Upon successful completion of this article, pharmacists should be able to:
1. Identify the key functional elements that are required to ensure competent, safe driving.
2. Identify the side effects associated with prescription, over-the-counter and herbal medications that can pose risks to drivers.
3. Describe the potential impact of certain medication classes on driving competence.
4. Describe the pharmacist’s duty to warn regarding medications that have the potential to impair a patient’s driving competence.
5. Provide counseling points to support safe driving in all patients who are receiving medication.

Upon successful completion of this article, pharmacy technicians should be able to:
1. Identify the key functional elements that are required to ensure competent, safe driving.
2. List side effects associated with the use of herbal remedies, over-the-counter and prescription medications that can pose risks to drivers.
3. Describe the potential impact of certain medication classes on driving competence.
4. Describe situations when the pharmacist should be alerted to counsel patients on the potential of a medication to impair driving competence.

INTRODUCTION
We are all well aware of the impact of drinking and driving through the media coverage of drinking related accidents and through the public service announcements sponsored by law and advocacy groups. Driving while under the influence of alcohol has long been accepted as one of the most important causes of traffic accidents and driving fatalities. Driving under the influence of alcohol has been studied not only in experimental research, but also in epidemiological road side studies. The effort that society has made to take serious legal action against those who choose to drink and drive has resulted in the significant deterrents of negative social stigma and incarceration. Recently, laws in some states were strengthened even further by making driving while intoxicated (DWI) a felony if there is a child in the car.

While the impact of alcohol on driving abilities is well known, there are few epidemiologic studies about the role of herbal remedies, over-the-counter and prescription drugs in motor vehicle accidents. There are some lab experiments in which the therapeutic doses of several drugs have been shown to impair psychomotor skills related to driving. It is also important to note that many medications may potentiate the impairing effects of alcohol and other drugs. Less attention has been given to driving under the influence of medication, whether prescription or OTC medication. Illicit drug use also seems to receive less media attention than alcohol, and is much more difficult to detect. Field sobriety tests and breathalyzer detection systems have been in place for some years to detect alcohol, but as yet
there is no valid test to measure impairment from other substances. Departments of motor vehicles (DMV) across the United States have tried to address this issue, and the New York state DMV medical advisory board tackled the issue of the impact of OTC medications on driving as a specific focus of community outreach years ago. The issue of tracking the absolute impact of medications on driving is difficult unless there is an accident which requires further investigation and confirmatory blood tests that can be evaluated. The question remains, however, whether appropriate use of herbal remedies and FDA approved medications poses a sufficiently significant potential hazard to suggest that these agents should not be used while driving. Researchers must consider that the same dose of a certain medication can have wide variability in both the intended therapeutic action of the drug, but also the side effects for individuals of different ages and states of health. People often drive without adequate knowledge of the degree of impairment their prescribed and OTC medications can have on their driving skills.

Individual differences in the absorption, distribution, metabolism and elimination of medications all cause a difference in the effect of a drug on the body. As we age, these differences become even more pronounced. Coupled with the age-specific decline in physical and cognitive ability to drive and operate machinery, changes of organ function and lean body mass can also play a role in driving deficits as we grow older. However, it is important to note that organ changes can be seen in younger patients with chronic disease and comorbidities conditions as well. The impairment of behavioral, mental and physical functions such as psychomotor performance, visual perception, attention, memory and information processing are all potential issues with medications. Aging in itself is not the key to impairment. However, diseases that are more likely to be experienced with increasing age, such as dementia and other medical comorbidities that can impact physical strength and executive function, are the real factors which must be considered as potential contributions to decreased driving competence. With the number of aging drivers expected to increase over time, these factors must be taken into account. One would expect that medications most commonly associated with sedation, such as sleep medicines and/or sedative-hypnotics, would significantly increase risk. However, even with these well-known offending drugs, the duration and severity of the effects differ between the medications studied, often depending on the half lives, dose, and formulation of the medications.

There has been research looking at the residual effects of benzodiazepines and non-benzodiazepine hypnotics (z-hypnotics), using single dose temazepam 20 mg and eszopiclone 7.5 mg in older drivers. Even though these two medications would be expected to cause significant residual side effects equally, the results of the study do not support this hypothesis. The study reported that single dose temazepam-impaired driving performance in elderly patients until 10 hours after bedtime administration, whereas eszopiclone impaired driving significantly until 11 hours after the dose.

Antidepressants were evaluated for similar effects. In a study of nefazodone, it was found that impairment is the same for both elderly and younger patients. It may be suggested that the testing parameters may not have been sensitive enough to detect effects on specific features of elderly drivers, especially when the same medications have demonstrated moderate impairment in younger subjects. Some studies have examined the effects of chronic use versus intermittent use of benzodiazepines with no difference noted, so caution should be extended even for those who use sedating medications on a regular basis.

Another factor to be considered is that while some drugs known to cause driving impairment can be isolated and avoided, other substances which cause significant impairment are combined with less impairing substances. Alcohol is known to impair driving, but also amplifies what might be minor or insignificant impairment. Multi-ingredient combinations may be perceived by the general population as less dangerous products and sold to patients who would otherwise not use the single source product. An example of this can be seen with OTC products such as the combination of acetaminophen and diphenhydramine, which is marketed for pain relief at bedtime while improving sleep. The diphenhydramine portion of this product is used...
alone as an OTC sleep aid. Other OTC medications, such as anti-diarrheals, can also be very sedating and impairing, so no medication should be considered entirely safe without consulting first with a health care professional. Another well-studied category of impairing medication seen prescribed in combination with other medications is the benzodiazepine class. Research has demonstrated that use of multiple sedating agents, such as duplicate benzodiazepine therapy and benzodiazepines combined with one or more antidepressants increases the risk of traffic accidents, so polypharmacy should be avoided when trying to reduce risk to drivers. On a positive note, researchers have concluded that in some cases, patients comply with recommendations to not drive—especially with opiate medications for pain and sedating antihistamines.

AGE AND DRIVING
The ability to identify hazardous situations, read the road and navigate the environment while driving are essential components of safe driving. A requirement for safe driving is the integration of high-level cognitive function and perception with coordinated physical activities. "Driving Fitness" is a balance between safety and mobility, and it is important for society to identify factors that reduce the fitness of certain drivers. The function of driving can be seen as the ultimate activity of daily living (ADL) in our current environment. However, it can be the most challenging competency to sustain in that it requires the highest level of integrated visual, motor, and cognitive functions.

WHAT IS REQUIRED FOR SAFE DRIVING?
Cognition Competence
Cognitive competence requires being able to receive, filter, and assimilate information that is critical to driving tasks, such as turning in time to avoid danger, maneuvering the vehicle concurrently and detecting dangerous conflicts. It also requires being able to focus one’s attention on the most critical information while filtering out the extraneous, less important distractions such as being able to see a red light as a warning with discrete meaning when compared to a streetlight without meaning.

Visual Attention
Visual attention is defined as the selection of visual stimuli based on location in space. This is a key function for detecting road side targets, and impairment in this category can be a reliable early indicator of many disorders including, but not limited to, dementia. Tests to determine the intactness of visual attention are available to specialists, however, are not widely available to most general practitioners.

Visual attention requires being able to pay attention to peripheral objects and their position in space and time, while maintaining one’s ability to reach one’s destination. This would be manifest by being able to see pedestrians on the side of the road while still avoiding a collision with a vehicle in front of you which is stopped at a stop sign. Visual attention also requires being able to retrieve information from one’s field of vision for further analysis in order to respond appropriately to the stimulus. Further, visual attention requires the ability to focus one’s gaze on a target containing important information and filter it out from other visual background noise to anticipate problems and see ways to avoid conflicts. It also requires being able to detect landmarks, information for direction or orientation in space and time, and the ability to organize information received through the visual sensory means so that it is identifiable.

Visual Perception
Visual perception is defined as the extraction and appropriate interpretation of visual information. Intact visual perception is required to read and understand traffic signs, to establish correct orientation while on the road, and to maintain stability in directions on the road. Abnormal detection of line orientation, altered visual perception, and impaired recognition of traffic signs have all been implicated in motor vehicle crashes, and have been linked to Lewy Body dementia. Visual perception requires the driver be able to shift visual focus from the automobile’s dashboard display back to the road quickly and effectively to ensure safety and driving competence. There is also the need for vision to be corrected when there is a case of diagnosed nearsightedness or farsightedness. The vision tests performed at the state DMV are just one small step in the identification of drivers who may be at baseline risk of visual deficits. Other visual factors include being able to interpret the speed of
cars approaching our vehicles, intersecting our paths, or when weather and light conditions change.

**Executive Function**

Executive function is defined as the ability to adapt to new situations effectively. This high level of brain function requires anticipation, planning, and effective performance. Impairment in this cognitive domain can be expressed through personality changes, altered insight, and decreased impulse control. When operating a motor vehicle, an individual with executive function impairment may respond by overestimating their driving skill or by making dangerous decisions and may lack insight. Many factors, including medication therapy, can affect executive function. This ability to reason and make decisions allows one to accurately choose within a range of possibilities a safe appropriate action. This executive function becomes extremely significant when an unexpected event occurs and it allows the individual to take action to keep him/her and passengers safe. Additionally, there is a factor of vigilance, which is one’s ability to maintain focused attention for a long period of time, for example, while driving long distances or on monotonous routes that can induce boredom or sleepiness.

**Memory (procedural, semantic, and episodic)**

Memory is defined as the acquisition and coding of information for use by the brain at a later time. Episodic memory, though not required for driving in a familiar location, is generally the first phase of compromise seen in dementia. Semantic memory, conversely, includes global knowledge of the world, such as a green light equating to “proceed” versus red for “stop.” Procedural memory is the application of a learned skill, such as turning off the car when parking or using a clutch when engaging the gears in a car with a standard transmission. Semantic memory and procedural memory are affected later in the progression of dementia and Alzheimer’s disease.

**Physical Competence**

A driver must possess intact muscle strength and tone in order to perform the extremely physical task of driving safely and effectively. Any impairment in this coordination and balance can lead to slowed reflexes and increased reaction time. There can be slowed physical movements related to physical and mental illness—called psychomotor retardation, and this must be evaluated fully to ensure the driver can manage to perform the required task should he/she be disabled or impaired in other ways. Specific physical tasks include, but are not limited to, pushing the brake and gas pedal—and being able to move one’s foot quickly to the correct pedal. Further, it is necessary to be able to demonstrate a sufficient range of motion when turning the head to the rear in order to back out of a parking spot or to be sure there is no vehicle in the blind spot prior to making a lane change on the highway. The act of turning the steering wheel sufficient range and speed is also a necessary physical requirement for safe driving.

There has been a significantly increased interest in elderly drivers. This interest has resulted from population and travel trends. Driving a car is the most common method of travel for elderly people in the United States. A driver’s license represents independence and evidence of continued competence, in addition to the right to operate an automobile. That said, the elderly drive less with increasing age. In the United States, those over 65 years of age drive less than half the average of all the miles traveled by other age groups.

Elderly drivers tend to compensate for age-related decreases in driving capabilities by modifying their driving habits, such as shifting to driving during the day to avoid night driving and its associated risks of reduced night vision and glare. Further, there is more purposeful avoidance of rush hour and high traffic times, bad weather and unfamiliar travel routes. While the focus on the older driver has been highly sensationalized in the media, not all driving issues are related to aging. Here are some issues related to younger drivers that can be worsened with medications that can cause driving impairments:

- Less experienced drivers can have reduced capacity to drive once darkness falls. Even under conditions where no medication is involved, the less experienced driver’s automatic reflexes and driving skills are in the early developing stages during the first months of driving. Darkness is an extra variable for the young driver to cope with.
• Less experienced drivers can be more easily distracted and more willing to operate within an environment of distraction (such as when driving with friends.) Teens are safer driving either by themselves or with family. One strategy to ensure young drivers acquire good skills is by shadowing an experienced driver as a mentor who can model responsible behavior and driving habits.
• Less experienced drivers may not understand the importance of wearing a safety belt and avoiding driving just for fun. New drivers should try to gain their experience driving for school and work, especially during the early stages of learning. This practice should focus on the road and not allow distraction by cell phones, texting, drinking and eating.
• Less experienced drivers are more likely to believe they are invincible and not impacted by drowsy driving. A key part of learning to drive should be how to respond to any sleepiness, especially a state made worse by medications. Sleepiness may cause even more accidents than alcohol and is often underestimated.
• Less experienced drivers must be taught about the dangers of driving and drinking alcohol or taking medications. Alcohol will impair the judgment and reaction time of anyone who drinks. Abuse of prescription and OTC medications can be even more dangerous than alcohol. Young adults may be more likely to experiment with Food and Drug Administration-approved medications, and evidence of misusing standard medication therapies, such as dextromethorphan, is on the rise. This trend of abusing what is perceived as “safer” drugs over illicit and more “traditional” drugs such as marijuana or cocaine, has given some youth a false sense of safety in driving under the influence of these substances.

POTENTIAL RISKS OF PRESCRIPTION, OTC AND HERBAL MEDICATIONS
A significant issue we must be concerned with is the impact of medication on the ability to drive safely. The cognitive process of decision making that is necessary to ensure that we arrive at our intended destination is just one of the many factors to consider in driving safety. Decreases in one’s ability to process information, whether due to an age-related decline in cognition or due to the influence of drugs, make safe arrival at one’s destination less likely. A decrease in cognitive processing impacts an additional factor in driving, spatial ability. This further complicates navigation by limiting one’s ability to extract information from maps and also to predict the time needed when stopping or turning.

Restricted visual fields can create yet another challenge by altering one’s ability to correctly read road signs and to recognize landmarks. Psychomotor retardation, defined as slowed physical movement, is a frequent side effect of certain medications and this adverse effect further reduces one’s ability to respond quickly to urgent situations that frequently occur while driving—such as the need to brake in order to avoid a crash, to navigate in icy or other hazardous weather conditions, and to maneuver through sharp turns on tight curvy roadways. Medication may not directly impact visual fields; however when peripheral visual fields are compromised either by age or other health conditions, the side effects of medication can worsen one’s overall driving competence.

Multiple medications that are prescribed in combination with each other (polypharmacy) increase the chances of adverse drug reactions and of a greater difficulty in an accurate identification of the medication causing the problem. Whenever possible, and only if it is necessary to use polypharmacy, it is best to add a single new drug to a current regimen so that the first dose effect of the combination can be safely monitored. A prescriber and pharmacist should always work together to reduce the number of medications a patient is on, as even the most sophisticated pharmacokineticist cannot predict the exact metabolic impact of multiple agents through various competing enzymatic systems. We are also learning more about ethnic predisposition and the resulting altered clearance of medications, which poses yet another nuance of uncertainty for our patients.

Although driving under the influence of any substance which alters perception and judgment must be avoided, it is a clear dilemma for a physician to avoid prescribing any and all agents that may pose such a risk. In today’s world, personal transportation is a minimum daily activity in which we must engage, and it is unrealistic for a
prescriber to make recommendations to avoid this activity while taking medication long term.

Previous efforts to maintain the driving skills of aging adults have included modifying the driving environment, improving and offering educational programs and enhancing vehicle design. Ostrow’s research group explored the effects of physical fitness training on the driving performance of older adults. The results demonstrated that increased shoulder flexibility and trunk rotations allowed the driver a better score when measured while driving. Thus further underscoring the need for the physical strength needed to properly handle a vehicle.

**CHRONIC DISEASE TREATMENT AND DRIVING COMPETENCE**

A common health condition that requires chronic medication is diabetes, which is well known to carry significant long term, serious sequellae. The outcome of experiencing a hypoglycemic state can significantly impair one’s ability to drive, so caution must be given to administration of insulin and other medications that can cause hypoglycemia. Diabetic hypoglycemia can translate into impaired cognitive motor function, which is assumed to increase the risk of motor vehicle accidents. The results of driving simulators under conditions of varying blood glucose measures provided further support that hypoglycemia can cause significant impairment. Driving performance was not altered with mild hypoglycemia, nor was there a difference when a patient was recovering from low blood glucose. However, when moderate hypoglycemia was present (a value defined as 2.6 mM or 47 mg/dL or less) there was disrupted steering, more swerving and time over midline and off road. There was also observed compensatory slowing and more very slow driving. In Figure 1, we see what the mmol/L is equivalent to the mg/dl measure.

In Europe we see that the government has progressively restricted driving permits for people with insulin dependent diabetes, while the United States has loosened its restriction. A key barrier for confirming the effect of hypoglycemia on driving has been the inability to assess driving performance, as actual driving exercises are not feasible or ethical because of difficulties controlling and replicating conditions among study subjects. When considering the elements of driving performance we look at steering and speed control and the factors affecting these. Thus, we consider the smoothness of braking (which requires adequate pressure on the brake pedal), smoothness of acceleration (which requires controlled foot pressure on the gas pedal), speeding (as defined by seconds driving with 10 percent greater than posted speed), versus slow driving (by seconds driven at less than 30 percent of posted speed limits). These variables can all add up to erratic operation of the motor vehicle and increase the chances of a crash. The Cox study found that mild hypoglycemia (3.6 mM or 65 mg/dL) and recovery from brief moderate hypoglycemia were not associated with impaired driving performance when measured during brief testing. However, moderate hypoglycemia was associated with impaired performance. The impairment was seen in 35 percent of the study subjects and primarily affected steering. Of those studied, 55 percent did not expect to be impaired and stated that they would be willing to drive under these same conditions. The significant increase in very slow driving may be a compensatory effort used by patients who felt some level of impairment. The research group recommends that people should be instructed not to drive without treating blood glucose below 3.6 mM or 65 mg/dL. Pharmacists should discuss with patients who experience hypoglycemia what their plan is to identify symptoms prior to driving, while operating a motor vehicle and to subsequently treat hypoglycemia.

When we consider the effects of diabetes-

<table>
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<th>Mg/dL</th>
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<th>Comparison of Blood Glucose values</th>
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related hypoglycemia on our patients, we should also consider the potential of any drug to cause drug induced hypoglycemia in non-diabetes patients, including (but not limited to) quinine and sulfamethoxazole. Also consider beta-blocker therapy, which may mask tachycardia associated with hypoglycemia. Another disease state, arthritis, may pose disease specific limitations—with altered joint performance and pain—but also the side effects of medications used for palliative treatment of the condition.

**EFFECTS OF FIRST DOSE MEDICATIONS**

It is important to note that any first dose of medication should be taken in a controlled environment to ensure that the patient is not allergic to and/or impaired by the new substance. Even medications that have a low risk of causing drowsiness or dizziness in most of the population can result in significant impairment in certain patients, often without warning. While we explore the categories of the medications available, it is important for pharmacists and physicians to remind their patients of the first dose phenomenon of all new medications and for dose changes to pre-existing medication regimens.

**MEDICATION AND DRIVING COMPETENCE**

The following reviews a sample of the more commonly prescribed drug classes used in ambulatory care settings. For a comprehensive review of all medication American Hospital Formulary Service (AHFS) categories and specific drug events within these classes, please refer to the AHFS *2011 Red Book*.

**Antihistamines**

We begin the exploration of the potential adverse effects of medication on driving with the first category of medication in the AHFS listing—antihistamines. First generation antihistamines, such as diphenhydramine, chlorpheniramine, brompheniramine and doxylamine are well known for their sedating effects. The second generation antihistamines are marketed as “non-sedating” antihistamines and, consequently, people purchase these brands to avoid the effects of drowsiness. It is important to note that even these newer non-sedating agents can still cause drowsiness and dizziness in many patients. Examples of second generation antihistamines include loratadine, fexofenadine, and cetirizine.

**Antihypertensives**

While no consistent neuropsychological changes have been observed with diuretic therapy or treatment with ACE-inhibitors, there have been clinical reports of drowsiness and psychomotor retardation with beta blockers. However, researchers have shown that the overall effects of beta-blockers on neurological function are few and are offset by the benefits of reduced blood pressure. Note that the hypotensive effects of all antihypertensives can lead to dizziness in the driver and warrants warning, especially with first doses or changes of medication. Alpha-2 agonists such as clonidine and guanfacine can be sedating, but also can alter sleep architecture by decreasing REM sleep and has been reported to cause insomnia. The effects of insomnia on patients can be a significant contribution to excessive daytime sleepiness and increased driving risk.

**Anti-infectives**

Another category of medication to be evaluated is the class of anti-infectives. Pharmacists may fail to consider this group of medications as potential contributors to increased driving risk, but many of these medications have documented adverse effects that can be problematic. Anti-infective products that are available for parenteral administration (IM or IV) only have been excluded from the summarized review due to the lower probability of a driving while still under the influence of these agents when administered as injections.

**Cephalosporins:** The central nervous system effects that have been reported following oral and intramuscular administration of cephalosporins include dizziness, headache and vertigo. However, some patients have reported the opposite effect, such as nervousness and anxiety. Alterations in color perception and somnolence have also been reported. Altered color perception could be considered a significant risk when one approaches an intersection with a green or red light, or even a stop sign that triggers our mental process to use our brake when we
recognize that color code for traffic control.

**Macrolides:** Though rare, drugs such as erythromycin, azithromycin, clarithromycin, and telithromycin have been reported to cause dizziness, vertigo and somnolence (ranging from 1–4 percent and dependant on the dose and indication of the antibiotic). The use of long term high dose azithromycin has resulted in reports of reversible hearing loss in roughly 5 percent of patients. Hearing loss and tinnitus are reported to resolve within five weeks of discontinuation of the medication. Clarithromycin has also had documented reports of confusion, tinnitus and tremor.

**Fluoroquinolones:** This class of medication, including ciprofloxacin, levofloxacin, moxifloxacin, and gemifloxacin is associated with an increased risk of tendonitis and tendon rupture for all age groups. Though tendon injury is seen more often in those over 60 years of age and those who are more physically active, patients who are not within these risk categories should also be counseled about this possible injury. Tendonitis and tendon rupture cause pain, decreased agility and decreased strength. The more common tendons affected are the shoulder, hand and Achilles tendon. Each is involved in the strength and reflex abilities required by competent drivers. The central nervous system (CNS) effects of ciprofloxacin are related to the GABA inhibiting action of the fluoroquinolones, so CNS stimulation can be expected, including tremor, nervousness and confusion. Some patients, however, do still experience sedation with this group of antibiotics. Additional reports of altered glucose control has been reported, causing either hyper or hypoglycemia, so diabetes patients receiving insulin or oral therapy should be cautioned about this potential impairment when driving. In general, maintaining blood glucose control during an infection requires close monitoring.

Sulfonamides, tetracyclines and antifungal anti-infective agents all exhibit central nervous system side effects for patients with varying degrees of incidence and intensity. It is imperative that pharmacists review the package inserts prior to dispensing so that proper consultation may be provided.

**Antiretrovirals:** The most common adverse CNS effects related to decreased driving potential in patients receiving these HIV therapies include insomnia, peripheral neurologic symptoms, dizziness and myalgia. Patients should be counseled on the specific drug regimen they are receiving. Many of these antiretrovirals have the capacity to increase the drug concentrations of other sedating medications, so extreme caution should be employed when providing combination therapy to HIV patients.

**Autonomic Agents**

**Parasympathetic (cholinergic) agents**
Parasympathetic (cholinergic) agents such as donepezil, galantamine and rivastigmine are agents used in Alzheimer’s disease. They can cause dizziness, drowsiness and tremor. The illness itself poses the danger of significant cognitive decline, which ultimately irreversibly impairs one’s ability to drive. Deficits in memory and executive function are so significant that patients often become progressively homebound and unable perform the basic activities of daily living (ADL). In the case of these supplemental medication therapies, it is best to counsel patients and their caretakers on the anticipated decline in function and the use of caution when using any medication that can compound memory deficits.

**Anticholinergic agents**
Many medications are known to cause undesirable effects and primary care providers may overlook the role a drug may play in causing cognitive impairment. Acetylcholine is a key neurotransmitter which can produce significant side effects when its action is blocked or altered. The current debate among health care providers questions the impact of one medication with pronounced anticholinergic effects or a cumulative consumption of multiple agents with varying degrees of anticholinergic properties. No one can question, however, the cognitive impact of anticholinergic agents. Some research has looked at the long-term use of these products and the cumulative exposure linked to poor memory in older men and found a correlated negative long term effect so caution is advised.

Researchers at Harvard Medical School developed a scale to assess the anticholinergic cognitive burden and have rated drugs by giving
scores ranging from 1 (if there were possible anti-
cholinergic effects based on lab simulation but no
clinical relevant cognitive effects) to 3. (See T able
1.) Scores of 2 or 3 were given if the drug had
established and relevant anticholinergic effects.
Drugs without any noted effect were not named.
This anticholinergic cognitive burden scale
is intended to serve as a tool for practitioners to
add up the scores of the multiple drugs a patient
is taking. In cases where the summed score is 3
or more, it would be advisable for the medication
regimen to be reviewed in order to recommend
medications with lower anticholinergic profile and
a reduced overall anticholinergic cognitive burden.

Other medications in this same AFHS cat-
genory include antimuscarinic, antispasmodics
(such as scopolamine), sympathomimetic (ad-
renergic) agents such as clonidine and methyl-
dopa, beta agonists such as albuterol, sympa-
thomimetic (adrenergic) blocking agents such
as the non selective beta-blockers (propranolol),
cardioselective beta-blockers (atenolol and
metoprolol), and skeletal the muscle relaxants
carisoprodol and baco1fen. All of these agents
have drowsiness and dizziness as frequently
documented adverse effects.

Central Nervous System Agents

Analgesics: The category of pain relievers
has a vast array of mechanisms of action and
potential adverse effects. While many medica-
tions, such as acetaminophen and aspirin, are
less likely to cause drowsiness than some of the
other agents in the same class, there are considera-
tions such as aspirin induced tinnitus that must also be fac-
tored into reduced driving competence. The non-steroidal
anti-inflammatory agents (such as ibuprofen) are not as
sedating as their opiate counterparts, but they still may
pose risk of dizziness.

Opiate agonists: The opiate agonists such as morphine,
codeine, oxycodone, hydrocodone, hydromorphone, metha-
done, fentanyl, butorphanol, meperidine, and tramadol have
a well-established profile of side effects which impair driving
ability. A 2007 random-stop roadside survey by the National
Highway Transportation Safety Administration found that
5 percent of drivers tested positive for medications which
could cause impairment. A Swedish study of drivers arrested
for drugged driving detected morphine or codeine in 19
percent of the 14,000 arrested subjects. It can be difficult to
predict the degree of impairment expected based on serum
level, and tolerance is an unpredictable mitigating factor.

Patients beginning opioid therapy must be counseled
to avoid driving following the first few doses to properly
assess the effects on reaction time, wakefulness and
attention. A low risk of driving impairment may be ob-
served in opioid tolerant patients on stable doses in stable
condition. Opioid tolerant patients should be cautioned
that a dose increase may impair driving. Likewise, inap-
propriate dose reduction or other events which precipitate
withdrawal symptoms may impair driving. Common side
effects of opiate agonists which lead to impaired driving
include somnolence, lethargy, dizziness and hallucination.
Reaction time is slowed and attention span is shortened.
Symptoms of withdrawal which lead to impaired driving
include agitation, muscle aches and cramping.

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<td>2</td>
<td>some relevant anticholinergic potential amantadine, belladonna alkaloids, carbamazepine, loxapine, oxcarbazepine, pimozide, cyclobenzaprine, cyproheptadine, meperidine</td>
</tr>
<tr>
<td>3</td>
<td>definitive anticholinergic potential Amitriptyline, amoxapine, clazapine, desipramine, doxepin, imipramine, nortriptyline, olanzapine, paroxetine, perphenazine, thioridazine, trifluperazine, trimipramine, flioxavate, oxybutynin, tolterodine, procyclidine, orphenadrine, benzotropine, carboinoxamine, chlorpheniramine, clemastine, dicyclomine, dimenhydrinate, hydroxyzine, meclizine, trihexyphenidyl, scopolamine, promethazine</td>
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**Benzodiazepines:** Benzodiazepines such as alprazolam, clonazepam, diazepam and lorazepam, have a wide range of adverse effects, ranging from the well-known sleep inducing effects to the less considered lack of coordination. Single dose and short-term studies have even demonstrated altered ability to learn visual and verbal information as well as psychomotor retardation and lessened vigilance. Supportive research demonstrates improved cognition upon the withdrawal of these medications from the regimen of elderly patients. The best way to avoid driving impairments is to educate patients about the risks of using benzodiazepines when driving, especially when used in combination with other central nervous system depressants, and to only use short acting agents at the lowest doses during times outside of driving.

**Anticonvulsants:** The neuropsychological effects of this medication class are complicated by not only the effects of the targeted seizure disorder, but also the individual differences in the metabolism of these drugs. The antiepileptic drugs can be ranked on their intrinsic ability to cause drowsiness. Carbamazepine has fewer reports of sedation than phenytoin or phenobarbital. However when factors of serum concentrations differences and impact of drug interactions must be considered it becomes very challenging for the prescriber and pharmacist to predict the degree of risk. When evaluating this total impact on driving competence, the dose, duration of treatment and subjective complaints of sedation must be considered.

**Psychotherapeutic Agents**  
**Antidepressants:** This class of medication is well known for the first dose effects of drowsiness and dizziness. Discontinuation of antidepressants also causes dizziness in many patients. The agents within the class vary in their potential contribution to this effect, however. Tricyclic antidepressants are highly anticholinergic as compared to the SSRI medications, such as paroxetine and sertraline. While the SSRIs are not anticholinergic, they are frequent offenders responsible for lightheadedness and dizziness. To avoid problems while driving, a pharmacist should recommend an agent with the least anticholinergic properties and use caution to observe potential additive effects of multiple medications with potential impairing qualities.

**Antipsychotics:** The prescribing of antipsychotic medications has been expanded for treatment beyond the diagnoses of psychosis and schizophrenia. Research, labeling changes, and promotion for use as augmenting agents for refractory depression and for insomnia has brought a greater reach to a broader population taking these medications. First generation antipsychotic agents, such as haloperidol and fluphenazine, have been burdened with the primary side effect of dystonic reactions and muscle spasms due to the inhibition of dopamine in the nigrostriatal system. Extrapyramidal symptoms (EPS) have made adherence and tolerance of this class of antipsychotic agents a challenge for the psychiatric community. While this muscular side effect is notable and may impact the physical ability of a person to operate a motor vehicle safely and competently, it is the sedation and light headedness that pose the greatest risk. The potential to cause cognitive effects within this class may be related in part to the anticholinergic properties, however even those agents with lower anticholinergic burden have been reported to cause impaired cognition.

Second generation agents are also known as the atypical antipsychotic agents and have become a popular choice over the first generation agents due to the reduced potential of extrapyramidal side effects. The impact of sedation, dizziness and hypotensive effects of medications such as aripiprazole, quetiapine, risperidone and olanzapine continue however to pose risks to drivers who are taking these medication. Further, the FDA has included a class effect warning for all these agents for the potential to cause metabolic syndrome and diabetes. In the case of any blood sugar changes, there can be significant impairment in judgment and autonomic stability.

**Sedatives and Hypnotics**  
Many adults in United States have reported some level of daytime sleepiness sufficient to have negatively impacted their lives. While we strive to be productive in our professional and personal lives, many of us operate in a sleep-deprived state. Cases in which excessive daytime sleepiness which is self inflicted, perhaps
by long hours at work or studying, the resolution is simply increasing one’s amount of sleep. However, when excessive daytime sleepiness is caused by other reasons, such as insomnia, the solution is more challenging. Improved sleep hygiene and clear diagnosis of the source of the insomnia is key. However, medication is often the only intervention to help individuals resolve their excessive daytime sleepiness.

It is estimated that sleep disorder and related complications contribute to more than 100,000 motor vehicle crashes, resulting in 71,000 personal injuries and 1,500 deaths annually. Sleep-related motor vehicle crashes tend to involve the driver falling asleep in almost 18 percent of these reported cases, and young adult male drivers are noted to be the most likely to be involved. It is difficult to get a clear sense of the impact of medication in these events, but the role must be considered when investigating the events for future safety recommendations.

While it seems counterintuitive, some of the medications used to alleviate insomnia can cause other sleep problems. Most sleep medications decrease sleep latency, which is defined as the time to fall asleep. Most medications used to treat insomnia can alter the sleep architecture, which in turn can lead to continued sleepiness during the day and, hence, impaired driving ability.

Some individuals seek to overcome excessive daytime sleepiness caused by medication therapy by using stimulants such as amphetamines and caffeine. When overused or used inappropriately, stimulants can cause significant lightheadedness.

The newer sleep medications have been launched touting an improved side effect profile, chiefly, less next day lag-over effects of the drug. While drug half life plays one role, metabolic differences exhibited can be the primary factor to consider in predicting the possible negative impact on alertness and driving behavior the next day. Manufacturers of the z-hypnotics and benzodiazepine agonists have been required to include in their FDA packaging label the warning of possible driving without memory. Also recommended is that a person plan to get a full eight-hour rest when taking medications to induce sleep, as opposed to taking these agents for short naps. The Epworth Sleepiness Scale and Stanford Sleepiness Scale can be helpful tools that the pharmacist can recommend to physicians to screen patients for excessive daytime sleepiness if presenting with this chief complaint.

Modafinil has emerged as a safer medication intervention to treat excessive daytime sleepiness due to the improved side effect profile over the older stimulant medications which include dextroamphetamine, methylphenidate, and pemoline. However, even this agent can cause lightheadedness. Pharmacists may also see an increased use of modafinil over the older standard therapies because of the reduced (though not absent) potential for abuse. Some of the side effects of the older stimulant medication interventions include tremor and agitation. There has been limited research evaluating the potential contribution of medications that cause agitation on aggressive driving or “road rage.” However, to ensure total medication safety, further research in this area is warranted.

A prescribing physician in partnership with a pharmacist should observe, discuss, and document adherence to prescribed medication therapy, especially for patients who have careers which require responsibility for the safety of others such as school bus drivers, airplane pilots and those with history of accidents related to previous excessive daytime sleepiness. Failure to adhere to the medication instructions which further poses risk for safe driving should be documented, and the patient should be educated about the shared societal obligation to make our roadways safe.

It is important to remember that alcohol is considered a drug and is associated with excessive daytime sleepiness, and is the most widely used substance with sedative effects. Pharmacists must always consider and counsel patients on the confounding effects of alcohol on medications with known potential somnolence effects. It is also critical for clinicians in the field to consider the impact of illicit drug use, such as amphetamine or cocaine abuse, on daytime sedation and impaired driving competence.

When individuals seek treatment for insomnia, they anticipate that medication will help bring refreshed sleep and reduced next day sleepiness. However, many medications used for sleep can cause next day lag-over drowsiness due to the altered sleep architecture. Intact sleep architecture requires a defined, progressive
percentage of time spent in structured sleep stages. If an individual gets too little sleep, or if sleep is interrupted, these critical stages of sleep are not experienced and therefore complete physically and mentally restorative sleep cannot be attained. Many medications can improve the time to fall asleep, but due to the deviation from the natural required staged sleep architecture, this sleep medication leaves most feeling “hung over” the next day. Additionally, the newer z-hypnotic agents have a more rapid onset and shorter duration of effects compared to older therapies; though it should be noted that eszopiclone has longer duration of effects.

In the case of chronic administration of these agents, patients may be at risk of withdrawal if abruptly discontinued. Withdrawal syndromes can also cause driving impairment, including adverse effects such as tremors, convulsions, fatigue, flushing, lightheadedness, nervousness, and panic attacks. Altered driving competence can be a result of drug induced unsteady gait, confusion, disorientation, and significant cognitive and psychomotor impairment which can be observed within one to five hours following zolpidem doses of 10–20 mg. Memory impairment, which is measured by learning, recall, and recognition of words, pictures, and numbers; psychomotor slowing; reduced capacity to sustain attention and impaired balance due to ataxia and dizziness have been reported. Visual disturbances and a reduced ability to estimate time and distance have also been reported. Dose-dependent psychomotor impairment can be caused by hypnotic drugs and can be found up to five hours after a single 15 mg oral dose of zolpidem. Memory and learning impairment can be found up to eight hours following a 10–20 mg dose.

There has been no significant residual effect on memory or actual driving when subjects have been tested the morning after a single 10 mg dose of zolpidem. Following a single 10–20 mg dose of zaleplon, studies have shown no continued effects on actual driving after five to 10 hours or on body sway, reasoning, retrieval and spatial memory after four to nine hours. However, significant impairment has still been reported within one to three hours of taking a dose of these medications. The drug manufacturer recommends that patients be warned about the potential impairment of mental alertness and motor coordination, which is required when operating machinery or driving a motor vehicle.

**MEDICATIONS WITH MEDICAL AND RECREATIONAL USES**

Dextromethorphan: is widely available as an OTC antitussive medication for temporary relief of coughs caused by minor throat and bronchial irritation. A recent trend among young adults exploring sources of euphoric effects has been the recreational use of dextromethorphan. At recommended doses, dextromethorphan produces little or no CNS depression. At recreational doses, positive effects may include acute euphoria, elevated mood, dissociation of mind from body, creative, dream-like experiences, and increased perceptual awareness. Other effects include disorientation, confusion, mydriasis, and altered time perception, visual and auditory hallucinations. Recreational doses of dextromethorphan are approximately 100–200 mg. This dose is reported to produce mild, stimulant effects. Doses of 200–500 mg produce a more impaired effect, and 500–1,000 mg may result in hallucinations and a mild dissociative reaction with an overall disturbance in senses, thinking and memory. Misuse and abuse of dextromethorphan will impair the user’s judgment, memory, language, and other mental performances related to driving safely.

**Marijuana**

Prevalence of treating a variety of symptoms with marijuana means pharmacists and health care providers must be prepared to counsel the patients seeking information about drug interactions and adverse effects. Dronabinol is a synthetic tetrahydrocannabinol (THC) and the only FDA-approved cannabinoid product. The manufacturer of dronabinol recommends that patients using this medication should be educated to avoid operating a motor vehicle until they are able to tolerate the drug and perform such driving tasks safely. Epidemiology data from road traffic arrests and fatalities indicate that after alcohol, marijuana is the most frequently detected psychoactive substance among driving populations. Marijuana has been shown to impair performance on driving simulator tasks and on open and closed driv-
ing courses for up to approximately three hours. Decreased car handling performance, increased reaction times, impaired time and distance estimation, inability to maintain road navigation, travel orientation, subjective sleepiness, motor in-coordination, and impaired sustained vigilance have all been reported. Paradoxically, some drivers may actually be able to improve performance for brief periods by overcompensating for self-perceived impairment. The greater the demands placed on the driver, however, the more critical the likely impairment. Marijuana may particularly impair monotonous and prolonged driving in particular. Decision times to evaluate situations and determine appropriate responses increase. Mixing alcohol and marijuana dramatically intensifies effects of the combination than with either drug on its own. Furthermore, it is important to recognize the increased bioavailability of inhaled marijuana over the oral and that the potential impairment will be based on the dosage form the patient is using.

HERBAL REMEDIES
All medications have potential side effects, and herbal products offer no improved safety over the FDA-approved drug therapies. Herbal remedies, also known as complementary alternative medications (CAM) are often revered by patients for their "natural" ingredients and "safety" profiles. The risk of unexpected adverse effects can be potentiated by the age and health of the patient; however, the side effect possibilities may be less well known than those that are regulated by the FDA. Further, doses of herbal products may vary in strength and quality, differing between manufacturing lots or within the same bottle being purchased by the patient. There are also concerns about contamination and adulteration of herbal therapies with pesticides and microorganisms which would otherwise remain unknown to the public without the high level scrutiny as is given to FDA approved medications. The impact of such variability and contamination cannot be measured in terms of driving capacity, but clearly an increase in sedative side effects or cognitive impairment adverse actions can be considered an additive risk.

Unlike FDA-approved drug products, herbal remedies are not labeled with standardized drug information providing dosing guidelines, common adverse effects, contraindications and side effects observed during research. However, it is important that we remember that the package insert is continually updated to reflect post marketing surveillance on side effects and other emerging safety information.

Clear, concise reporting of the post marketing “patient experience” on all prescription and non-prescription agents becomes even more important as we move ahead in our advocacy for safer driving recommendations related to drug therapy. Of additional concern is the impact on drug interactions that increase adverse effects and should be considered whenever driving while medicated. Recognizing the adverse effects of herbal therapies is more challenging and the reporting of these events is infrequent. Unlike the required reporting which is in place for manufacturers that produce FDA-approved medications, adverse event reporting instruction is not required for makers of herbal medication products. Patients who wish to report an herbal remedy adverse event may use MedWatch and the toll-free reporting hotline, 1-800-FDA-1088. Though the most common general reactions involve the liver and gastrointestinal tract, herbal drugs can cause significant neurologic effects such as dizziness and drowsiness and play a role in the impairment of drivers.

POTENTIAL FACTORS LEADING TO INCREASED IMPAIRMENT
Smoking Cessation
Many medications, including sedating antipsychotic medications, are extensively metabolized by the liver, mainly by the CYP 1A2 enzyme system. It is well documented that products of incomplete combustion called polycyclic aromatic hydrocarbons (PAH) are found in tobacco smoke and induce this same enzyme system. For this reason, smokers who take medications that rely on the 1A2 metabolic pathway will have lower plasma concentrations of these agents compared with their non-smoking counterparts. Smoking cessation has been shown to increase the incidence of side effects of the medications that are metabolized via this hepatic metabolic pathway.

This increase in side effects occurs as a result of increased serum concentrations of these drugs when the in-
duced CYP1A2 enzyme returns to the baseline metabolic rate as a result of the removal of PAH upon smoking cessation, despite no change in prescribed doses (See Table 2.). The addition of nicotine replacement to the patient’s regimen will help reduce the withdrawal from nicotine, but will not lessen the impact of the metabolic consequences and increased serum concentrations of drugs affected by the 1A2 enzymatic pathway.

**Drug Interactions**
Pharmacokinetic interactions occur when combinations of drugs, or a drug and another substance, result in a change in the way the body affects a drug. In other words, how the combination affects drug absorption, distribution, metabolism, and elimination (ADME). An example of this was discussed earlier with the metabolic consequences of smoking on the 1A2 enzymatic system.

Pharmacodynamic interactions occur when the drug affects the body, such as a confounding effect of bone marrow suppression with carbamazepine and clozapine. The combination of these two medications creates a more intense risk of adverse effects than either drug alone, and cannot be otherwise explained by metabolism through the liver. Polypharmacy, in the absence of enzymatic pathway competition, may pose an increased risk of pharmacodynamic interactions, which result in elevated serum concentrations and intensified adverse effects of the drug.

**PHARMACIST DUTY TO WARN**
How far should we go with the duty to warn patients about driving risk? It is key for pharmacists to know the likelihood, by percentages, for certain medications to cause increased driving risk.

As we consider our elderly patients, we must take into account the impact of the multiple-medication regimens they are taking and balance this with the proposed legislation for renewed driving testing for ensured competence. It is unlikely that we can make our elders go on a “drug holiday” so they can pass their test, so let’s use our best efforts to reduce the total number of medications for these individuals. Increased risks of falls and hip fractures have been identified as a medication issue for all those involved in treating geriatric patients. Certain guidelines in long-term care, such as the Beer’s list, ensure that this real risk is considered. Medications such as muscle relaxants and antihistamines can be expected to reduce one’s ability to operate motor vehicles. However it may be those medications less likely implicated in impairment that may pose greatest risk due to the less prominent warnings and consultations.

How can we keep our patients safe? Some suggested things to consider when counseling your patients in order to fulfill your duty to warn:

- For patients who are in high risk driving occupations or for those who have specific concerns about driving, pharmacists must advocate that the patient seek advice and ask for specific warnings that could impair driving competence. Pharmacists can assist patients by providing medications that pose less risk of driving impairment. Most OTC medications will also provide warnings in their packaging about driving risk and altered sense of alertness. Providing specific signage within your pharmacy may be an important step in achieving a safer community. Suggestions for signs can be “Ask your pharmacist if your medication can affect your ability to drive.”
- Patients should always start a new medication therapy when they are in a controlled setting to allow for full observation of any potential adverse effects. Some patients have a false sense of “tolerance” to the effects of medications, perhaps from previous exposure to medication that had similar warnings but did not affect their ability to function. Emphasize...
that each new medication has a unique set of side effects. When coupled with a patient’s individualized pharmacokinetics and pharmacodynamics, a new medication requires the same caution with first dose as previously initiated medication.

- Patients must be encouraged to share the full comprehensive list of medications he/she is taking. This should include OTC, herbal, and any medication they are receiving from friends, family or through the Internet. Even medications/supplements that are obtained through the health food stores can be a significant contribution to the medication repertoire and must be disclosed. Pharmacists should also encourage patients to divulge any illicit medication use, as such substances can have an individual or combined effect on driving, for example, hepatic metabolism can be significantly affected even through the inhalation of smoked marijuana.

- Patients must communicate plans for smoking cessation. Health care providers should encourage all patients to stop smoking. However, we must also consider the impact of the cessation on liver metabolism. Smokers have increased clearance due to CYP1A2 metabolic induction, which causes some medications to be eliminated from the body more quickly and serum concentrations to be lower because of this. Upon cessation, the body quickly resumes normal liver clearance, and if a patient continues to consume the same amount of drug metabolized by CYP1A2, he/she will experience a serum concentration that can be double than prior to smoking cessation.

- Patients also must be reminded to adhere to the medication instructions and not to double dose when missed or to alter extended release formulations. These decisions by patients can result in unintended higher than recommended serum concentrations. Most often drowsiness and dizziness are directly correlated to serum concentration of medications and this will only intensify the risk of impaired driving.

- Patients must remember that OTC and herbal therapy can be problematic.

- Never drink alcohol and drive. It is critical that patients recognize that the intoxicating effect of alcohol with sedating medications is additive. Even if not warned to avoid alcohol with the prescribed medications, teach patients that concomitant consumption of alcohol never is safe. Any potential impairing side effect of medications will be exaggerated by the central nervous system depressant effects of alcohol, a bad mix before driving.

- Though written medication information is generally provided to patients as a standard of practice, patients should make sure to ask if they don’t receive a medication guide. These guides can be made available in different languages to promote culturally inclusive medication literacy to all patients.

- Patients should be counseled not to crush, chew or alter medications that are slow release (SR) or extended release (ER), as this will cause an increased absorption and higher serum concentrations of the drug. Impaired driving will be more likely with higher serum concentrations of sedating and CNS depressing substances.

- Avoid alcohol while taking medication. There are few medications that have demonstrated 100 percent safety with concurrent medication administration. Never drink alcohol and drive, and don’t add extra risk by taking medications along with even minimal ingestion of alcohol if planning on driving.

- Whether taking a chronic course of the same medication, or when doses change of something you have been taking, always be prepared to recognize the signs of impaired driving performance (stop for rest if any occur):
  - Blurred vision
  - Difficulty in concentrating or staying awake
  - Unusual surprise by ordinary traffic events
  - Not being able to remember how exactly you came at destination
  - Difficulty in holding steady course in traffic lanes

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CONTINUING EDUCATION QUIZ
Select the correct answer.

Please base questions 1–2 on the following case:

A 65-year-old female patient arrives at your pharmacy counter with a new prescription for zolpidem for sleep. She is currently taking clonidine for hypertension, but otherwise is healthy and not taking any other prescription or OTC medications. She is worried about the extra cost of the medication and asks your opinion about taking some OTC Benadryl which is much more affordable.

1. Which of the following is an appropriate counseling response for this patient?
   a. Benadryl is a better choice, considering that it does not interact with her clonidine and is much less expensive.
   b. Clonidine may be causing her sleep disturbance; she may not need the zolpidem if she discusses alternative antihypertensive therapy with her physician.
   c. Zolpidem is never safe for elderly patients to use and should be avoided.
   d. None of the above

2. Which of the following is a reasonable goal for her to ensure future safer driving?
   a. Taking any first dose of medication at home or in a controlled setting in order to assess possible side effects which may impact driving
   b. Only taking medications without noted side effects of dizziness or somnolence, everything else should be avoided
   c. No medication should be taken when driving.
   d. Only prescription medications pose risk.

3. AP is a 70-year-old male presenting to your pharmacy with complaints of episodes of hypoglycemia with his new insulin regimen. What “signs” of potential impaired driving would you offer the patient to ensure he knows the status of his driving competence related to his blood sugar?
   a. Blurred vision
   b. Unusual surprise by ordinary traffic events
   c. Difficulty in holding steady course in traffic lanes
   d. All of the above

4. Which of the following medications is least likely to cause excessive daytime sleepiness?
   a. Loperamide
   b. Dextromethorphan
   c. Modafinil
   d. Diphenhydramine

5. Which of the following medications has become more likely to be a driving risk due to trends of misuse?
   a. Loperamide
   b. Dextromethorphan
   c. Modafinil
   d. Diphenhydramine

6. BT, a 45-year-old female, arrives at your pharmacy with the hope of embarking on her smoking cessation New Year resolution. She currently takes olanzapine for a psychiatric illness and hydrocodone for back pain. What concern do you share with her prior to her stopping her smoking?
   a. Her olanzapine serum concentrations can be lowered due to the smoking cessation and resolution of hepatic metabolism: she may need more medication.
   b. Her olanzapine serum concentration can be increased due to the smoking cessation and resolution of hepatic metabolism: she may need less medication.
   c. Her olanzapine will not be affected, but hydrocodone effects will be intensified and may cause her daytime drowsiness.
   d. Her olanzapine will not be affected nor will her hydrocodone, so driving will not be a problem.
To prevent BT from experiencing potential increased sedation and impaired driving, what would you recommend for her therapeutic plan?

- Application of a nicotine topical patch once daily to offset the liver metabolism that occurs with smoking cessation
- Inhalation of the nicotine inhaler, to mimic more naturally the smoking of cigarettes and to reduce the changes in medication concentration
- Consider implementing a proactive dose reduction of olanzapine during smoking cessation to accommodate the changes in expected serum concentration.
- Consider implementing a proactive dose increase of olanzapine during smoking cessation to accommodate the changes in expected serum concentration.

What is NOT an example of a factor of driving competence?

- Visual attention
- Visual perception
- Executive memory
- Semantic memory

Which of the following statements is (are) true?

- All issues related to unsafe driving are related to aging.
- Young drivers may experience effects of medication impairment.
- Older drivers may experience effects of medication impairment.
- B and C

Young drivers may experience increased impaired driving due to which one of the following of which most likely reason(s)?

- They are likely to be consuming more sedating OTC medications.
- The organ systems of adolescents do not efficiently metabolize drugs like older patients.
- Adolescents may think that prescription and OTC medications carry less risk than "illicit" drugs.
- Adolescents seek medications for the purpose of impairment and therefore do not fear driving under the influence.

As a pharmacist concerned about the driving competence of your patients, which of the following recommendations would you make to prescribers?

- A prescriber is better off giving two moderately sedating medications instead of one very sedating medication
- Long-term administration of a sedating medication always results in tolerance to the sedative effects
- First doses of all new medications should be observed before driving while medicated.
- A and C

Which of the following disease states can pose increased driving risk?

- Type 2 non insulin dependent diabetes
- Type 1 insulin dependent diabetes
- Arthritis
- All of the above

Which of the following physiologic states can significantly increase driving risk?

- Moderate hyperglycemia
- Mild hyperglycemia
- Mild hypoglycemia
- None of the above

Which of the following medications has been known to cause hypoglycemia?

- Trimethoprim
- Olanzapine
- Trimethoprim/Sulfamethoxazole
- Zaleplon

Patients are at greatest increase risk of driving impairment due to sedation with which of the following medications?

- Second generation antihistamines
- Acetaminophen
- Modafinil
- All are equally impairing.

Please select the appropriate ranking of medications based on a progressively worse ranking of anticholinergic side effect burden according to the Harvard Researchers (least < moderate < most)

- Trazodone < hydroxyzine < cyproheptadine
- Codeine < cyproheptadine < quetiapine
- Tolterodine < oxybutynin < brompheniramine
- Brompheniramine < codeine < cyproheptadine
17. Please select the appropriate ranking of medications based on an equivalent ranking of anticholinergic side effect burden according to the Harvard Researchers (all drugs share a similar anticholinergic burden)
   a. Brompheniramine = cimetidine = benztropine
   b. Cimetidine = oxcarbazepine = olanzapine
   c. Amitriptyline = clozapine = scopolamine
   d. Dicyclomine = amitriptyline = meperidine

18. Olanzapine can increase the likelihood of driving impairment with which of the following factors most likely attributed to this therapy?
   a. Drug induced hypoglycemia
   b. Daytime sleepiness
   c. Dystonia
   d. Tinnitus

19. Which of the following medication scenarios would put the patient at risk of driving impairment?
   a. Using a benzodiazepine when a full night of rest is expected
   b. Using z-hypnotics when a full nights rest is not expected
   c. Taking a dose of a friend’s herbal medication labeled for “sleep”
   d. All of the above

20. Which of the following consultation tips to keep patients safe is most effective?
   a. If a medication package insert does not list alcohol as a contraindication, the combination of drug and alcohol poses no increased risk to the driver.
   b. Medication side effects which may impair driving always wear off with continued use.
   c. If a patient has been taking his/her medication for a year or more, dose changes will not result in an increased potential for impairment.
   d. None of the above are true.

Medication Use and Driving Risks
March 1, 2012 (expires March 1, 2015) • Activity Type: Knowledge-based

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Quiz: Shade in your choice

1. a b c d e 11. a b c d e
2. a b c d e 12. a b c d e
3. a b c d e 13. a b c d e
4. a b c d e 14. a b c d e
5. a b c d e 15. a b c d e
6. a b c d e 16. a b c d e
7. a b c d e 17. a b c d e
8. a b c d e 18. a b c d e
9. a b c d e 19. a b c d e
10. a b c d e 20. a b c d e

Quiz: Circle your choice

21. Is this program used to meet your mandatory C.E. requirements?
   a. yes b. no
22. Type of pharmacist: a. owner b. manager c. employee
23. Age group: a. 21–30 b. 31–40 c. 41–50 d. 51–60 e. Over 60
24. Did this article achieve its stated objectives? a. yes b. no
25. How much of this program can you apply in practice?
   a. all b. some c. very little d. none

How long did it take you to complete both the reading and the quiz? ______ minutes

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