive.

High grade atrio-ventricular (AV) block

For symptomatic block managed with pacemaker implantation, please see pacemaker recommendations.

For symptomatic block corrected without a pacemaker (eg, by withdrawal of medications that caused the block), the patient may resume driving after he/she has been asymptomatic for four weeks and EKG documentation shows resolution of the block.

*Sick sinus syndrome/sinus bradycardia/
sinus exit block/sinus arrest*

No restrictions if patient is asymptomatic. Regular medical follow-up is recommended to monitor progression.

For symptomatic disease managed with pacemaker implantation, please see pacemaker recommendations.

Physicians should be alert to clinically significant cognitive deficits due to chronic cerebral ischemia. Physicians may refer patients with significant cognitive changes to a driver rehabilitation specialist for a driver evaluation (including on-road assessment) to evaluate the patient's driving safety.

Cardiac disease resulting from structural or functional abnormalities

Two major considerations in determining medical fitness to drive are the risk of pre-syncope or syncope due to low cardiac output and the presence of cognitive deficits due to chronic cerebral ischemia. Patients who experience pre-syncope, syncope, extreme fatigue, or dyspnea at rest or at the wheel should cease driving.

Cognitive testing is recommended to detect cognitive deficits that may impair the patient's driving ability. Physicians may refer patients with clinically significant cognitive changes to a driver rehabilitation specialist for an evaluation (including on-road assessment) to evaluate the patient's driving safety.

*Congestive heart failure (CHF)
with low output syndrome*

Patients should not drive if they experience symptoms at rest or at the wheel.

Physicians should reassess patients for driving fitness every six months to two years as needed, depending on clinical course and control of symptoms. Patients with Functional Class III CHF (marked limitation of activity but no symptoms at rest, working capacity 2 to 4 METS) should be reassessed at least every six months.

Hypertrophic obstructive cardiomyopathy

Patients who experience syncope or pre-syncope should not drive until they have been treated.

Valvular disease (especially aortic stenosis)

Patients who experience syncope or pre-syncope should not drive until the underlying disease is corrected.

**Time-limited restrictions:
cardiac procedures**

Driving restrictions for the following cardiac procedures are based on the patient's recovery from the procedure itself and from the underlying disease for which the procedure was performed.

*Percutaneous transluminal
coronary angioplasty (PTCA)*

The patient may resume driving 48 hours to one week after successful PTCA and/or stenting procedures, depending on the patient's baseline condition and course of recovery from the procedure and underlying coronary artery disease.^{6,9}

Pacemaker insertion or revision

The patient may resume driving after one week if:

- The patient no longer experiences pre-syncope or syncope;
- EKG shows normal sensing and capture; and
- Pacemaker performs within manufacturer's specifications.⁹

*Cardiac surgery involving
median sternotomy*

Driving may usually resume four weeks following coronary artery bypass grafting (CABG) and/or valve replacement surgery, and within eight weeks following heart transplant, depending on resolution of cardiac symptoms and the patient's course of recovery. In the absence of surgical and post-surgical complications, the main limitation to driving is the risk of sternal disruption following median sternotomy.

If clinically significant cognitive changes persist following the patient's physical recovery, cognitive testing is recommended before the patient is permitted to resume driving. In addition, driver evaluation (including on-road assessment) performed by a driver rehabilitation specialist may be useful in assessing the patient's fitness to drive.

Internal cardioverter defibrillator

Please see the recommendations for nonsustained and sustained ventricular tachycardia.

Section 3: Cerebrovascular Diseases

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

Strokes and other insults to the cerebral vascular system may cause a wide variety of symptoms, including sensory deficits, motor deficits, and cognitive impairment. These symptoms range from mild to severe and may resolve almost immediately or persist for years. Because each patient is affected uniquely, the

physician must take into account the individual patient's constellation of symptoms, severity of symptoms, course of recovery, and baseline function when making recommendations concerning driving.

Driving should always be addressed prior to the patient's discharge from the hospital or rehabilitation center. Patients with residual deficits who wish to resume driving should be referred to a driver rehabilitation specialist (DRS) whenever possible. Upon stabilization of symptoms, the DRS assesses the patient for fitness to drive through clinical and on-road evaluations. After assessment, the DRS may recommend adaptive techniques or

adaptive devices (eg, wide-angle rear view mirror, spinner knob for the steering wheel, left foot accelerator) and provide training for their proper use. Even patients with mild deficits should undergo driver evaluation prior to resuming driving, if possible. Research indicates that a post-stroke determination of driving safety made on a medical basis alone may be inadequate.¹⁰

For the patient whose symptoms clearly preclude driving, it should not be assumed that the patient is aware that he/she should not drive. In such cases, the physician should counsel the patient on driving cessation.

Section 3: Cerebrovascular Diseases

Post intracranial surgery

The patient should not drive until stabilization or resolution of disease and surgery symptoms. See also stroke recommendations below.

Stroke

Patients with acute 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.

Upon the patient's discharge from the hospital or rehabilitation center, the physician may recommend temporary driving cessation until further neurological recovery has occurred. Once neurological symptoms have stabilized, physicians should refer patients with residual sensory loss, cognitive impairment, visual field deficits, and/or motor deficits to a driver rehabilitation specialist, if available, for driver assessment and rehabilitation. The specialist may prescribe vehicle adaptive devices and train the patient in their use.

Patients with neglect or inattention should be counseled not to drive until symptoms have resolved and safe driving ability has been demonstrated through assessment by a driver rehabilitation specialist.

All patients 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, patients should still undergo driver assessment, as reaction time may continue to be affected.

Patients with aphasia who demonstrate safe driving ability may fail in their efforts to renew their license due to difficulties with the written exam. In these cases, the physician should urge the licensing authority to make reasonable accommodations for the patient's language deficit.

Patients with residual cognitive deficits should be assessed and managed as described under the dementia recommendations in Section 4. Periodic reevaluation of these patients is recommended, as some patients may recover sufficiently over time to permit safe driving.

Subarachnoid hemorrhage

Patients should not drive until symptoms have stabilized or resolved. Driving may resume following medical assessment and, if deemed necessary by the physician, driver evaluation (including on-road assessment) performed by a driver rehabilitation specialist.

Syncope

Syncope may result from various cardiovascular and non-cardiovascular causes, and it is recurrent in up to 1/3 of cases. Cardiac arrhythmias are the most common cause of syncope.¹¹ (See Section 2 for causes of cardiac syncope.)

Driving restrictions for neurally-mediated syncope should be based on the severity of the presenting event. No driving restrictions are necessary for infrequent syncope that occurs with warning and with clear precipitating causes. Patients 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 Section 2).¹² For patients who continue to experience unpredictable symptoms after treatment with medications and pacemaker insertion, driving cessation is recommended.

Transient ischemic attacks (TIA)

Patients who have experienced a single TIA or recurrent TIAs should refrain from driving until they have undergone medical assessment and appropriate treatment.

Vascular malformation

Following the detection of a brain aneurysm or arterio-venous (AV) malformation, the patient should not drive until he/she has been assessed by a neurosurgeon. The patient may resume driving if the risk of a bleed is small, an embolization procedure has been successfully completed, and/or the patient is free of other medical contraindications to driving, such as uncontrolled seizures or significant perceptual or cognitive impairments.

Section 4: Neurologic Diseases

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

Dementia deserves a special emphasis in this section because it presents a significant challenge to driving safety. With progressive dementia, patients ultimately lose the ability to drive safely and the ability to be aware of this. Therefore, dementia patients 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 highly unsafe for them to be on the road. It becomes the responsibility of family members and other caregivers to protect the safety of these patients by enforcing driving cessation.

While it is optimal to initiate discussions of driving safety with the patient and family members before driving becomes unsafe, dementia is too often undetected and undiagnosed until late in the course of the disease. Initially, family members and physicians may assume that the patient's decline in cognitive function is a part of the "normal" aging process. Physicians may also hesitate to screen for and diagnose dementia because they erroneously believe that it is futile—in

other words, that nothing can be done to improve the patient's situation or slow the progression of the disease. In addition, physicians may be concerned about the amount of time required to effectively diagnose dementia and educate patients and their families.¹³

Despite these barriers, physicians are encouraged to be alert to the signs and symptoms of dementia and to pursue an early diagnosis. Early diagnosis is the first step to promoting the driving safety of dementia patients. The second step is intervention, which includes medications to slow the course of the disease, counseling to prepare the patient and family for eventual driving cessation, and serial assessment of the patient's driving abilities. When assessment shows that driving may pose a significant safety risk to the patient, driving cessation is a necessary third step. With early planning, patients and their families can make a more seamless transition from 'driving' to 'non-driving' status.

Section 4: Neurologic Diseases

Brain tumor

Driving recommendations should be based on the type of tumor; location; rate of growth; type of treatment; presence of seizures; and presence of cognitive or perceptual impairments. Due to the progressive nature of some tumors, the physician may need to evaluate the patient's fitness to drive serially.

See also the stroke recommendations in Section 3.

If the patient experiences seizure(s), see also the seizure recommendations in this section.

Dementia

The following recommendations are adapted from the Alzheimer's Association's *Position Statement on Driving*¹⁴ and recommendations of the Canadian Consensus Conference on Dementia.¹⁵

- 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.¹⁶ Therefore, the determining factor in

withdrawing driving privileges should be the individual's driving ability. When the individual poses a serious risk to self or others, driving privileges must be withheld.

- Physicians 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 patients and their families. When appropriate, patients should be included in decisions about current or future driving restrictions and cessation; otherwise, physicians and families must decide in the best interests of the patient whose decision-making capacity is impaired.
- Physicians are recommended to perform a focused medical assessment that includes history of driving difficulty from a family member or caregiver and an evaluation of cognitive abilities, including memory, attention, judgement, and visuospatial abilities. Physicians should be aware that patients with progressive dementia require serial assessment, and they should familiarize themselves with their state reporting laws and procedures for dementia (if any). (See Chapter 8 for a state-by-state reference list of reporting laws.)
- If there is concern that an individual 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 an on-road driving assessment performed by a driver rehabilitation specialist. Such an assessment should lead to specific recommendations, consistent with state laws and regulations, as to whether the individual is safe to drive.
- Physicians should encourage patients with progressive dementia to plan early for eventual cessation of driving privileges by developing alternative transportation options. The patient should be encouraged to coordinate these efforts with their family members and caregivers, and to seek assistance (as needed) from their local area agency on aging.

Migraine and other recurrent headache syndromes

Patients with recurrent severe headaches should be cautioned against driving when experiencing neurologic manifestations (eg, visual disturbances or dizziness), when distracted by pain, and while on any barbiturate, narcotic, or narcotic-like analgesic. (See Section 5 for further recommendations regarding narcotic analgesics.)

Movement disorders

If the physician elicits complaints of interference with driving tasks or is concerned that the patient's symptoms compromise his/her driving safety, referral to a driver rehabilitation specialist for a driver evaluation (including on-road assessment) is recommended.

Multiple sclerosis

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

A driver evaluation (including on-road assessment) performed by a driver rehabilitation specialist may be useful in determining the patient's safety to drive. Serial evaluations may be required as the patient's symptoms evolve or progress.

Paraplegia/quadruplegia

Referral to a driver rehabilitation specialist is necessary if the patient wishes to resume driving or requires vehicle modifications to accommodate him/her as a passenger. The specialist can recommend an appropriate vehicle and prescribe adaptive devices (such as low-resistance power steering and hand controls) and train the patient in their use. In addition, the specialist can assist the patient with access to the vehicle, including opening and closing car doors, transfer to the car seat, and independent wheelchair stowage, through vehicle adaptations and training.

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

Parkinson's disease

Patients with advanced Parkinson's disease may be at increased risk for motor vehicle crashes due to both motor and cognitive dysfunction.¹⁷ Physicians should base their driving recommendations on the level of motor and cognitive symptom involvement, patient's response to treatment, and presence and extent of any medication side effects. (See Section 5 for specific recommendations on antiparkinsonian medications.) Serial physical and cognitive evaluations are recommended every six to twelve months due to the progressive nature of the disease.

If the physician is concerned that dementia and/or motor impairments may affect the patient's driving skills, a driver evaluation (including on-road assessment) performed by a driver rehabilitation specialist may be useful in determining the patient's fitness to drive.

See also the dementia recommendations in this section.

Peripheral neuropathy

Lower extremity deficits in sensation and proprioception may be exceedingly dangerous for driving, as the driver may be unable to control the foot pedals or may confuse the accelerator with the brake pedal.

If deficits in sensation and proprioception are identified, referral to a driver rehabilitation specialist is recommended. The specialist may prescribe vehicle adaptive devices (eg, hand controls in place of the foot pedals) and train the patient in their use.

Seizure disorder

The seizure disorder recommendation below is adapted from the *Consensus Statements on Driver Licensing in Epilepsy* crafted and agreed on by the American Academy of Neurology, American Epilepsy Society, and Epilepsy Foundation of America in March 1992.¹⁸ Please note that these recommendations are subject to each particular state's licensing requirements and reporting laws.

A patient with seizure disorder should not drive until he/she has been seizure-free for three months. This three-month interval may be lengthened or shortened based on the following favorable and unfavorable modifiers:

Favorable modifiers

- Patient experiences only simple partial seizures that do not interfere with consciousness and/or motor control
- Seizures have consistent and prolonged aura
- There is an established pattern of pure nocturnal seizures
- Seizures occurred during medically directed medication changes
- Seizures were secondary to acute metabolic or toxic states that are not likely to recur
- Seizures were caused by sleep deprivation
- Seizures were 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 three months
- Increased number of seizures in the past year
- Prior bad driving record
- Structural brain lesion
- Noncorrectable brain functional or metabolic condition
- Frequent seizures after seizure-free interval
- Prior crashes due to seizures in the past five years

Single unprovoked seizure

The patient should not drive until he/she has been seizure-free for three months. This time period may be shortened with physician 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 family history positive for epilepsy
- Generalized spike waves or focal spikes are present on EEG recordings

Withdrawal or change of anticonvulsant therapy

The patient should temporarily cease driving during the time of medication withdrawal or change due to the risk of recurrent seizure and potential medication side effects that may impair driving ability.

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

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

Sleep Disorders

Narcolepsy

The patient should cease driving upon diagnosis. The patient may resume driving upon treatment when he/she no longer suffers excessive daytime drowsiness or cataplexy. Physicians may consider using scoring tools such as the Epworth Sleepiness Scale¹⁹ to assess the patient's level of daytime drowsiness.

Sleep apnea

See Section 11.

Stroke

See Section 3.

Tourette's syndrome

In evaluating the patient's fitness to drive, the physician should consider any comorbid disorders (including attention deficit hyperactivity disorder, learning disabilities, and anxiety disorder) in addition to the patient's motor tics. (For specific recommendations regarding these disorders, see Section 6).

If the physician is concerned that the patient's symptoms compromise his/her driving safety, referral to a driver rehabilitation specialist for driver evaluation (including on-road assessment) is recommended.

Physicians should be aware that certain medications used in the treatment of Tourette's syndrome have the potential to impair driving performance. (See Section 5 for more information on medication side effects.)

Traumatic brain injury

Patients should not drive until symptoms have stabilized or resolved. For patients whose symptoms resolve, driving may resume following medical assessment and, if deemed necessary by the physician, driver evaluation (including on-road assessment) performed by a driver rehabilitation specialist.

Patients with residual neurological or cognitive deficits should be assessed and managed as described under the dementia recommendations in this section.

If the patient experiences seizure(s), see the seizure recommendations in this section.

Vertigo

Vertigo and the medications commonly used to treat vertigo have a significant potential to impair driving skills.

For acute vertigo, the patient should cease driving until symptoms have fully resolved. Under no circumstances should the patient drive to seek medical attention.

Patients with a chronic vertiginous disorder are strongly recommended to undergo driver evaluation (including on-road assessment) performed by a driver rehabilitation specialist prior to resuming driving.

Section 5: Medications

1. Alcohol
2. Anticholinergics
3. Anticonvulsants
4. Antidepressants
 - a. Bupropion
 - b. Mirtazapine
 - c. Monoamine oxidase (MAO) inhibitors
 - d. Selective serotonin reuptake inhibitors (SSRI)
 - e. Tricyclic antidepressants (TCA)
5. Antiemetics
6. Antihistamines
7. Antihypertensives
8. Antiparkinsonians
9. Antipsychotics
10. Benzodiazepenes and other sedatives/anxiolytics
11. Muscle relaxants
12. Narcotic analgesics
13. Nonsteroidal anti-inflammatory drugs (NSAID)
14. Stimulants

Many commonly used prescription and over-the-counter medications can impair driving performance. In general, any drug with a prominent central nervous system (CNS) effect has the potential to impair an individual's ability to operate a motor vehicle. The level of impairment varies from patient to patient, between different medications within the same therapeutic

class, and in combination with other medications or alcohol.

Medication side effects that can affect driving performance include drowsiness, dizziness, blurred vision, unsteadiness, fainting, slowed reaction time, and extrapyramidal side effects. In many cases, these side effects are dose-dependent and attenuate with time.

Whenever possible, the physician should prescribe non-impairing medications. If the physician must prescribe or change the dosage of a medication that can potentially impair driving performance, he/she should counsel the patient regarding the side effects. He/she should also recommend that the patient take the first few doses in a safe environment to determine the presence and extent of any side effects, and that he/she temporarily cease driving as needed until the body has adjusted to the medication.

In addition to being alert to potential side effects, the patient should also understand that with certain medications, subjective effects do not always correlate with impairment.²⁰⁻²³ Medications that cause drowsiness, euphoria, and/or anterograde amnesia may also diminish insight, and the patient may experience impairment without being aware of it. In the case of these medications, the concerned physician and patient may wish to consider formal psychomotor testing (up to and

including driving simulation) or driver evaluation (including on-road assessment) performed by a driver rehabilitation specialist, while off and on the medication to determine the extent of impairment.

When prescribing new medications, the physician should always consider the patient's existing regimen of prescription and non-prescription medications, including medications taken seasonally. Combinations of drugs may affect drug metabolism and excretion to produce additive or synergistic interactions. In fact, use of multiple psychoactive medications is a common cause of hospitalization for delirium among older adults.²⁴ Because individuals react differently to drug combinations, the degree of impairment caused by polypharmacy may vary from patient to patient. With polypharmacy's strong but unpredictable potential to produce impairment, physicians should add new medications at the lowest dosage possible, counsel the patient to be alert to any impairing side effects, and adjust the dosages of individual medications as needed to achieve therapeutic effects with a minimum of impairment.

Section 5: Medications

Alcohol

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 performance in many individuals. In many cases, individuals may be impaired without being aware of it. Furthermore, alcohol can potentiate the central nervous system (CNS) effects of medications to produce profound and dangerous levels of impairment. *Physicians should always warn their patients against drinking and driving, and against combining alcohol with their CNS-active medications.*

For recommendations on alcohol abuse, see Section 6.

Anticholinergics

When a patient takes single or multiple medications with anticholinergic activity (including some antidepressants, antihistamines, antiemetics, antipsychotics, and antiparkinsonian drugs), the physician should be alert to the possibility of anticholinergic toxicity and adjust medication dosages accordingly.

Anticholinergic effects that can impair driving performance include blurred vision, sedation, confusion, ataxia, tremulousness, and myoclonic jerking. Patients should be counseled about these symptoms and should alert their physician immediately if these symptoms occur. Patients should also be advised that psychomotor and cognitive impairment may be present even in the absence of subjective symptoms.

Subtle deficits in attention, memory, and reasoning may occur with therapeutic dosages of anticholinergic drugs without signs of frank toxicity. These deficits have often been mistaken for symptoms of early dementia in elderly patients. Physicians are advised to be aware of this possibility.

Anticonvulsants

The patient should temporarily cease driving during the time of medication initiation, withdrawal, or dosage change due to the risk of recurrent seizure and potential medication side effects that may impair driving performance.

If there is significant risk of recurrent seizure during medication withdrawal or change, the patient should cease driving during this time and for at least three months thereafter. (See Section 4 for further recommendations.)

Note that many anticonvulsants (eg, valproic acid, carbamazepine, gabapentine, lamotrigine and topiramate) are also being used as mood stabilizers for treatment of bipolar disorder and as sedating agents for anxiety. These are typically an adjunct to antidepressants, antipsychotics and/or anxiolytics. By themselves, anticonvulsants may be mildly impairing, but the combined medication effects on psychomotor performance tend to be more severe. When coprescribing anticonvulsants and other psychoactive drugs, it is wise to start with low doses of each and gradually increase the dosage of each one *separately* to minimize side effects.

Antidepressants

Impairing side effects vary among the different classes of antidepressants, and even within certain classes of antidepressants. In general, antidepressants that possess antagonistic activity at cholinergic, alpha-1-adrenergic, and histaminergic receptors are the most impairing. Whenever possible, physicians should initiate antidepressant therapy with the least impairing medication possible.

Patients should be advised not to drive during the initial phase of antidepressant dosage adjustment(s) if they experience drowsiness, lightheadedness, or other side effects that may impair driving performance. Patients should also be advised that they may experience impairment in the absence of any subjective symptoms.

Bupropion

Side effects of bupropion (also known as Wellbutrin® and Zyban®) include anxiety, restlessness and insomnia (leading to daytime drowsiness). Patients should be counseled about these side effects and their potential to impair driving performance. Because bupropion may cause seizures at high doses, it should not be prescribed to patients with epilepsy, brain injuries, eating disorders, or other factors predisposing to seizure activity.

Mirtazapine

Mirtazapine (also known as Remeron®) is typically taken only at night due to its sedating effects. It has been shown to cause substantial impairment for many hours after dosing. Whenever possible, it should be avoided in patients who wish to continue driving.

Monoamine oxidase (MAO) inhibitors

Side effects of MAO inhibitors that may impair driving performance include blurred vision, overstimulation, insomnia (leading to daytime drowsiness), orthostatic hypotension (with transient cognitive deficits), and hypertensive crisis (presenting with severe headaches and/or mental status changes). The latter can be caused by failure to adhere to dietary and medication restrictions. Patients should be counseled about these side effects and their potential to impair driving performance.

Selective serotonin reuptake inhibitors (SSRI)

Common side effects of SSRIs that may impair driving performance include sleep changes (insomnia or sedation), headache, anxiety, and restlessness. While these side effects tend to be mild and well-tolerated, physicians should counsel patients to be alert to their potential to affect driving performance.

Tricyclic antidepressants (TCA)

Common side effects of TCAs that may impair driving performance include sedation, blurred vision, orthostatic hypotension, tremor, excitement, and heart palpitations. In studies involving healthy volunteers, the more sedating TCAs have been shown to impair psychomotor function, motor coordination, and open-road driving. Other studies appear to indicate an increased crash risk for drivers who take TCAs.²⁴

Whenever possible, TCAs should be avoided in patients who wish to continue driving. If non-impairing alternatives are not available, then the physician should advise patients of the potential side effects and recommend temporary driving cessation during the initial phase of medication initiation/dosage adjustment. Patients should also be advised that they may experience impairment even in the absence of subjective symptoms.

Antiemetics

Numerous classes of drugs—including anticholinergics, antihistamines, antipsychotics, cannabinoids, benzodiazepenes, 5HT antagonists, and glucocorticoids—are used for their antiemetic effect. Side effects of antiemetics that may impair driving performance include sedation, blurred vision, headache, confusion, and dystonias. Significant impairment may be present even in the absence of subjective symptoms. Patients should be counseled about side effects and their potential to impair driving performance, and should be advised that they may experience impairment even in the absence of subjective symptoms.

For more detailed information, see also the recommendations for anticholinergics, antihistamines, antipsychotics, and benzodiazepenes.

Antihistamines

In many patients, the older antihistamines (such as diphenhydramine and chlorpheniramine) have pronounced central nervous system effects. In studies involving healthy volunteers, sedating antihistamines have been shown to impair psychomotor performance, simulated driving, and open-road driving.²⁴ Furthermore, subjects may experience impairment even in the absence of subjective symptoms of impairment.²³ In contrast, most nonsedating antihistamines do not produce these types of impairment after being taken in recommended doses.²⁴ However, even nonsedating antihistamines may cause impairments if taken in higher-than-recommended doses, and one of them—cetirizine—may be slightly impairing to certain patients in normal doses.

Patients who take a sedating antihistamine should be advised not to drive while on the medication. If these patients wish to continue driving, they should be prescribed a nonsedating antihistamine.

Antihypertensives

With their hypotensive properties, common side effects of antihypertensives that may impair driving performance include lightheadedness, dizziness, and fatigue. In addition, antihypertensives with a prominent central nervous system effect, including beta-blockers and the sympatholytic drugs clonidine, guanfacine and methyldopa, may cause sedation, confusion, insomnia, and nervousness.

Patients should be counseled about these side effects and their potential to impair driving performance. In addition, patients taking antihypertensives that may potentially cause electrolyte imbalance (ie, diuretics) should be counseled about the symptoms of electrolyte imbalance and their potential to impair driving performance.

Antiparkinsonians

Several medications and classes of medications including levodopa, antimuscarinics (anticholinergics), amantadine, and dopamine agonists may be used in the treatment of Parkinson's disease symptoms. Common side effects of antiparkinsonian drugs that may impair driving performance include excessive daytime sleepiness, lightheadedness, dizziness, blurred vision, and confusion. (See also the recommendations for anticholinergics.)

Patients should be counseled about these side effects and advised not to drive if they experience side effects. Based on the extent of disease symptoms and medication side effects, the physician may also consider referring patients for formal psychomotor testing or for driver evaluation (including on-road assessment) performed by a driver rehabilitation specialist.

Antipsychotics

Most—if not all—antipsychotic medications have a strong potential to impair driving performance through various central nervous system effects. Some of the original or “classic” antipsychotics are heavily sedating, and all produce extrapyramidal side effects (EPS). Although the modern or “atypical” drugs have a lower tendency to cause EPS, they, too, are sedating.

Patients should be counseled about these side effects and advised not to drive if they experience side effects severe enough to impair driving performance. The physician should consider referring the patient for formal psychomotor testing or for driver evaluation (including on-road assessment) performed by a driver rehabilitation specialist. If medication therapy is initiated while the patient is hospitalized, the impact of side effects on driving performance should be discussed prior to discharge.

Benzodiazepenes and other sedatives/anxiolytics

Studies have demonstrated impairments in vision, attention, motor coordination, and driving performance with benzodiazepene use. Evening doses of long-acting benzodiazepenes have been shown to markedly impair psychomotor function the following day, while comparable doses of short-acting compounds produce a lesser impairment.²⁴ In contrast, benzodiazepene-like hypnotics (such as zolpidem and zaleplon) have a more rapid rate of elimination. Studies of driving performance and psychomotor function have shown that five hours after taking zaleplon and nine hours after taking zolpidem at recommended doses, it is generally safe to drive again.²⁵⁻²⁷

Patients should be prescribed evening doses of the shortest-acting hypnotics whenever possible. Patients who take longer-acting compounds or daytime doses of any hypnotic should be advised of the potential for impairment, even in the absence of subjective symptoms. These patients should also be advised to avoid driving, particularly during the initial phase of dosage adjustment(s).

Muscle relaxants

Most skeletal muscle relaxants (eg, carisoprodol and cyclobenzaprine) have significant central nervous system effects. Patients should be counseled about these side effects and advised not to drive during the initial phase of dosage adjustment(s) if they experience side effects severe enough to affect safe driving performance.

Nonsteroidal anti-inflammatory drugs (NSAID)

Isolated case reports of confusion following the use of the NSAIDs phenylbutazone and indomethacin suggest that they may rarely impair driving performance.²⁸ If the patient reports this side effect, the physician should consider adjusting the dosage or changing the medication.

Narcotic analgesics

Patients should be counseled about the impairing effects of narcotic analgesics (ie, opioids) and the potential for impairment even in the absence of subjective symptoms. They should also be advised not to drive while on these medications.

In addition, many narcotic analgesics have a high potential for abuse. Accordingly, physicians should always be alert to signs of abuse. (For more information, see the recommendations for substance abuse in Section 6.)

Stimulants

Common side effects of traditional stimulants (such as amphetamines and methylphenidate) that may impair driving performance include euphoria, overconfidence, nervousness, irritability, anxiety, insomnia, headache, and rebound effects as the stimulant wears off. Patients should be counseled about these side effects and advised not to drive during the initial phase of dosage adjustment(s) if they experience side effects severe enough to impair driving performance. (The novel stimulant, modafinil, is not euphorogenic, nor does it appear to cause rebound effects. However, its safety for use when driving has not yet been demonstrated.)

In addition, many stimulants have a high potential for abuse. Accordingly, physicians should always be alert to signs of abuse. (For more information, see the recommendations for substance abuse in Section 6.)

Section 6: Psychiatric Diseases

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 (ADD)/attention deficit hyperactivity disorder (ADHD)
7. Tourette's syndrome

Psychiatrists may wish to consult the American Psychiatric Association's *Position Statement on the Role of Psychiatrists in Assessing Driving Ability*.²⁹

Patients should not drive while they are in the acute phase of a psychiatric illness. In general, driving may resume once the condition is stable, although side effects from medications and compliance with the medication regimen may need to be taken into consideration. (For recommendations on medications and driving, see Section 5.)

Section 6: Psychiatric Diseases

Affective disorders

Physicians should advise the patient not to drive during the acute phase of illness. Physicians should also be aware that certain medications used in the treatment of affective disorders have the potential to impair driving performance. (See Section 5 for more information on medication side effects.)

Depression

No restrictions if the condition is mild and stable. The physician should always specifically ask about suicidal ideation and cognitive and motor symptoms.

Patients should not drive if they are actively suicidal or experiencing significant mental or physical slowness, agitation, and/or impaired concentration. Patients who seek care for these conditions should be counseled not to drive themselves to the clinic or hospital.

Bipolar disorder

No restrictions if the condition is stable.

Patients should not drive if they are actively suicidal or in an acute phase of mania. Patients who seek care for these conditions should be counseled not to drive themselves to the clinic or hospital.

Anxiety disorders

Patients should not drive during acute episodes of anxiety. Otherwise, there are no restrictions if the condition is stable.

Physicians should also be aware that certain medications used in the treatment of anxiety disorders have the potential to impair driving performance. (See Section 5 for more information on medication side effects.)

Psychotic illness

Physicians should advise the patient not to drive during the acute phase(s) of illness. Physicians should also be aware that medications used in the treatment of psychotic illness have the potential to impair driving performance. (See Section 5 for more information on medication side effects.)

Acute episodes

Patients should not drive during acute episodes of psychosis. Patients who seek care for acute psychosis should be counseled not to drive themselves to the clinic or hospital.

Chronic illness

No restrictions if the condition is stable and there are no other factors (eg, medication side effects) that can affect driving performance.

Personality disorders

No restrictions unless the patient has a history of driving violations and his/her psychiatric review is unfavorable. This includes—but is not limited to—uncontrolled erratic, violent, aggressive, or irresponsible behavior.

Due to the high co-morbidity of substance abuse with personality disorders, physicians are urged to be alert to substance abuse in these patients and counsel them accordingly. (See recommendations for substance abuse below.)

Substance abuse

Driving while intoxicated is not only highly dangerous to the driver, passengers, and other road users, but it is also illegal. Drunk 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 intoxicated driving. Substances including, but not limited to, marijuana, cocaine, amphetamines (including amphetamine analogs), opiates, and benzodiazepenes may also impair driving skills. Physicians should always screen for alcohol and other drug abuse as part of the routine medical history. Questionnaires such as CAGE,³⁰ MAST,³¹ TWEAK,³² and AUDIT^{33,34} are useful in screening for alcohol abuse, and such questionnaires may be adapted to screen for other substance abuse.

Physicians should follow up all positive screens with appropriate interventions, including brief interventions or referral to support groups, counseling, and substance abuse treatment centers. Physicians 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 nonjudgmental and supportive attitude and frequent follow-up may aid substance abusers in their efforts to achieve and maintain sobriety.

Physicians should also familiarize themselves with any state laws holding them responsible for detaining intoxicated patients who have driven to the hospital or clinic until they are legally unimpaired.

Attention deficit disorder (ADD)/ attention deficit hyperactivity disorder (ADHD)

Adolescent drivers have a high rate of driving offenses, and adolescent drivers with attentional difficulties have even higher rates of crashes, traffic violations, and drinking and driving. Given these findings, physicians are advised to counsel adolescents with ADD/ADHD to take care when driving, and strongly caution them against drinking and driving.³⁵⁻³⁷ In addition, physicians should be aware that a comorbid learning disability may interfere with the patient's ability to learn how to drive. For patients with a learning disability, referral to a driver rehabilitation specialist or driver education specialist for one-on-one instruction is highly recommended.

For recommendations regarding the medications used to treat this disorder, see Section 5.

Tourette's syndrome

See Section 4.

Section 7: Metabolic Diseases

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

Individuals in the acute phase of a metabolic disorder (eg, diabetes, Cushing's disease, Addison's disease, hyperfunction of the adrenal medulla, and thyroid disorders) may experience signs and symptoms that are incompatible with safe driving. Physicians should advise these individuals to refrain from driving

(including driving to seek medical attention) until the symptoms have abated.

Section 7: Metabolic Diseases

Diabetes mellitus

Insulin dependent diabetes mellitus (IDDM)

No restrictions if the patient demonstrates satisfactory control of his/her diabetes, recognizes the warning symptoms of hypoglycemia, and meets required visual standards.

Patients should be counseled not to drive during acute hypoglycemic and hyperglycemic episodes. In addition, patients are advised to keep candy or glucose tablets within reach in their car at all times, in the event of a hypoglycemic attack.

For recommendations on peripheral neuropathy, see Section 4.

Patients who experience recurrent hypoglycemic or hyperglycemic attacks should not drive until they have been free of significant hypoglycemic or hyperglycemic attacks for three months.

Non-insulin dependent diabetes mellitus (NIDDM)

If the patient's condition is managed by lifestyle changes and/or oral medications, there are no restrictions unless the patient develops related conditions (eg, diabetic retinopathy).

If the physician prescribes an oral medication that has a significant potential to cause hypoglycemia, he/she should counsel the patient as above.

Hypothyroidism

Patients who experience symptoms that may compromise safe driving (eg, cognitive impairment, drowsiness, and fatigue) should be counseled not to drive until their hypothyroidism has been satisfactorily treated. If residual cognitive deficits are apparent despite treatment, a driver evaluation (including on-road assessment) performed by a driver rehabilitation specialist may be useful in determining the patient's ability to drive safely.

Hyperthyroidism

Patients who experience symptoms that may compromise safe driving (eg, anxiety, tachycardia, and palpitations) should be counseled not to drive until their hyperthyroidism has been satisfactorily treated and symptoms have resolved.

Section 8: Musculoskeletal Disabilities

1. Arthritis
2. Foot abnormalities
3. Limitation of cervical movement
4. Limitation of thoracic and lumbar spine
5. Loss of extremities
6. Muscle disorders
7. Orthopedic procedures/surgeries
 - a. Amputation
 - b. Anterior cruciate ligament (ACL) 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 (TKA)

The pain, decrease in motor strength, and compromised range of motion associated with musculoskeletal disabilities can affect an individual's ability to drive safely. Physicians should encourage their patients with musculoskeletal disabilities to drive a vehicle with power steering and automatic transmission, if they do not already do so. Such vehicles require the least amount of motor ability for operation among all standard vehicles. If the physician is concerned that the patient's musculoskeletal disabilities impair his/her driving performance, referral to a driver rehabilitation specialist for a driver evaluation (including

on-road assessment) is also recommended. In addition to assessing the patient's driving skills, the specialist can prescribe adaptive techniques and devices and train the patient in their use.

In some cases, rehabilitative therapies such as physical or occupational therapy and/or a consistent regimen of physical activity may help improve the patient's ability to drive and overall level of physical fitness.

Whenever possible, the use of narcotics, barbiturates, and muscle relaxants should be avoided in those patients with musculoskeletal disabilities who wish to continue driving. See Section 5 for recommendations regarding specific classes of medications.

Section 8: Musculoskeletal Disabilities

Arthritis

If symptoms of arthritis compromise the patient's driving safety, referral to a physical or occupational therapist for rehabilitative therapy and/or to a driver rehabilitation specialist for driver evaluation (including on-road assessment) is recommended. The specialist may prescribe vehicle adaptive devices and train the patient in their use.

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

Foot abnormalities

Foot abnormalities (eg, bunions, hammer toes, long toe nails, and calluses) that affect the patient's dorsiflexion, plantar flexion and/or contact with vehicle foot pedals should be addressed and treated, if possible. The physician may also refer the patient to a driver rehabilitation specialist, who can prescribe vehicle adaptive devices and train the patient in their use.

Limitation of cervical movement

Some loss of head and neck movement is acceptable if the patient has sufficient combined rotation and peripheral vision to accomplish driving tasks (eg, turning, crossing intersections, parking, backing up) safely. The physician should ask if the patient's vehicle is equipped with right and left outside mirrors and encourage the patient to make use of them. The physician may also refer the patient to a physical or occupational therapist for rehabilitative therapy and/or to a driver rehabilitation specialist, who can prescribe wide-angle mirrors and train the patient in their use.

Limitation of thoracic or lumbar spine

Patients 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 driver rehabilitation specialist. The specialist can prescribe vehicle adaptive devices such as raised seats and wide-angle mirrors and train the patient in their use. The specialist can also prescribe safety belt adaptations as needed to improve the patient's safety and comfort, and ensure that the patient is seated at least ten inches from the vehicle air bags.

Patients 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. (For paraplegia and quadriplegia, see Section 4.)

Loss of extremities

For patients who have lost one or more extremities, referral to a driver rehabilitation specialist is highly recommended. These specialists can prescribe vehicle adaptive devices and/or adaptations to limb prostheses and train the patient in their use.

Note that the use of artificial limbs on vehicle foot pedals is unsafe because there is no sensory feedback (ie, pressure and proprioception). For these patients, specialized hand controls in place of pedals are required.

Driving should be restricted until the patient demonstrates safe driving ability with the use of adaptive devices.

Muscle disorders

If the physician is concerned that the patient's symptoms compromise his/her driving safety, referral to a driver rehabilitation specialist for driver evaluation (including on-road assessment) is recommended. If needed, the specialist may prescribe vehicle adaptive devices and train the patient in their use.

Orthopedic procedures/surgeries

Physicians should counsel patients who undergo surgery—both inpatient and outpatient—not to drive themselves home. In addition to deficits in range of motion, motor strength, proprioception, and reaction time from the surgical procedure itself, the patient's driving skills may be affected by anesthesia, analgesics, and pain.

In helping the patient make decisions about temporary driving restrictions, it is useful for the physician to ask whether the patient's car has power steering and automatic transmission, and whether the patient normally uses one or two feet in operating the foot pedals. As patients resume driving, they should be advised to assess their comfort level in familiar, traffic-free areas before driving in heavy traffic.

Amputation

See the recommendations for loss of extremities.

Anterior cruciate ligament (ACL) reconstruction

The patient should not drive for four weeks following right ACL reconstruction. If the patient drives a vehicle with manual transmission, he/she should not drive for four weeks following right or left ACL reconstruction.³⁸

Limb fractures and treatment involving splints and casts

No restrictions if the fracture or splint/cast do not interfere with driving tasks. If the fracture or splint/cast interfere with driving tasks, the patient may resume driving after the fracture heals or the splint/cast is removed, upon demonstration of the necessary strength and range of motion.

Physicians should counsel patients to wear their safety belts properly (over the shoulder, rather than under the arm) whenever they are in a vehicle as a driver or passenger. The patient should sit in the vehicle seat that best accommodates this need.

Rotator cuff repair—open or arthroscopic

The patient should not drive for four to six weeks following rotator cuff repair. If the patient's vehicle does not have power steering, the waiting period may be much longer.

Physicians should counsel patients to wear their safety belts properly (over the shoulder, rather than under the arm) whenever they are in a vehicle as a driver or passenger. The patient should sit in the vehicle seat that best accommodates this need.

Shoulder reconstruction

The patient should not drive for four to six weeks following shoulder reconstruction. If the patient's vehicle does not have power steering, the waiting period may be longer.

Physicians should counsel patients to wear their safety belts properly (over the shoulder, rather than under the arm) whenever they are in a vehicle as a driver or passenger. The patient should sit in the vehicle seat that best accommodates this need.

Total hip replacement

The patient should not drive for at least four weeks following right total hip replacement. If the patient drives a vehicle with manual transmission, he/she should not drive for at least four weeks following right or left total hip replacement.

Physicians should counsel patients 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. Physicians should also advise patients that reaction time may not return to baseline until eight weeks after the surgery, and that they should exercise extra caution while driving during this time.³⁹

Total knee arthroplasty (TKA)

The patient should not drive for three to four weeks following right TKA. If the patient drives a vehicle with manual transmission, he/she should not drive for three to four weeks following right or left TKA.⁴⁰

The physician should also counsel patients that reaction time may not return to baseline until eight weeks after the surgery, and that they should exercise extra caution while driving during this time.⁴¹

Section 9: Peripheral Vascular Diseases

1. Aortic aneurysm
2. Deep vein thrombosis (DVT)
3. Peripheral arterial aneurysm

Section 9: Peripheral Vascular Diseases

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)

Patients with acute DVT may resume driving when their international normalized ratio (INR) is therapeutic or risk of embolism is otherwise appropriately treated, and they can demonstrate adequate ankle dorsiflexion.

The physician 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. Patients 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 10: Renal Disease

1. Chronic renal failure
2. Renal transplant

Section 10: Renal Disease

Chronic renal failure

No restrictions unless the patient experiences symptoms that are incompatible with safe driving (eg, cognitive impairment, impaired psychomotor function, seizures, or extreme fatigue from anemia). If the physician is concerned that the patient's symptoms compromise his/her driving safety, referral to a driver rehabilitation specialist for a driver evaluation (including on-road assessment) is recommended.

Many patients who require hemodialysis can drive without restriction. However, management of renal failure requires that the patient be compliant with substantial nutrition and fluid restrictions, frequent medical evaluations, and regular hemodialysis treatments. Patients with a history of noncompliance should be advised against driving. Furthermore, certain medications used to treat the side effects of hemodialysis (eg, diphenhydramine for dialysis-associated pruritis), may be substantially impairing and dialysis itself may result in hypotension, confusion, or agitation in many patients. These effects may require that patients avoid driving in the immediate post-dialysis period.

Renal transplant

Patients may resume driving four weeks following successful transplant on the recommendation of the physician.

Section 11: Respiratory Diseases

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

Section 11: Respiratory Diseases

Asthma

No restrictions.

Patients should be counseled not to drive during acute asthma attacks or while suffering transient side effects (if any) from their asthma medications.

Chronic obstructive pulmonary disease (COPD)

No restrictions if symptoms are well-controlled and the patient does not experience any significant side effects from the condition or medications.

The patient should not drive if he/she suffers dyspnea at rest or at the wheel (even with the use of supplemental oxygen), excessive fatigue, or significant cognitive impairment. If the patient requires supplemental oxygen to maintain a hemoglobin saturation of 90% or greater, he/she should be counseled to use the oxygen at all times while driving. Due to the often tenuous oxygenation status of these patients, they should also be counseled to avoid driving when they have other respiratory symptoms that may indicate concomitant illness or exacerbation of COPD (eg, new cough, increased sputum production, change in sputum color, or fever).

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

If the physician is concerned that the patient's symptoms compromise his/her driving safety, referral to a driver rehabilitation specialist for a driver evaluation (including on-road assessment) is recommended. The patient's oxygen saturation may be measured during the course of the on-road assessment to provide additional information for patient management.

Sleep apnea

The patient may resume driving when he/she no longer suffers excessive daytime drowsiness. Physicians may consider using scoring tools such as the Epworth Sleepiness Scale¹⁹ to assess the patient's level of daytime drowsiness, or brief cognitive tests to assess the patient's level of attention.

Section 12: 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

Physicians should be alert to peri- and post-operative risk factors that may affect the patient's cognitive function post-surgery, placing the patient at risk for impaired driving. Risk factors include:

- Pre-existing cognitive impairment
- Duration of surgery
- Age (over 60 years)

- Altered mental status post-surgery
- The presence of multiple co-morbidities
- Emergency surgery

If the physician is concerned that residual visual, cognitive, or motor deficits following the surgery may impair the patient's driving performance, referral to a driver rehabilitation specialist for a driver evaluation (including on-road assessment) is highly recommended.

Physicians should counsel patients who undergo surgery—both inpatient and outpatient—not to drive themselves home following the procedure. Although they may feel capable of driving, their driving skills may be affected by pain, physical restrictions, anesthesia, and/or analgesics. (For specific recommendations regarding musculoskeletal restrictions and narcotic analgesics, please see Sections 8 and 5, respectively.) Physicians should also remind patients to wear their safety belts

properly (over the shoulder, rather than under the arm) and position themselves at least 10 inches from the vehicle airbags whenever they are in a vehicle as a driver or passenger. The patient should sit in the vehicle seat that is most likely to accommodate these needs.

In counseling patients about their return to driving after a surgical procedure, it is useful for the physician to ask whether the patient's car has power steering and automatic transmission. Physicians can tailor their driving advice accordingly.

As patients resume driving, they should be counseled to assess their comfort level in familiar, traffic-free areas before driving in heavy traffic. If the patient feels uncomfortable driving in certain situations, he/she should avoid these situations until his/her confidence level has returned. A patient should never resume driving until he/she feels ready to do so.

Section 12: Effects of Anesthesia and Surgery

Abdominal, back and chest surgery

The patient may resume driving after demonstrating the necessary strength and range of motion for driving.

See Section 2 for recommendations on surgeries involving median sternotomy.

See Section 10 for recommendations on renal transplant.

Anesthesia

Because anesthetic agents and adjunctive compounds (such as benzodiazepenes) may be administered in combination, the patient should not resume driving until the motor and cognitive effects from all anesthetic agents have subsided.

General

Both the surgeon and anesthesiologist should advise patients 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.

Local

If the anesthetized region is necessary for driving tasks, the patient should not drive until he/she has recovered full strength and sensation (barring pain).

Epidural

The patient may resume driving after recovering full strength and sensation (barring pain) in the affected areas.

Spinal

The patient 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 8.

Section 13: Miscellaneous Conditions

1. Cancer
2. Hearing loss

Section 13: Miscellaneous Conditions

Cancer

Patients who experience significant motor weakness or cognitive impairments from the cancer itself, metastases, cachexia, anemia, radiation therapy, and/or chemotherapy should cease driving until their condition improves and stabilizes.

Many medications prescribed to relieve the side effects of treatment (eg, antiemetics for treatment of nausea) may impair driving performance. Physicians should counsel their patients accordingly. (See Section 5 for recommendations on specific medications.)

Hearing loss

No restrictions.

There are relatively few studies that have examined the relationship between hearing impairment and risk of motor vehicle crash. Of these studies, none have demonstrated a significant relationship between hearing impairment and risk of crash.⁴

References

- Shinar D, Schieber F. Visual requirements for safety and mobility of older drivers. *Human Factors*. 1991;33(5):507-519.
- American Academy of Ophthalmology. Policy statement: Vision requirements for driving. Approved by Board of Trustees, October 2001. Available at: <http://www.aaopt.org/aaopt/member/policy/driving.cfm>. Accessed January 9, 2003.
- Peli E, Peli D. *Driving With Confidence: A Practical Guide to Driving with Low Vision*. Singapore: World Scientific Publishing Co. Pte. Ltd.; 2002:100-101.
- Dobbs BM. *Medical Conditions and Driving: A Review of the Scientific Literature*. Washington, DC: National Highway Traffic Safety Administration; 2003.
- Vingrys AJ, Cole BL. Are color vision standards justified in the transport industry? *Ophthalmic and Physiological Optics*. 1998;8(3):257-274.
- Petch MC. European Society of Cardiology Task Force Report: Driving and heart disease. *European Heart Journal*. 1998;19(8):1165-1177.
- Binns H, Camm J. Driving and arrhythmias. *British Medical Journal*. 2002;324:927-928.
- Epstein AI, Miles WM, Benditt DG, et al. Personal and public safety issues related to arrhythmias that may affect consciousness: implications for regulation and physician recommendations. *Circulation*. 1996;94:1147-1166.
- Canadian Cardiovascular Society Consensus Conference. Assessment of the cardiac patient for fitness to drive. *Canadian Journal of Cardiology*. 1992;8:406-412.
- Wilson T, Smith T. Driving after stroke. *International Rehabilitation Medicine*. 1983;5(4):170-177.
- Syncope. In: Beers MH, Berkow R (eds.). *The Merck Manual of Diagnosis and Therapy*, 17th ed. Merck and Co., Inc., 1999. Available at: <http://www.merck.com/pubs/mmanual/section16/chapter200/200b.htm>. Accessed January 9, 2003.
- North American Society of Pacing and Electrophysiology/American Heart Association. Personal and public safety issues related to arrhythmias that may affect consciousness: Implications for regulation and physician recommendations (Part 3 of 4). September 1, 1996. Available at: http://naspe.org/naspe_in_action/position_statements/view/?id=8505. Accessed January 9, 2003.
- Valcour VG, Masaki KH, Curb JD, Blanchette PL. The detection of dementia in the primary care setting. *Archives of Internal Medicine*. 2000;160:2964-2968.
- Alzheimer's Association. Position statement: Driving. Adopted by the Alzheimer's Association Board of Directors, October 2001. Available at: <http://www.alz.org/aboutus/positionstatements/overview.htm>. Accessed January 9, 2003.
- Patterson CJS, Gauthier S, Bergman H, et al. The recognition, assessment and management of denoting disorders: conclusions from the Canadian Consensus Conference on Dementia. *Canadian Medical Association Journal*. 1999;160(12suppl):S1-S15.
- Carr DB, Duchek J, Morris JC. Characteristics of motor vehicle crashes with dementia of the Alzheimer type. *Journal of the American Geriatrics Society*. 2000;48(1):18-22.
- Zesiewicz TA, Cimino CR, Malek AR, et al. Driving safety in Parkinson's disease. *Neurology*. 2002;59:1787-1788.
- American Academy of Neurology, American Epilepsy Society, and Epilepsy Foundation of America. Consensus statements, sample statutory provisions, and model regulations regarding driver licensing and epilepsy. *Epilepsia*. 1994;35(3):696-705.
- Johns MW. A new method for measuring daytime sleepiness: the Epworth Sleepiness Scale. *Sleep*. 1991;14:540-545.
- Mattila M. Acute and subacute effects of diazepam on human performance: Comparison of plain tablet and controlled release capsule. *Pharmacology and Toxicology*. 1988;63(5):369-374.
- Roache JD, Griffiths RR. Comparison of triazolam and pentobarbital: performance impairment, subjective effects and abuse liability. *Journal of Pharmacology and Experimental Therapeutics*. 1985;234(1):120-133.
- Aranko K, Mattila MJ, Bordinon D. Psychomotor effects of alprazolam and diazepam during acute and subacute treatment, and during the follow-up phase. *Acta Pharmacologica et Toxicologica*. 1985;56(5):364-372.
- Weiler JM, Bloomfield JR, Woodworth GG, et al. Effects of fexofenadine, diphenhydramine, and alcohol on driving performance: A randomized placebo-controlled trial in the Iowa driving simulator. *Annals of Internal Medicine*. 2000;132(5):354-363.
- Ray WA, Purushottam BT, Shorr RI. Medications and the older driver. *Clinics in Geriatric Medicine*. 1993;9(2):413-438.
- Vermeeren A, Danlou PE, O'Hanlon JF. Residual effects of zaleplon 10 and 20 mg on memory and actual driving performance following administration 5 and 2 hours before awakening. *British Journal of Clinical Pharmacology*. 1999;48:367-374.
- Vermeeren A, Muntjewerff ND, van Boxtel M, et al. Residual effects of zaleplon and zopiclone versus the effects of alcohol on actual car driving performance [abstract]. *European Neuropsychopharmacology*. 2000;10(suppl 3):S394.
- Volkerts ER, Verster JC, Heuckelein JHG, et al. The impact on car-driving performance of zaleplon and zolpiden administration during the night [abstract]. *European Neuropsychopharmacology*. 2000;10(suppl 3):S395.
- Ray WA, Gurwitz J, Decker MD, Kennedy DL. Medications and the safety of the older driver: Is there a basis for concern? *Human Factors*. 1992;34(1):33-47.
- American Psychiatric Association. Position statement on the role of psychiatrists in assessing driving ability. Approved by the Board of Trustees, December 1993. Available at: http://www.psych.org/pract_of_psych/driving_pstate.cfm. Accessed January 9, 2003.
- Mayfield D, McLeod G, Hall P. The CAGE questionnaire: Validation of a new alcoholism instrument. *American Journal of Psychiatry*. 1974;131:1121-1123.
- Selzer ML. The Michigan Alcoholism Screening Test: The quest for a new diagnostic instrument. *American Journal of Psychiatry*. 1971;127:1653-1658.
- Russell M, Martier SS, Sokol RJ, Jacobson S, Jacobson J, Bottoms S. Screening for pregnancy risk drinking: TWEAKING the tests. *Alcoholism: Clinical and Experimental Research*. 1991;15(2):638.
- Babor TF, de la Fuente JR, Saunders JB, Grant M. AUDIT: The alcohol use disorders identification test: Guidelines for use in primary health care. Geneva, Switzerland: World Health Organization; 1992.
- Saunders JB, Aasland OG, Babor TF, de la Fuente JR, Grant M. Development of the alcohol use disorders screening test (AUDIT): WHO collaborative project on early detection of persons with harmful alcohol consumption. II. *Addiction*. 1993;88:791-804.
- Nada-Raja S, Langley JD, McGee R, Williams SM, Begg DJ, Reeder AI. Inattentive and hyperactive behaviors and driving offenses in adolescence. *Journal of the American Academy of Child and Adolescent Psychiatry*. 1997;36(4):515-522.

- 36 Barkley RA, Guevremont DC, Anastopoulos AD, DuPaul GJ, Shelton TL. Driving-related risks and outcomes of attention deficit hyperactivity disorder in adolescents and young adults: A 3-5 year follow-up survey. *Pediatrics*. 1993;92:212-218.
- 37 Woodward LJ, Fergusson DM, Horwood LJ. Driving outcomes of young people with attentional difficulties in adolescence. *Journal of the American Academy of Child and Adolescent Psychiatry*. 2000;39(5):627-634.
- 38 Gotlin RS, Sherman AL, Sierra N, Kelly MA, Pappas Z, Scott WN. Measurement of brake response time after right anterior cruciate ligament reconstruction. *Archives of Physical Medicine and Rehabilitation*. 2000;81(2):201-204.
- 39 MacDonald W, Owen JW. The effect of total hip replacement on driving reactions. *Journal of Bone and Joint Surgery*. 70B(2):202-205, 1988.
- 40 Pierson JL, Ramsey J, Clayton RT, Stippich KT. TKA improves drivers' brake reaction time. *The American Academy of Orthopaedic Surgeons: Academy News*. February 7, 1999.
- 41 Spalding TJ, Kiss J, Kyberd P, Turner-Smith A, Simpson AH. Driver reaction times after total knee replacement. *Journal of Bone and Joint Surgery. British Volume*. 1994;76(5):754-756.