

CHAPTER 9

# **Medical Conditions and Medications That May Affect Driving**

# Medical Conditions and Medications That May Affect Driving

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

The medical conditions were chosen for their relevance to clinical practice and/or because there is some evidenced-based literature indicating a correlation with driving impairment. The interested clinician is referred to two recent reviews that comprehensively covered many of these conditions.<sup>187 188</sup> In addition, several other countries have published guidelines, including Canada,<sup>189</sup>

Australia,<sup>190</sup> the United Kingdom,<sup>191</sup> and New Zealand.<sup>192</sup>

Although the corresponding recommendations are based on scientific evidence whenever possible, please note that use of these recommendations has not yet been proven to reduce crash risk,<sup>193</sup> except for a few medical conditions (e.g., treating obstructive sleep apnea, performing cataract surgery, and discontinuing a benzodiazepine). As such, these recommendations are provided to physicians as a tool to guide the decision-making process. They are not intended to substitute for the physician's clinical judgment.

## How to use this chapter

Physicians may consult this chapter if they have questions on specific medical conditions and their effect on driving. If a patient presents with a particular medical condition and/or related functional deficits (e.g., deficits in vision,

cognition, or motor function) that may affect his/her driving safety, the physician may base interventions for driving safety on this chapter's guidelines. We make the following recommendations:

- Treat the underlying medical condition to correct functional deficits and prevent further functional decline.
- If the functional deficit is due to an offending agent (e.g., medication with impairing side effects), remove the offending agent or reduce the dose, if possible.
- Advise the patient about the risks to his/her driving safety, and recommend driving restrictions or driving cessation as needed.
- For acute or episodic illnesses (e.g., seizure disorder and/or diabetics with hypoglycemia), clinical judgment and subspecialist input is recommended, in addition to following specific State statutes.

If further evaluation is required or the functional deficits are not medically correctable, refer the patient to a driver rehabilitation specialist for a driving evaluation (including an on-road assessment) for a chronic condition whenever possible. The driver rehabilitation specialist may prescribe adaptive techniques and devices to compensate for these deficits, and train the patient in their use. (See Chapter 5 for a further discussion of driver rehabilitation services.)

Physicians should advise patients against driving if they report symptoms

187. Charlton, J., Koppel, S., O'Hare, M., et al. (2004). Influence of Chronic Illness on Crash Involvement of Motor Vehicle Drivers. Monash University. Accident Research Centre. Report #213. Supported by Swedish National Road Administration. Melbourne, Australia: Monash University.

188. Dobbs, B. M. (2002). Medical Conditions and Driving: Current Knowledge, Final Report Association for the Advancement of Automotive Medicine. NHTSA Publication DOT HS 809 690. Washington, DC: National Highway Traffic Safety Administration. [www.nhtsa.dot.gov/people/injury/research/Medical\\_Condition\\_Driving/pages/TRD.html](http://www.nhtsa.dot.gov/people/injury/research/Medical_Condition_Driving/pages/TRD.html).

189. Canadian Medical Association. Determining Medical Fitness to Drive: A Guide for Physicians, 6th ed. Ottawa; 2000.

190. Austroads. Assessing Fitness to Drive for Commercial and Private Vehicle Drivers. Medical Standards for Licensing and Clinical Management Guidelines. *A Resource for Health Professionals in Australia*; 2003.

191. Driver Medical Group DVLA Swansea for Medical Practitioners. *At a Glance Guide to the Current Medical Standards of Fitness to Drive*. (2003). Swansea, UK.

192. Land Transport Safety Authority. (2002). *Medical Aspect of Fitness to Drive*. Wellington, New Zealand.

193. 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.

that are irreversible and incompatible with safe driving (e.g., visual changes, syncope or pre-syncope, vertigo, severe pain, etc.). If despite extensive medical work-up these symptoms continue, such patients should be strongly urged to seek alternate forms of transportation, including taxis, rides from family and friends, and medical transportation services.

In the inpatient and emergency department, driving should be routinely addressed prior to the patient's discharge whenever appropriate, especially when prescribing new sedating medications. Even for the patient whose symptom or treatment clearly precludes 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 (e.g., resumption of driving upon resolution of symptoms, driver rehabilitation upon stabilization of symptoms, and so forth.).

Keep in mind that an individual's driving purposes (e.g., responsible for taking grandchildren to day care) and/or need to drive for a vocation (e.g., salesperson who has increased exposure or miles driven per year) may influence the extent of the interventions or advice in regard to an evaluation. For example, more restriction or a performance-based road test may be more aggressively pursued for a patient who frequently drives long distances over unfamiliar roads in comparison to a patient who drives short, familiar routes.

## Medical conditions and medications that may affect driving

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## Section 1: Vision and hearing loss

Vision is the primary sense employed in driving when compared to hearing and proprioception, and is responsible for 95 percent of driving-related sensory inputs.<sup>194</sup> Age- and disease-related changes of the eye and brain may affect visual acuity, visual fields, night vision, contrast sensitivity, and other aspects of vision. External obstruction of view (e.g., blepharoptosis) should not be overlooked, as it may significantly limit visual fields. The literature that is available on eye disease suggests that driving impairment is likely mediated by impairment in contrast sensitivity,<sup>195</sup> visual fields,<sup>196</sup> or visual processing speed.

Whenever possible, vision deficits should be managed and corrected. Recent data suggest that intervention with current treatments for common eye diseases such as age-related macular degeneration,<sup>197</sup> glaucoma,<sup>198</sup> and cataracts<sup>199</sup> have the potential to improve or stabilize the condition, and in some cases these interventions have been noted to reduce crash risk.<sup>200</sup> Patients with persistent vision deficits may reduce their impact on driving safety by restricting travel to low-risk areas and conditions, such as familiar surround-

194. Shinar, D., & Schieber, F. (1991). Visual requirements for safety and mobility of older drivers. *Hum Factors*. 33(5):507-519.

195. Mabtyjari, M., & Tuppurainen, K. (1999). Cataract in traffic. *Graefes Arch Clin Exp Ophthalmol*. 237:278-282.

196. Szlyk, J. P., Mahler, C. L., Seiple, W., et al. (2005). Driving performance of glaucoma patients correlates with peripheral visual field loss. *J Glaucoma*. 14:145-150.

197. Smith, B.T., Joseph, D.P., & Grand, M.G. (2007). Treatment of neovascular age-related macular degeneration: past, present, and future directions. *Curr Opin Ophthalmol*. 18:240-244.

198. Leske, M.C., Hejl, A., Hussein, M., et al. (2003). Factors for glaucoma progression and the effect of treatment: the Early Manifest Glaucoma Trial. *Arch Ophthalmol*. 121:48-56.

199. Van Den Berg, T., Van Rijn, L.J., Rene, M., Michael, R., Heine, C., et al. (2007). Straylight effects with aging and lens extraction. *Am J Ophthalmol*. 144(3):358-363.

200. Owsley, C., McGwin, G. Jr., Sloane, M., et al. (2002). Impact of cataract surgery on motor vehicle crash involvement by older adults. *JAMA*. 288:841-849.

ings, low speed areas, non-rush hour traffic, daytime, and good weather conditions. This has been noted for certain eye diseases, especially glaucoma.<sup>201</sup>

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201. Adler, G., Bauer, M. J., Rottunda, S., et al. (2005). Driving habits and patterns in older men with glaucoma. *Social Work Health Care*. 40(3):75–87.

### Sensory Deprivation

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

- c. Monocular vision
- d. Ptosis or upper lid redundancy
- e. Retinitis pigmentosa

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## Section 1: Sensory deprivation

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### Visual acuity

Please note that the recommendations stated below are subject to your particular State's licensing requirements. (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.<sup>3</sup> State driver licensing agencies are urged to base their visual acuity requirements on the most current data, as appropriate. However, referral to an ophthalmologist is recommended since common causes for visual impairment (cataracts, macular degeneration, glaucoma) can improve and/or stabilize with treatment.

Visual acuity may be measured with both eyes open or with the best eye open, as the 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 (e.g., familiar surroundings, non-rush hour traffic, low speed areas, daytime, and good weather conditions).

For best-corrected far visual acuity less than 20/70, 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 Telescopic lens in this section.)

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### 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 adverse weather conditions.

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### Diabetic or hypertensive retinopathy

No restrictions if standards for visual acuity and visual fields are met. It is recommended that diabetic patients have annual eye examinations.

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*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.

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*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.

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*Nystagmus*

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

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*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.<sup>202</sup> 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 (approved by Board of Trustees, October 2001):

“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.”

Please note that the statement above is subject to your particular State’s licensing requirements. A road test should be administered only in those States that permit the use of bioptic telescopes in driving.

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**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” nor any consistent standard as to how visual fields are tested. Visual field requirements vary between States, with many States requiring a visual field of 100 degrees or more along the horizontal plane, and other States having a lesser requirement or none at all.<sup>203</sup> (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 defect (e.g., 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.

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202. Peli, E., & Peli, D. (2002). *Driving With Confidence: A Practical Guide to Driving with Low Vision*. Singapore: World Scientific Publishing Co. Pte. Ltd.; p.100–101.

203. Peli, E., & Peli, D. (2002). *Driving With Confidence: A Practical Guide to Driving with Low Vision*. Singapore: World Scientific Publishing Co. Pte. Ltd.; p.20–22.

## Visual field (continued)

For binocular visual field at or near the State minimum requirement or of questionable adequacy (as deemed by clinical judgment), a driver evaluation (including on-road assessment) performed by a driver rehabilitation specialist is strongly recommended. Through driving rehabilitation, the patient may learn how to compensate for decreased visual fields, although not hemi-neglect. In addition, the driver rehabilitation specialist may prescribe enlarged side and rear view mirrors as needed and train the patient in their use.

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### *Glaucoma*

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

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### *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 the recommendations stated above are subject to your particular State's licensing restrictions, if any, for hemianopia and quadrantanopia.

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### *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 among 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. Again, use of larger mirrors and evaluation and training by a driver rehabilitation specialist is encouraged.

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### *Ptosis or lid redundancy, blepharospasm*

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

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### *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.

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### 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.<sup>204</sup>

Among older drivers, binocular measures of contrast sensitivity have been found to be a valid predictor of crash risk in patients with cataracts.<sup>205</sup> However, there are presently no standardized cut-off points for contrast sensitivity and safe driving, and it is not routinely measured in eye examinations.

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### 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.

There appears to be no correlation between defective color vision and crash rates.<sup>206</sup> Only 19 States require prospective drivers to undergo color vision screening, and most of these States require screening for commercial drivers only.<sup>207</sup>

Despite reported difficulties with color vision discrimination while driving (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 significant driving hazard.<sup>208</sup> 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.

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### 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 or at dusk.

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### Diplopia

Patients with double vision in the central aspect of vision (20 degrees above and below, left and right of fixation) should not drive. Patients with uncorrected diplopia should be referred to an ophthalmologist or optometrist for further assessment to determine if the defect can be corrected with prisms or a patch and meet standards for driving. There should be a three-month adjustment period, after which specialists can determine if adequate adjustment has occurred.<sup>209</sup>

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204. Dobbs, B. M. (2002, February). *Medical Conditions and Driving: Current Knowledge*, p. 15. DTNH22-94-G-05297. Submitted to the Association for the Advancement of Automotive Medicine under contract with the Washington, DC: National Highway Traffic Safety Administration.

205. Owsley, C., Stalvey, B. T., Wells, J., et al. (2001). Visual risk factors for crash involvement in older drivers with cataract. *Arch Ophthalmol.* 119: 881–887.

206. Policy Statement. American Association of Ophthalmology, 2006. [www.aao.org/about/policy/upload/AAODrivingPolicyWebcopy.pdf](http://www.aao.org/about/policy/upload/AAODrivingPolicyWebcopy.pdf). Accessed December 12, 2007.

207. Peli, E., & Peli, D. (2002). *Driving With Confidence: A Practical Guide to Driving with Low Vision*. Singapore: World Scientific Publishing Co. Pte. Ltd.; p.25.

208. Dobbs, B. M. (2002, February). *Medical Conditions and Driving: Current Knowledge*. DTNH22-94-G-05297. Submitted to the Association for the Advancement of Automotive Medicine under contract with NHTSA, p. 15. Washington, DC: National Highway Traffic Safety Administration.

209. Canadian Ophthalmological Society. Vision Standards for Driving in Canada, 2000. <http://eyesite.ca/english/program-and-services/policy-Statements-guidelines/drivingstd.html>. Accessed December 12, 2007.

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## Hearing loss

No restrictions.

Relatively few studies have examined the relationship between hearing impairment and risk of motor vehicle crash. Of these, none have shown a significant relationship between hearing impairment and risk of crash.<sup>210</sup>

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210. Dobbs, B. M. (2002, February). Medical Conditions and Driving: Current Knowledge. DTNH22-94-G-05297. Submitted to the Association for the Advancement of Automotive Medicine under contract with NHTSA, p. 37-38. Washington, DC: National Highway Traffic Safety Administration.

## 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
  - 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
  - d. Coronary artery bypass graft (CABG)
  - e. Valve repair or replacement
  - f. Heart transplant
5. Internal cardioverter defibrillator (ICD)

Although the data are still unclear in regard to a definitive relationship between crash risk and cardiovascular diseases, a recent study did note a modest increase in total crash risk and at-fault risk for older adults with cardiac disease.<sup>211</sup> For the patient with known cardiac disease, the physician should strongly and repeatedly caution him/her to seek help immediately upon experiencing any symptoms—including prolonged chest discomfort, acute shortness of breath, syncope, pre-syncope, palpitations, lightheadedness—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 antihypertensive medications.

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211. McGwin, G., Sims, R. V., Pulley, L., & Roseman, J. M. (2000). Relations among chronic medical conditions, medications, and automobile crashes in the elderly: a population-based case-control study. *Am J Epidemiol.* 152,424–431.

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## Section 2: Cardiovascular diseases

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### 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).<sup>212</sup> (See also recommendations for CABG below [4.c in this section].)

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

A 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.<sup>213</sup> 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.

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

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

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### *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.

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### *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 ICD) guided by invasive electrophysiologic (EP) testing, and VT is noninducible at repeat EP testing. They may resume driving after six months without arrhythmia events if they are on empiric antiarrhythmic therapy (with or without an ICD), or have an ICD alone without additional antiarrhythmic therapy.<sup>214</sup>

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### *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 arrhythmia events if they are on empiric antiarrhythmic therapy (with or without an ICD), or have an ICD alone without additional antiarrhythmic therapy.<sup>215</sup>

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212. Petch, M. C. (1998). European Society of Cardiology Task Force Report: Driving and Heart Disease. *Eur Heart J.* 19(8):1165–1177.

213. Binns, H., & Camm, J. (2002). Driving and arrhythmias. *Br Med J.* 324:927–928.

214. Epstein, A. I., Miles, W. M., Benditt, D. G., et al. (1996). Personal and public safety issues related to arrhythmias that may affect consciousness: implications for regulation and physician recommendations. *Circulation.* 94:1147–1166.

215. Ibid.

*Sustained ventricular tachycardia (VT)*  
(Continued)

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.<sup>216</sup>

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*Cardiac arrest*

Please refer to the recommendations for sustained ventricular tachycardia.

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

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, on-road testing performed by a driver rehabilitation specialist may be useful in assessing the patient's fitness to drive.

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*High grade atrio-ventricular (AV) block*

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

For symptomatic block corrected without a pacemaker (e.g., 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.

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*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 in this section.

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

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**Cardiac disease resulting from  
structural or functional abnormalities**

A main consideration in determining medical fitness to drive for patients with abnormalities of cardiac structure or function is the risk of pre-syncope or syncope due to low cardiac output, and 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 for those patients with a history of cognitive impairment that may impair the patient's driving ability. Physicians may refer patients with clinically significant cognitive changes to a driver rehabilitation specialist for a driver evaluation (including on-road assessment) to evaluate the patient's driving safety.

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<sup>216</sup>. Ibid.

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Congestive heart failure (CHF)  
with low output syndrome

Patients should not drive if they experience symptoms at rest or while operating a motor vehicle.

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.

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Hypertrophic obstructive cardiomyopathy

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

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Valvular disease (especially aortic stenosis)

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

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**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.

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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 disease.<sup>217, 218</sup>

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Pacemaker insertion or revision

The patient may resume driving one week after pacemaker implantation if:

The patient no longer experiences pre-syncope or syncope

- a. EKG shows normal sensing and capture; and
  - b. Pacemaker performs within manufacturer's specifications.<sup>219</sup>
- 

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 or post-surgical complications, the main limitation to driving is the risk of sternal disruption following median sternotomy.

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

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**Internal cardioverter defibrillator**

Please see the recommendations for nonsustained and sustained ventricular tachycardia (2.c and 2.d in this section).

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217. Petch, M. C. (1998) European Society of Cardiology Task Force Report: Driving and Heart Disease. *Eur Heart J.* 19(8):1165–1177.

218. Consensus Conference, Canadian Cardiovascular Society: Assessment of the cardiac patient for fitness to drive. (1992). *Can J Cardiol.* 8:406–412.

219. Ibid.

### Section 3: Cerebrovascular disorders

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

Strokes and other insults to the cerebral vascular system may cause a wide variety of symptoms, including sensory deficits (e.g., numbness or loss of sensation), motor deficits (e.g., weakness), and cognitive impairment (e.g., memory, hemispatial inattention). These symptoms range from mild to severe and may resolve almost immediately or persist for years. Because each 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. Studies have indicated that a significant number (>40%) of community dwelling stroke patients continue to drive a car.<sup>220</sup> However, the majority of stroke patients (87 %) may not receive any type of formal driving

220. Legh-Smith, J., Wade, D. T., & Langton Hewer, R. L. (1986). Driving after stroke. *J R Soc Med.* 79: 200–203.

evaluation, but simply resume the operation of a motor vehicle.<sup>221</sup> The larger the presence of a homonymous visual field defect, the more likely it is that the patient will lose his/her driver's license. Unfortunately, many patients may not be aware of this deficit.<sup>222</sup>

Driving should always be discussed 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 whenever possible. Although the time frame for this evaluation will depend on the severity and extent of the deficits, many evaluations for cognitive and motor defects will occur somewhere between three to six months. 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 (e.g., wide rear view mirror, spinner knob for the steering wheel, left foot accelerator) and provide training for

221. Fisk, G.D., Owsley, C., & Vonne Pulley, L. (1997). Driving after stroke: driving exposure, advice, and evaluations. *Arch Phys Med Rehabil.* 78:1338–1345.

222. Poole, D., Chaudry, F., & Jay, W. M. (2008). Stroke and driving. *Topics Stroke Rehab.* 15:37–41.

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.<sup>223</sup> More recent studies note associations with impairment on road tests with measures of perception, visual selective attention, mental speed, working memory, executive function and complex visual-perception/attention information.<sup>224, 225, 226</sup>

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.

223. Wilson, T., Smith, T. (1983). Driving after stroke. *Int Rehab Med.* 5(4):170–177.

224. Engrum, E.S., Lambert, E. W., & Scott, K. (1990). Criterion-related validity of the cognitive behavioral driver's inventory: brain injured patients versus normal controls. *Cogn Rehabil.* 1990;8:20–26.

225. Lundberg, C., Caneman G., Sven-Marten S., et al. (2003). *Scand J Psychol.* 44:23–30.

226. Nouri F. M., & Lincoln N. B. (1993). Predicting driving performance after stroke. *Br Med J.* 307:482–483.

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### Section 3: Cerebrovascular diseases

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#### Post intracranial surgery

The patient should not drive until stabilization or resolution of disease and surgery symptoms. See also stroke recommendations below (Section 3.2).

#### Stroke

Patients with acute, severe motor, sensory, or cognitive deficits should refrain from driving. 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 appropriate patients with residual sensory loss, cognitive impairment, visual field defects, and/or motor deficits to a driver rehabilitation specialist for driver assessment and rehabilitation. The specialist may prescribe vehicle adaptive devices and train the patient in their use.

## Stroke (continued)

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, if available, as reaction time may continue to be affected and other comorbid conditions could further increase risk.

Patients with aphasia who demonstrate safe driving ability may fail in their efforts to renew their license due to difficulties with the written examination. In these cases, the physician should urge the licensing authority to make reasonable accommodations for the patient's language deficit. A driving rehabilitation specialist may be able to determine whether the deficit is expressive in nature and thus may allow for interpretation of written (e.g., traffic signs) stimuli. However, traffic signs may still be interpreted based on color, shape, and symbol recognition.

Patients with residual cognitive deficits should be assessed and treated as described in section 4 on Dementia. Periodic re-evaluation of these patients is recommended, as some patients may recover sufficiently over time to permit safe driving.

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## 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.

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## 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 performed by a driver rehabilitation specialist (including on-road assessment).

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## 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.

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## Syncope

Syncope usually results from various cardiovascular causes, and is recurrent in up to 30 percent of cases. Cardiac arrhythmias are the most common cause of syncope.<sup>227</sup> (See Section 2 for causes of cardiac syncope.)

Driving restrictions for neurally mediated syncope should be based on the severity of the presenting event and the anticipant likelihood of recurrence. 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 4 in Section 2).<sup>228</sup> For patients who continue to experience unpredictable symptoms after treatment with medications and pacemaker insertion, driving cessation is recommended.

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227. Beers, M. H., & Berkow, R. (eds). (1999). *The Merck Manual of Diagnosis and Therapy*, 17th ed. Whitehouse Station, NJ: Merck and Co., Inc. Section 6, Chapter 200.

228. 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.

## Section 4: Neurologic diseases

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

Dementia deserves 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 lack insight. 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.

Several recent reviews on this topic may be of interest to physicians.<sup>229, 230</sup> Fitness-to-drive studies in patients with dementia indicate that 90 percent may be able to pass a road test in the very mild stages of the disease (clinical dementia rating of 0.5), whereas 40 percent may fail at a mild level of cognitive impairment (clinical

dementia rating of 1.0).<sup>231</sup> Furthermore, most patients with Alzheimer's disease will eventually fail subsequent road tests when followed longitudinally, indicating that repeat testing at six to twelve months should be strongly considered.<sup>232</sup> Some of these studies have led the American Academy of Neurology to conclude that patients with a mild level of dementia severity or greater should no longer operate an automobile.<sup>233</sup> However, this recommendation has recently been challenged by a longitudinal study that found that some mildly demented drivers not only passed a performance-based road test, but also had an acceptable crash risk prospectively.<sup>234</sup> Furthermore, recent studies indicate that physician evaluation in the office cannot replace the on-the-road assessment;<sup>235</sup> however, tests of working memory and executive function are improving classification rates.<sup>236, 237</sup> Finally, a dementia and driving curriculum modeled after this AMA guide has been shown to improve knowledge, attitudes, confidence, and behaviors for health professionals who deal with older adults with dementia.<sup>238</sup>

This is encouraging information that supports the feasibility and utility of using this guide.

While it is optimal to initiate discussions of driving safety with the patient and family members before driving becomes unsafe, dementia may be 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 feel that it is futile—in other words, that nothing can be done to improve the patient's situation or slow disease progression. In addition, physicians may be concerned about the amount of time required to effectively diagnose dementia and educate patients and their families.<sup>239</sup> However, some patients are able to achieve cognitive stability, at least for a period of time, with cholinesterase inhibitors or N-methyl d-aspartate (NMDA) receptor blockers. In addition, patients are now being diagnosed on the "cusp" of the disease in the very early stages. A diagnosis of dementia by itself should not preclude driving.

Physician reluctance to screen for dementia is unfortunate because early diagnosis is the first step in promoting the driving safety of these patients. The second step is intervention, which includes medications to slow or stabilize 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 nondriving status.

229. Dobbs, B., Carr, D. B., & Morris, J. C. (2002). Management and assessment of the demented driver. *Neurologist*, 8:61–70.

230. Brown, L. B., & Ott, B. R. (2004). Driving and dementia: a review of the literature. *J Geriatr Psychiatry Neurol*, 17:232–240.

231. Hunt L., Murphy C., Carr D., Duchek J., Buckles V., & Morris, J. (1997). The reliability of the Washington University Road Test. *Arch Neurol*, 54:707–712.

232. Duchek, J. M., Carr DB., Hunt L., et al. (2003). Longitudinal driving performance in early stage dementia of the Alzheimer type. *J Am Geriatr Soc*, 51:1342–1347.

233. Dubinsky, RM., Stein, AC., Lyons, K. (2000). Practice parameter: risk of driving and Alzheimer's disease (an evidence-based review) —Report of the Quality Standards Subcommittee of the American Academy of Neurology. *Neurology*, 54, 2205–2211.

234. Ott, BR., Heindel, WC., Papandonatos, GD., et al. (2008). Longitudinal study of drivers with Alzheimer's disease. *Neurology*, 70:1171–1178.

235. Ott, B. R., Anthony, D., Papandonatos, G. D., D'Abreu, A., Burock, J., Curtin, A., Wu, C. K., & Morris, J. C. (2005) Clinician assessment of the driving competence of patients with dementia. *J Am Geriatr Soc*, 53(5):829–833.

236. Grace, J., Amick, M. M., D'Abreu, A., Festa, E. K., Heindel, W. C., & Ott, B. R. (2005). Neuropsychological deficits associated with driving performance in Parkinson's and Alzheimer's disease. *J Int Neuropsychol Soc*, 11(6):766–775.

237. Brown, L. B., Stern, R. A., Cahn-Weiner, D. A., et al. (2005). Driving scenes test of the Neuropsychological Assessment Battery and on-road driving performance in aging and very mild dementia. *Arch Clin Neuropsychol*, 20:209–215

238. Meuser, T. M., Carr, D. B., Berg-Weger, M., Niewoehner, P., & Morris, J. C. (2006). Driving and dementia in older adults: implementation and evaluation of a continuing education project. *Gerontologist*, 46:680–687.

239. Valcour, V. G., Masaki, K. H., Curb, J. D., & Blanchette, P. L. (2000). The detection of dementia in the primary care setting. *Arch Intern Med*, 160:2964–2968.

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## Section 4: Neurologic diseases

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### 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 3.2.

If the patient experiences seizure(s), please see the seizure disorder recommendations below (4.10 in this section).

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### Closed head injury

Patients should not drive until symptoms or signs have stabilized or resolved. For patients whose symptoms or signs 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 managed as described in Section 3.

If the patient experiences seizure(s), please see the seizure disorder recommendations below.

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### Dementia

The following recommendations are adapted from the Canadian Consensus Conference on Dementia and the Alzheimer's Association Policy Statement on Driving and Dementia (approved 10/20/01):

- 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 states of their illness.<sup>240</sup> Therefore, the determining factor in withdrawing driving privileges should be the individual's driving ability. When the individual poses a heightened risk to self or others, driving privileges must be withheld.
- 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 a history of any new impaired driving behaviors (e.g., new motor vehicle crashes) from a family member or caregiver and an evaluation of cognitive abilities, including memory, attention, judgment, and visuospatial abilities. Physicians should be aware that patients with a progressive dementia who are initially believed to be safe to drive will require serial assessment, and they should familiarize themselves with their State reporting laws and procedures for dementia (if any). (See Chapter 8 for a reference list of State reporting laws.)

If concern exists 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.

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240. Carr, D. B., Duchek, J., & Morris, J. C. (2000). Characteristics of motor vehicle crashes with dementia of the Alzheimer type. *J Am Geriatr Soc*, 48(1):18–22.

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## Dementia (continued)

- 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 his/her family members and caregivers, and to seek assistance (as needed) from the local Area Agency on Aging.

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## Migraine and other recurrent headache syndromes

Patients with recurrent severe headaches should be cautioned against driving when experiencing neurologic manifestations (e.g., visual disturbances or dizziness); when distracted by pain; and while on any barbiturate, narcotic, or narcotic-like analgesic. (See Section 13 for further recommendations regarding narcotic analgesics.) Patients without a typical aura preceding the acute attack may be at higher risk.

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## Movement disorders (e.g., parkinsonism, dyskinesias)

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.

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## Multiple sclerosis

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

A 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.

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## Paraplegia and quadriplegia

Referral to a driver rehabilitation specialist is necessary if the patient wishes to resume driving and/or requires a vehicle modified to accommodate him/her as a passenger. The specialist can recommend an appropriate vehicle and prescribe vehicle 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.

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## 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.<sup>241</sup> Physicians should base their driving recommendations on the level of both motor and cognitive symptom involvement, patient's response to treatment, and presence and extent of any medication side effects. (See Section 13 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.

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241. Zesiewicz, T. A., Cimino, C. R., Malek, A. R., Gardner, N., Leaverton, P. L., Dunne, P. B., & Hauser, R. A. (2002). Driving safety in Parkinson's disease. *Neurology*, 59:1787–1788.

### Parkinson's disease (continued)

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.

Lower extremity deficits in sensation and proprioception may be exceedingly dangerous for driving, as the driver may be unable to control the foot pedals.

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### Peripheral neuropathy

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

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### Seizure disorder

The recommendations below (in this section only) are adapted from the Consensus Statements on Driver Licensing in Epilepsy, crafted and agreed upon by the American Academy of Neurology, American Epilepsy Society, and Epilepsy Foundation of America in March 1992.<sup>242</sup> 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 recommendation appears consistent with recent data.<sup>243</sup> This three-month interval may be lengthened or shortened based on the following favorable and unfavorable modifiers:

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#### *Favorable modifiers:*

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

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242. American Academy of Neurology, American Epilepsy Society, and Epilepsy Foundation of America. (1994). Consensus Statements, Sample Statutory Provisions, and Model Regulations Regarding Driver Licensing and Epilepsy. *Epilepsia*. 35(3):696-705.

243. Draskowski, J. F., Fisher, R. S., Sirven, J. I., et al. (2003). Seizure-related motor vehicle crashes in Arizona before and after reducing the driving restriction from 12 to 3 months. *Mayo Clin Proc*. 78:819-825.

## Seizure disorder (continued)

### **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
  - Impaired 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
- 

### *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 positive family history for epilepsy
  - Generalized spike waves or focal spikes are present on EEG recordings
- 

### *Withdrawal or change of anti-epileptic drug 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 should not drive for six months if he/she refuses to resume this medication regimen, but is seizure-free during this period.

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## **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 Scale to assess the patient's level of daytime drowsiness.<sup>244</sup>

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### *Sleep apnea*

See Section 10.

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## **Stroke**

See Section 3.

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244. Johns, M. W. (1991). A new method for measuring daytime sleepiness: the Epworth Sleepiness Scale. *Sleep*. 14:540–545.

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**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 on these disorders, see Section 5, Psychiatric Disorders).

If the physician is concerned that the patient's symptoms compromise his/her driving safety, referral to a driver rehabilitation specialist for 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 13 for more information on medication side effects.)

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**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 on-road assessment performed by a driver rehabilitation specialist prior to resuming driving.

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## Section 5: Psychiatric disorders

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

Patients in the acute phase of a psychiatric illness need to be aware that driving skills could be affected. In general, driving is safe when the condition is stable, although 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 13, Medications.)

Psychiatrists may wish to consult the American Psychiatric Association's Position Statement on the Role of Psychiatrists in Assessing Driving Ability (American Journal of Psychiatry. 1995. 152(5):819; also at [www.psych.org/pract\\_of\\_psych/driving\\_pstate.cfm](http://www.psych.org/pract_of_psych/driving_pstate.cfm)).

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## Section 5: Psychiatric disorders

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### 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 13 for more information on medication side effects.)

#### *Depression*

No restrictions if 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 psychosis, impaired attention, 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 condition is stable.

Patients should not drive if they are actively suicidal, depressed as in 1.a (above) 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.

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### Anxiety disorders

Patients should not drive during severe 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 13 for more information on medication side effects.)

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**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 13 for more information on medication side effects.)

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**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.

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**Chronic illness**

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

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**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 comorbidity 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).

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**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 benzodiazepines may also impair driving skills.

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.

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**Attention Deficit Disorder/Attention Deficit Hyperactivity Disorder**

A recent review noted increased risk of driving behaviors and a positive effect of stimulant medications on driving performance.<sup>245</sup> Physicians should educate their patients about the increased risk associated with the disease and the potential benefits of treatment.

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**Tourette's syndrome**

See Section 4.

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245. Barkley, R. A., & Cox, D. (2007). A review of driving risks and impairments associated with attention-deficit/hyperactivity disorder and the effects of stimulant medication on driving performance. *Journal of Safety Research*, 38(1):113–28.

## Section 6: Metabolic disorders

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 (e.g., 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. There are data that suggest that older diabetic patients may be at increased risk for impaired driving, but the literature is not consistent in this area. Concern has been raised that the trend in the medical profession has been toward tighter control, which could result in hypoglycemia and possibly increased crash risk.

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## Section 6: Metabolic disorders

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### 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.

The major concerns with insulin dependent diabetics are hypoglycemia unawareness. There are several studies that have noted that patients with type 1 IDDM had impaired driving performance during episodes of hypoglycemia and were unaware of their low blood sugars at the time of driving assessment.<sup>246, 247</sup>

It is apparent from these studies that many drivers did not take appropriate action even when they recognized the symptoms of hypoglycemia. Diabetic patients who use insulin should be evaluated for hypoglycemia and should consider checking their blood sugar before driving or on prolonged trips. This is especially the case for individuals who have exhibited hypoglycemia unawareness (e.g., documented blood sugars below 60 mg/dL without symptoms).

Patients should be counseled not to drive during acute hypoglycemic or 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 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)*

Patients who are managed by lifestyle changes and/or oral medications have no restrictions unless they develop relevant disabilities (e.g., 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. Oral medications may also increase the likelihood of hypoglycemia, which should be managed as in 1.a in this section.

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246. Weinger, I., Kinsley, B. T., Levy, C. J., et al. (1999). The perception of safe driving ability during hypoglycemia in patients with type I diabetes. *Am J Med.* 107:246–253.

247. Cox, D. J., Gonder-Frederick, L. A., Kovatchev, B. P., et al. (2000). Progressive hypoglycemia's impact on driving simulation performance: occurrence, awareness, and correction. *Diabetes Care.* 23:163–170.

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**Hypothyroidism**

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

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**Hyperthyroidism**

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

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## Section 7: Musculoskeletal disabilities

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

Patients with musculoskeletal disorders, typically have problems with seat belt and ignition key use, adjusting mirrors and seats, in steering, in transferring in and out of the car, in driving in reverse, and in using the controls like the foot

pedal.<sup>248</sup> Driving impairment has been correlated with the inability to reach above the shoulder.<sup>249</sup> Older adults with physical frailty or disabilities may be at increased risk for a crash,<sup>250, 251</sup> and are more likely to be injured.<sup>252</sup> Presence of foot abnormalities, walking less than one block a day, and impaired left knee flexion have been associated with adverse driving events.<sup>253</sup> In one study, older crash-involved subjects were more likely to have difficulty walking one-quarter mile than controls; and the authors also noted an increased crash risk for drivers with a history of falls.<sup>254</sup> Diminished cervical range of motion and a slowed rapid pace walk have also been recently associated with an increased crash risk.<sup>255</sup>

The use of nonsteroidal anti-inflammatory agents (NSAIDs) and a diagnosis of arthritis were associated with increased

at-fault crash risk in a recent study.<sup>256</sup> Similarly, an examination of medically impaired drivers in Utah found an increased crash risk for drivers with musculoskeletal disorders, but not for those with muscle or motor weakness.<sup>257</sup> Conversely, patients with a specific diagnosis of osteoarthritis<sup>258</sup> were no more at risk for a crash than controls in one study. Also reassuring was a recent study noting no increase in crash risk of drivers with cars that had been adapted for their musculoskeletal restrictions.<sup>259</sup> Thus, physicians can play a role in diagnosing, managing, and referring their patients with musculoskeletal disorders and, ideally, play a role in maintaining driving privileges and improving traffic safety.

Rehabilitative therapies such as physical or occupational therapy and/or a consistent regimen of physical activity may 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 or minimized in those patients with musculoskeletal disabilities who wish to continue driving. See Section 13 for recommendations on specific classes of medications.

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## Section 7: Musculoskeletal disabilities

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### 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 on limitation of cervical movement or limitation of the thoracic or lumbar spine.

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### Foot abnormalities

Foot abnormalities (e.g., 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. Consideration should be given to referral to a podiatrist. 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.

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### 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 (e.g., turning, crossing intersections, parking, backing up) safely. The physician may also refer the patient to physical or occupational therapist for rehabilitative therapy, and/or to a driver rehabilitation specialist, who can prescribe wide-angled mirrors and train the patient in their use.

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### 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-angled mirrors, and train the patient in their use. The specialist can also prescribe seat belt adaptations as needed to improve the patient's safety and comfort, and ensure that the patient is seated at least 10 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. These types of fractures can be extremely painful and require large doses of narcotics for control of pain, which also can increase risk. (For paraplegia or quadriplegia, see Section 4.)

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### Loss of extremities or loss of use of extremities

For patients who have lost (or lost the use) of 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 (i.e., 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, as needed).

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## 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.

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## Orthopedic procedures/surgeries

### *Amputation*

See Loss of extremities (previous page).

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### *Anterior cruciate ligament (ACL) reconstruction*

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.<sup>260</sup>

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### *Limb fractures and treatment involving splints and casts*

No restrictions if the fracture or splint/cast does not interfere with driving tasks. If the fracture or splint/cast interferes 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.

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### *Rotator cuff repair—open or arthroscopic*

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 seat belts properly (over the shoulder, rather than under the arm) whenever they are in a vehicle as a driver or passenger.

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### *Shoulder reconstruction*

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 much longer.

Physicians should counsel patients to wear their seat belts properly (over the shoulder, rather than under the arm) whenever they are in a vehicle as a driver or passenger.

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### *Total hip replacement*

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 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 period.<sup>261</sup>

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261. MacDonald, W., & Owen, J. W. (1988). The effect of total hip replacement on driving reactions. *J Bone Joint Surg.* 70B(2):202-205

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*Total knee arthroplasty (TKA)*

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.<sup>262</sup>

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 period.<sup>263</sup>

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## Section 8: Peripheral vascular diseases

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

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### Section 8: Peripheral vascular diseases

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#### 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.

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#### Deep vein thrombosis (DVT)

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

The physician should advise individuals with a history of DVT to take frequent “mobilization breaks” when driving long distances.

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#### 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.

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## Section 9: Renal disease

1. Chronic renal failure
2. Renal transplant

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## Section 9: Renal disease

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### Chronic renal failure

No restrictions unless the patient experiences symptoms that are incompatible with safe driving (e.g., 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 with renal failure requiring 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 side effects of hemodialysis may be substantially impairing (e.g., diphenhydramine for dialysis-associated pruritis), 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.

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### Renal transplant

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

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## Section 10: Respiratory diseases

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

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

sleep.<sup>264</sup> Sleep disorder crash risk may be elevated further by medication use, such as narcotics or antihistamine.<sup>265</sup> Sleep apnea patients have been noted to have as high as a seven-fold increased crash risk compared to controls depending on the study.<sup>266</sup> Patients may also be at increased risk for serious injury.<sup>267</sup> This

topic has been extensively reviewed elsewhere.<sup>268</sup> Obstructive sleep apnea is one of the few medical conditions where treatment has been shown to reduce crash risk back to baseline levels.<sup>269</sup> In addition, recent studies indicate a high prevalence of sleep disorders or daytime sleepiness in older adults<sup>270</sup> and in diabetic patients.<sup>271</sup>

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## Section 10: Respiratory diseases

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### 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.

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### 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 the medication.

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 percent 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 (e.g., new cough, increased sputum production, change in sputum color, 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.

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## Sleep apnea

Patients with excessive daytime sleepiness, loud snoring (particularly if accompanied by witnessed apneic events), large neck circumference ( $\geq 16$  inches in women,  $\geq 17$  inches in men), elevated body mass index (above  $35 \text{ kg/m}^2$ ), and/or hypertension that requires two or more medications should be considered at risk for obstructive sleep apnea, and formal sleep study evaluation should be considered, especially in any patient who reports having fallen asleep while driving a vehicle. A patient diagnosed with sleep apnea (apnea/hypopnea index of 5 or greater) who has fallen asleep while driving, or a patient with severe obstructive sleep apnea (apnea/hypopnea index of 30 or greater) should be counseled to refrain from driving until he/she is receiving effective treatment (via a positive airway pressure device) following a formal sleep study to confirm the diagnosis. If these patients undergo other treatments (surgery, oral appliances), they should be advised to have a post-treatment sleep study to confirm effectiveness. Physicians should counsel patients using positive airway pressure devices that they should not drive if they do not use the device unless a formal sleep study confirms resolution of their obstructive sleep apnea (e.g., following substantial weight loss).

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## Section 11: Effects of anesthesia and surgery

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

Physicians should be alert to peri- and post-operative risk factors that may affect the patient's cognitive function post-surgery, or restrictions on limb movement or joint range of motion that place the patient at risk for impairments in driving performance. Risk factors include:

- Pre-existing cognitive impairment
- Duration of surgery
- Age (over 60)
- Altered mental status post-surgery
- Presence of multiple comorbidities
- Emergency surgery

If the physician is concerned that residual visual, cognitive or motor deficits following 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,

cognitive impairment, and/or analgesics. (For specific recommendations on musculoskeletal restrictions and narcotic analgesics, please see Sections 7 and 13, respectively.)

In counseling patients about their return to driving after a surgical procedure, it is useful to ask whether the patient's car has power steering and automatic transmission. Physicians can tailor their 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 before he/she feels ready to do so and has received approval from the physician.

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## Section 11: Effects of anesthesia and surgery

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### 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 for surgeries involving median sternotomy.

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### Anesthesia

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

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### 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.

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### 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).

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### Epidural

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

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### Spinal

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

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**Neurosurgery**

See recommendations for post intracranial surgery in Section 3.

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**Orthopedic surgery**

See the recommendations for orthopedic procedures/surgeries in Section 7.

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## **Section 12: Miscellaneous conditions**

### 1. Cancer

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## **Section 12: Miscellaneous conditions**

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### **Cancer**

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

Many medications prescribed to relieve the side effects of treatment (e.g., antiemetics for nausea) may impair driving performance. Physicians should counsel their patients accordingly. (See Section 13 for recommendations for specific medications.)

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## Section 13: Medications

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

Many classes of medication have been associated with increased crash risk or impaired driving skills when assessed by simulators or road tests. These include, but are not limited to hypnotics, alcohol, antiepileptic agents, anti-emetic agents, narcotics, barbiturates, benzodiazepines, antihistamines, antidepressants, antipsychotics, and muscle relaxants. Some of the highest crash rates have been noted with long-acting benzodiazepines when prescribed to older adults.<sup>272</sup> Other studies suggest that a significant number of

older adults may be driving while under the influence of other medications.<sup>273, 274</sup>

Potential driving impairing (PDI) medications is a relatively new term that identifies medications that have been associated with increased crash risk. Crash risk does increase when multiple PDI drugs are prescribed.<sup>275</sup> Mechanisms whereby drugs may impair driving are myriad and include: sleepiness, fatigue, or sedation; lightheadness, dizziness, or low blood pressure; blackouts or syncope; or impaired judgment coordination. Medications can affect eyesight in numerous ways, including blurred vision, impaired visual fields, and nighttime vision.<sup>276</sup> However, it should be noted that many medication and driving studies are usually correlational in nature, and may suggest increased crash risk but not necessarily causation. Whether it is the medication itself, the condition for which it is prescribed, the presence of other comorbidities, or a combination of these issues is often difficult to sort out.<sup>277</sup> Clinicians should be aware of the risk and attempt to use the safest class of medications based on the most recent evidence. An excellent review of this subject for pharmacists may be of interest to physicians and is

273. Higgins, J. P., Wright, S. W., & Wrenn, K. D. (1996). Alcohol, the elderly, and motor vehicle crashes. *Am J Emerg Med*, 14:265–267.

274. Johansson, K., Bryding, G., Dahl, M. L., et al. (1997). Traffic dangerous drugs are often found in fatally injured older male drivers. *J Am Geriatr Soc*, 45:1029–1031.

275. Leroy, A., & Morse, M. M. (N.A.). Exploratory Study of the Relationship Between Multiple Medications and Vehicle Crashes: Analysis of Databases. NHTSA Contract DTNH22-02-C-05075. Publication under review. [Published as Multiple Medications and Vehicle Crashes: Analysis of Databases. (2008, May). NHTSA Report No. DOT HS 810 858. Washington, DC: National Highway Traffic Safety Administration. Available at [www.nhtsa.dot.gov/staticfiles/DOT/NHTSA/Traffic%20Injury%20Control/Articles/Associated%20Files/810858.pdf](http://www.nhtsa.dot.gov/staticfiles/DOT/NHTSA/Traffic%20Injury%20Control/Articles/Associated%20Files/810858.pdf).]

276. Wang, K. (2007). Adverse Ocular Side-Effects of Commonly Prescribed Systemic Medications. Online CE provided by Pacific University College of Optometry. [www.Opt.pacificu.edu/ce/catalog/11466-PHWandgDrugs.html](http://www.Opt.pacificu.edu/ce/catalog/11466-PHWandgDrugs.html). Accessed October 21, 2007.

277. Bramness, JG., Skurtvelt, S., Neutel, CI., et al. (2008). Minor increase in traffic accidents after prescriptions of antidepressants: a study of population registry data in Norway. *J Clin Psychiatry*, 69:1099–1103.

available on-line.<sup>278</sup>

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 may 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 about the side effects. The physician 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, caregivers, and physicians should also understand that with certain medications, subjective effects do not always correlate with impairment.<sup>279</sup> Medications that cause drowsiness, euphoria, and/or anterograde amnesia may also diminish insight, and the patient may experience impairment without being aware of it.

278. Walgreens Health Services. Continuing Pharmacy Education Web Site. Medication-Related Impaired Driving: For Pharmacist. <https://webapp.walgreens.com/cePharmacy/programsHTML/transportation-tech.pdf>. Accessed November 16, 2007.

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Roache, JD., & Griffiths, R. R. (1985). Comparison of triazolam and pentobarbital: performance impairment, subjective effects and abuse liability. *J Pharmacol Exp Therapeut*, 234(1):120–133.  
Aranko, K., Mattila, M. J., & Bordignon, D. (1985). Psychomotor effects of alprazolam and diazepam during acute and subacute treatment, and during the follow-up phase. *Acta Pharmacologica Toxicologica*, 56(5):364–372.  
Weiler, JM., et al. (2000). Effects of fexofenadine, diphenhydramine, and alcohol on driving performance. a randomized placebo-controlled trial in the Iowa Driving Simulator. *Ann Intern Med*, 132(5):354–363.

272. Hemmelgarn, B., Suissa, S., Huang, A., et al. (1997). Benzodiazepine use and the risk of motor vehicle crash in the elderly. *JAMA*, 278:27–31.

When prescribing new medications, the physician should always consider the patient's existing regimen of prescription and nonprescription medications. Combinations of drugs may affect drug metabolism and excretion, and produce additive or synergistic interactions. In fact, use of multiple psychoactive medications is a common cause of hospitalization for delirium among older adults.<sup>280</sup> 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.

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280. Ray, W. A., Purushottam, B. T., Shorr, R. I. (1939). Medications and the older driver. *Clin Geriatr Med.* 9(2):413–438.

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## Section 13: Medications

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### 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. Due to age-related changes in body metabolism (e.g., increased body fat and decreases in lean muscle mass), the same weight-adjusted amount of alcohol (hydrophilic) is likely to result in higher blood levels of alcohol and functional impairment in advanced age. In many cases, individuals may be impaired without being aware of it. Furthermore, alcohol can potentiate the 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 and their CNS-active medications.**

For recommendations on substance abuse, see Section 5.

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### 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 counselled about these symptoms and should alert their physicians immediately if they occur. Patients should also be advised that psychomotor and cognitive impairment might be present even in the absence of subjective symptoms (this has been well documented for antihistamines).

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.

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## 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/or 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.

Note that many anticonvulsants (e.g., valproic acid, carbamazepine, gabapentine, lamotrigine and topiramate) are also being used as mood stabilizers for treatment of bipolar disorder, for agitation in dementia, and as sedating agents for anxiety. These agents 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 enhance their effects. When prescribing 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 significant side effects. In addition, this would allow for a clear identification of which drug may be producing a benefit or problem.

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## 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.) Recent data have also implicated venlafaxine as being associated with motor vehicle crashes.<sup>281</sup> Whenever possible, physicians should initiate antidepressant therapy with the least impairing medication possible. However, the data indicating increased crash risk with the specific use of certain medications may reveal associations but not necessarily causation. It is difficult to know whether increased risk is associated with the drug, a drug-drug interaction, or the disease itself (e.g., depression, which may independently impair attention, judgment, etc).

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 might experience impairment in the absence of any subjective symptoms.

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### Bupropion

Side effects of bupropion (also known as Wellbutrin<sup>®</sup> and Zyban<sup>®</sup>) include anxiety, restlessness, weight loss, 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.

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### Mirtazapine

Mirtazapine (also known as Remeron<sup>®</sup>) is typically taken only at night due to its sedating effects. It has been shown to cause substantial impairment for many hours after dosing. If daytime sedation is noted as an adverse side effect, another antidepressant should be considered or driving discontinued.

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281. Walgreens Health Services. Continuing Pharmacy Education Web Site. Medication-Related Impaired Driving: For Pharmacist. <https://webapp.walgreens.com/cePharmacy/programsHTML/transportation-tech.pdf>. Accessed November 16, 2007.

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*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.

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*Selective serotonin reuptake inhibitors (SSRIs)*

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. Special mention is made of serotonin syndrome, wherein mental status changes, autonomic hyperactivity, and neuromuscular side effects are observed due to excessive amounts of the drug or a drug-drug interaction. Treatment includes discontinuing the offending agent or hospitalization in severe cases.

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*Tricyclic antidepressants (TCAs)*

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.<sup>282</sup>

Whenever possible, other agents like SSRIs or TCA's with a low propensity for anticholinergic effects (nortryptiline or desipramine) should be considered for those who wish to continue driving. If nonimpairing 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 might experience impairment even in the absence of subjective symptoms.

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**Antiemetics**

Numerous classes of drugs—including anticholinergics, antihistamines, antipsychotics, cannabinoids, benzodiazepines, 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; this has been well documented for many benzodiazepines and over-the-counter antihistamines. 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 Anticholinergics, Antihistamines, Antipsychotics, and Benzodiazepines in this section.

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282. Ray, W. A., Purushottam, B. T., Shorr, R. I. (1993). Medications and the older driver. *Clin Geriatr Med.* 9(2):413–438.

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### Antihistamines

In many patients, the first generation antihistamines (such as diphenhydramine and chlorpheniramine) have pronounced CNS effects. In studies involving healthy volunteers, sedating antihistamines have been shown to impair psychomotor performance, simulated driving, and open-road driving.<sup>283</sup> Furthermore, subjects may experience impairment even in the absence of subjective symptoms of impairment.<sup>284</sup> In contrast, most nonsedating antihistamines do not produce these types of impairment after being taken in recommended doses.<sup>285</sup> Even nonsedating antihistamines may cause impairments if taken in higher-than-recommended doses, however, and one of them (i.e., cetirizine) may be slightly impairing to certain patients in normal doses.

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

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### 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 CNS 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 (i.e., diuretics) should be counseled about the symptoms of electrolyte imbalance and their potential to impair driving performance.

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### 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, dyskinesias, on-off phenomenon, hallucinations, and confusion. (See also Anticholinergics in this section for more information.)

Patients should be counseled about these side effects and advised not to drive if they experience side effects. The physician may also consider referring patients for formal psychomotor testing or for on-road assessment performed by a driver rehabilitation specialist.

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### Antipsychotics

Most—if not all—antipsychotic medications have a strong potential to impair driving performance through various CNS 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.

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283. Ibid.

284. Weiler, JM., et al. (2000). Effects of fexofenadine, diphenhydramine, and alcohol on driving performance. a randomized placebo-controlled trial in the Iowa Driving Simulator. *Ann Intern Med.* 132(5):354–363.

285. Ray, W. A., Purushottam, B. T., Shorr, R. I. (1993). Medications and the older friver. *Clin Geriatr Med.* 9(2):413–438.

### Antipsychotics (continued)

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 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.

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### Benzodiazepines and other sedatives / anxiolytics

Studies have demonstrated impairments in vision, attention, motor coordination, and driving performance with benzodiazepine use. Evening doses of long-acting benzodiazepines have been shown to markedly impair psychomotor function the following day, while comparable doses of short-acting compounds produce a lesser impairment.<sup>286</sup> In contrast, benzodiazepine-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.<sup>41</sup> Recently, reports in the news media and some studies indicate that zolpidem has not uncommonly been found during serum toxicology testing of drivers involved in fatal accidents or arrested for driving under the influence of drugs.<sup>287</sup>

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).

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### Muscle relaxants

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

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### Nonsteroidal anti-inflammatory drugs (NSAIDs)

Isolated case reports of confusion following the use of the NSAIDs phenylbutazone and indomethacin suggest that they may rarely impair driving performance.<sup>288</sup> Recent data reveal an association with motor vehicle crashes, although this could represent the effects of the disease and not specifically treatment.<sup>289</sup> If the patient reports this side effect, the physician should consider adjusting the dosage or changing the medication.

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<sup>286</sup>. Ibid.

<sup>287</sup>. Vermeeren, A., Danlou, P. E., O'Hanlon, J. F. (1999). Residual effects of zaleplon 10 and 20 mg on memory and actual driving performance following administration 5 and 2 hours before awakening. *Br J Clin Pharmacol*. 48:367–374.

Vermeeren, A., Muntjewerff, N. D., van Boxtel, M., et al. (2000). Residual effects of zaleplon and zopiclone versus the effects of alcohol on actual car driving performance. *Eur Neuropsychopharmacol*. 10(suppl 3):S394.

Volkerts, E. R., Verster, J. C., Heuckelein, J. H. G., et al. (2000). The impact on car-driving performance of zaleplon and zolpidem administration during the night. *Eur Neuropsychopharmacol*. 10(suppl 3):S395.

<sup>288</sup>. Jones, A. W., Holmgren, A., & Kugelberg, F. C. (2007). Concentrations of scheduled prescription drugs in blood of impaired drivers: considerations for interpreting the results. *Ther Drug Monitor*. 29:248–260.

<sup>289</sup>. Ray, W. A., Gurwitz, J., Decker, M. D., & Kennedy D. L. (1992). Medications and the safety of the older driver: is there a basis for concern? *Hum Factors*. 34(1):33–47.

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**Narcotic analgesics**

Patients should be counseled about the impairing effects of narcotic analgesics (i.e., 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. However, the literature also indicates that physicians often undertreat pain in the general population and with older adults. Accordingly, physicians should always be alert to signs of abuse. (For more information, see the recommendations for substance abuse in Section 5.)

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**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 5.5.)

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