Impact of Pharmaceuticals on Aircrew Performance and Safety

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Holloman AFB High Speed Test Track
Aircraft Fatal Mishap Rates (2008)

- Part 121 scheduled carriers 0/100,000 hrs
  - Scheduled carriers 20 mishaps with 0 fatalities
  - Nonscheduled (chartered) - 8 mishaps with 3 fatalities
    - 0.322/100,000 hrs
- Part 135 (commuter) 0/100,000 hrs
  Total 7 mishaps with 0 fatalities
- Part 135 On Demand (air taxi) 1.52/100,000 hrs
  Total 56 mishaps with 66 fatalities
- Part 91 General Aviation 1.25/100,000 hrs
  Total 275 mishaps with 495 fatalities

Source: NTSB
Incidence of *prescription* drugs in postmortem toxicology examination

- 4142 deceased pilots between Jan 1993-Dec 2003 where specimens were available
- Positive specimens: 387 (9.4% of fatalities)
- Prescription medications
  - Psychotropic medications 223 (5%) (14 reports)
  - Cardiovascular medications 149 (4%) (69 reports)
  - Neurological medications 15 (0.4%) (1 report)
- In 80% of mishaps biological specimens are obtained

Canfield DV, Salazar GJ, Lewis RJ, Whinnery JE. Pilot medical history and medications found in postmortem specimens from aviation accidents. Aviat Space Environ Med 2006: 77:1171-3
Why There Are So Few Neuro Meds

- Compared with Cardiovascular Disease Authorizations for Special Issuance (waivers) are rarely granted for psychotropic or neurological medications
- These conditions are generally more debilitating
Reported on FAA Exams vs Found in Postmortem Toxicology

• 92% of pilot fatalities with positive toxicology failed to report meds, or reported a different medication

• Of 387 positive toxicology results, no medications were reported by 286 pilots on the FAA medical exam (74%)

• Different medications from that found in toxicology were reported by 71 pilots (18%)
Why Fewer Mishaps Under Part 121

• Part 121 – professional full time pilots
• Highly trained and most experienced
• Generally more mature
• More frequently monitored on Federal Drug Testing programs and undergo more frequent physical examinations
• Always a minimum of 2 pilots in the cockpit
• Most sophisticated/safe aircraft with sophisticated avionics
The Slide You Don’t Have

- 1587 civil aviation mishaps between 1999 and 2003
- 90% of these were general aviation mishaps
  - 35% of Class I, 50% of Class II, 60% of Class III
- 52% of pilot fatalities had specimens testing positive for drugs or alcohol
  - 19% positive for scheduled drugs
  - 36-38% positive for drugs alone (no alcohol)
    - Prescription drugs constitute 69%
  - Diphenhydramine discovered in 21% of fatalities
  - 12% alcohol
  - Up to 7% could be drugs administered at the scene (e.g. atropine/pain medications)
- Compared to 1989-1993 incidence of post crash positive toxicological specimens is rising
Controlling Use of Prohibited Pharmaceutical Agents

- Periodic FAA certification physicals—once every 6 months to 4 years, depending on age and class
  - Threat of fine and imprisonment for fraud IAW Title 18
- Self policing IAW Title 14
- Reasonable suspicion or post mishap drug testing
- FAA’s Anonymous Safety Hotline (800) 255-1111
- Amnesty
- AME Assisted Special Issuances—easier access to waiver renewal
The Stick

- 18 U.S. Code Secs. 1001;3517
- A person ... making any false, fictitious or fraudulent statements may be fined up to $250,000 or imprisoned not more than 5 years or both.
- Signed with each completion of Application for Airman Medical Certificate (FAA Form 8500-8)
- Ronald Crews was sentenced to 16 months in federal prison and two years of supervised release on March 20 after pleading guilty in 2007 to four counts of making false statements to a federal agency about his diabetes and dependence on insulin injections.
Title 14: § 91.17 Alcohol or drugs

(a) No person may act or attempt to act as a crewmember of a civil aircraft—

– (1) Within 8 hours after the consumption of any alcoholic beverage;
– (2) While under the influence of alcohol;
– (3) While using any drug that affects the person's faculties in any way contrary to safety; or
– (4) While having an alcohol concentration of 0.04 or greater in a blood or breath specimen. Alcohol concentration means grams of alcohol per deciliter of blood or grams of alcohol per 210 liters of breath.
Title 14 CFR § 61.53, Prohibition on Operations During Medical Deficiency

- A person who holds a current medical certificate issued under part 67 of this chapter shall not act as pilot in command, or in any other capacity as a required pilot flight crewmember, while that person:

  - Knows or has reason to know of any medical condition that would make the person unable to meet the requirements for the medical certificate necessary for the pilot operation; or

  - Is taking medication or receiving other treatment for a medical condition that results in the person being unable to meet the requirements for the medical certificate necessary for the pilot operation.
Drug and Alcohol Testing

- On request of a law enforcement officer, submit to a test to indicate the alcohol concentration in the blood or breath (violation of local drunk driving laws).
- Whenever the Administrator has a reasonable basis to believe that a person may have violated paragraph (a)(3) of this section, that person shall, upon request by the Administrator, furnish the Administrator, or authorize any clinic, hospital, doctor, or other person to release to the Administrator, the results of each test taken within 4 hours after acting or attempting to act as a crewmember that indicates the presence of any drugs in the body.
- Any test information obtained by the Administrator under paragraph (c) or (d) of this section may be evaluated in determining a person's qualifications for any airman certificate or possible violations of this chapter and may be used as evidence in any legal proceeding under section 602, 609, or 901 of the Federal Aviation Act of 1958.

Flying, A Complex Mental Activity

“Whether you’re flying by hand or using technology to help, you’re ultimately flying the airplane with your mind by developing and maintaining an accurate real-time mental model of your reality—the airplane, the environment, and the situation.”

Earl Wiener, Ph.D., former Air Force pilot and retired from the U of Miami’s Department of Management Science, cited by Capt Chesley Sullenberger in Highest Duty, 2009
Potential Effects of Medications

- Loss of situational awareness
- Loss of alertness/vigilance
- Loss of memory
- Sense of infallibility
- Visual and night vision deficiency
- Judgment loss
- *Failure to recognize impairment*
Reasons Occupational Medicine Physicians Should Be Concerned

• Applicability to other transportation industries, for which we do certification examinations
• Need to realize the importance of taking a thorough history and doing a complete physical exam, especially for certification exams
• To be sensitive about the potential side effect of medications we prescribe for employees who may perform safety sensitive jobs
Concerning Medications for Occ Docs

- Sedative/hypnotics
- Pain medications
- Muscle relaxants
- Medications for peripheral neuropathy
- Medications potentially causing dizziness
- Anti-emetics
Medication concerns

• Direct effects
  – Sedation
  – Vertigo
  – Judgment
  – Visual effects
  – Hypotension
• Indirect effects or unintended consequences
• Unusual side effects
  – Pravastatin case
• Drug interactions
• Fatigue—a role for pharmacologic agents?
FAA Does Not Have Comprehensive Permissible Medication List

• Cannot interfere with or dictate medical treatment
• No comprehensive data base on the adverse effects of all pharmacological agents
• Individual reaction to individual or classes of medications
• New medications coming out all the time
• Potential issues associated with aviators not getting appropriately treated if they know the treatment medications are disqualifying
FAA Approach to Approving Pharmacological Agents

- One-year of post-marketing experience with a new drug before we will consider whether we can safely certificate airmen using the drug.
  - Applies to new drugs within an existing class and for drugs in a completely new class of drug
- Generally anti-muscarinic and anti-nicotinic drugs require a 2-year waiting period
- Exceptions to one year waiting period fall in the drug categories of antibiotics, antihypertensives [except centrally-acting drugs] and lipid-lowering agents
  - If the new medication is within an entirely new class or has an entirely new mechanism of action then we do require a one-year wait.
Cautions to Drug Use

• Use of a drug for conditions not included in the FDA-approved indications, i.e., “off-label” use, raises some concern and the circumstances would be evaluated carefully before any certification decision.

• Certain drug combinations may be unacceptable because of side effects or issues related only to the combination [example: a beta-blocker taken with either insulin or a sulfonylurea].
FAA Disqualifying Drugs

- The anti-Parkinson’s drugs pramipexole (Mirapex) and ropinirole (Requip). Pergolide (Permax) was also disqualifying but the FDA removed it from the market.
- Anti-seizure medications
- Psychotropic medications including antipsychotics, antidepressants (including SSRIs), anxiolytics, mood stabilizers, ADHD medications
- Sedative-hypnotics
- Antihistamines, with the exception of some of the truly non-sedating antihistamines such as fexofenadine (Allegra), loratadine (Claritin), desloratadine (Clarinex)
- Centrally acting antihypertensives such as, reserpine, guanethidine, guanadrel, guanabenz, and methyldopa are unacceptable
- The anti-smoking drug, varenicline (Chantix)
- Investigational drugs (drugs which have not yet been approved by the FDA for general marketing)
First Generation Antihistamines

- 6 year period between 1991 to 1996, various antihistamines were detected in 111 of the 2172 pilot fatalities received at CAMI – 5.1% *

- Chlorpheniramine maleate alone has a fairly strong negative influence on task and mood

- Diphenhydramine had greater impact on driving than alcohol

- “Medication haze” described by 57% of those taking OTC antihistamines. Probable cause of 50,000 auto injuries and 600 fatalities per year

SSRIs and SNRIs

- Between 1990 and 2001 of 4,184 CAMI accidents, SSRIs were found in 61 pilot fatalities*
- Percentage of drug related fatalities: .0145 %
- Mechanism and potential for drug interaction
  - Inhibit many cytochrome P450 and CYP2D6 (CYP1A2, CYP2B6, CYP2C9/2C19, and CYP3A4) enzymes
  - Inhibit the activity of P-glycoprotein, a membrane transport protein
  - The simultaneous use of fluoxetine with triptans, tramadol or other serotonergic agents can result in a rare, but potentially life-threatening adverse drug reaction called serotonin syndrome
- Prozac approved by FDA in 1987, followed by Zoloft, Paxil, Effexor and Celexa
- Major concern by FAA is the underlying condition of depression itself
- “Buy the farm”—concern about increased aviation suicide risk

FAA Guidance Regarding Pharmaceutical Agent in Pilots

- The individual must manifest no significant adverse effects
- A drug that is “investigational” or “experimental” is unacceptable. It must be approved by the FDA for marketing and use in the United States
- The medication is not taken at greater than the maximum dose recommended by the manufacturer
- The medication, as reported by the usual authorities, must not produce frequent effects that could pose a safety risk in aviation. ["frequent" is considered more than 1% of the patients by FDA definition of adverse event rates]
- The drug should not carry significant warning labels. Examples that would normally preclude certification include:
  - An FDA recommendation that a drug be used only in hospitalized patients or in life-threatening conditions
  - A “black box” warning for an aeromedically significant cardiovascular or neurologic adverse event
Permitted Allergy Medications

- Permitted: Claritin (lorantadine), Clarinex (deslorantadine), Allegra (fexofenadine)
- Pseudoephedrine & phenylephrine
- Cromolyn sodium and nasal steroids
- Pantanol for allergic conjunctivitis
- Singulair, only for allergies
- Desensitization injections
- Guaifenisin
First Generation Antihistamines

- Ubiquitous: sleep meds, cold remedies
- Metabolized by the P450 cytochrome system
  - Metabolic rate dependent on liver enzyme phenotype, age and liver disease
  - Metabolism reduced in presence of macrolides, azole antifungals or calcium channel blockers
- Highly liposoluble
- Pharmacokinetics
  - Chlorpheniramine T max 2.8 +/- 0.8 hrs; T ½ 12-15 hrs
  - Diphenhydramine T max 1.7 +/- 1.0 hrs; T ½ 6-8, up to 13 in elderly
Some Products Containing Diphenhydramine

Aler-Cap [OTC]; Aler-Dryl [OTC]; Aler-Tab [OTC]; AllerMax® [OTC]; Banophen® [OTC]; Benadryl® Allergy [OTC]; Benadryl® Children's Allergy [OTC]; Benadryl® Children's Allergy Fastmelt® [OTC]; Benadryl® Dye-Free Allergy [OTC]; Benadryl® Injection; Benadryl® Itch Stopping [OTC]; Benadryl® Itch Stopping Extra Strength [OTC]; Compoz® Nighttime Sleep Aid [OTC]; Diphen® [OTC]; Diphen® AF [OTC]; Diphenhist [OTC]; Dynatan™; Genahist® [OTC]; Hydramine® [OTC]; Nytol® Quick Caps [OTC]; Nytol® Quick Gels [OTC]; Siladryl® Allergy [OTC]; Siladryl® DAS [OTC]; Silphen® [OTC]; Simply Sleep® [OTC]; Sleepinal® [OTC]; Sominex® [OTC]; Sominex® Maximum Strength [OTC]; Triaminic® Thin Strips™ Cough and Runny Nose [OTC]; Twilite® [OTC]; Unisom® Maximum Strength SleepGels® [OTC]
Potential Diphenhydramine Side Effects

Cardiovascular: Hypotension, palpitation, tachycardia
Central nervous system: Sedation, sleepiness, dizziness, disturbed coordination, headache, fatigue, nervousness, paradoxical excitement, insomnia, euphoria, confusion
Dermatologic: Photosensitivity, rash, angioedema, urticaria
Gastrointestinal: Nausea, vomiting, diarrhea, abdominal pain, xerostomia, appetite increase, weight gain, dry mucous membranes, anorexia
Genitourinary: Urinary retention, urinary frequency, difficult urination
Hematologic: Hemolytic anemia, thrombocytopenia, agranulocytosis
Neuromuscular & skeletal: Tremor, paresthesias
Ocular: blurred vision
Respiratory: Thickening of bronchial secretions
Diphenhydramine Interactions

• CYP2D6 substrates: Diphenhydramine may increase the levels/effects of CYP2D6 substrates. Example substrates include amphetamines, selected beta-blockers, dextromethorphan, fluoxetine, lidocaine, mirtazapine, nefazodone, paroxetine, risperidone, ritonavir, thioridazine, tricyclic antidepressants, and venlafaxine.

• CYP2D6 prodrug substrates: Diphenhydramine may decrease the levels/effects of CYP2D6 prodrug substrates. Example prodrug substrates include codeine, hydrocodone, oxycodone, and tramadol.

• Ethanol/Nutrition/Herb Interactions:
  Ethanol: may increase CNS depression

• Herb/Nutraceutical: Avoid valerian, St John's wort, kava kava, gotu kola (may increase CNS depression)
Chlorpheniramine

- Aller-Chlor; Allergican; Allergisan; Antagonate; Chlo-Amine; Chlor-Trimeton; Chlor-Trimeton Allergy; Chlor-Trimeton Repetabs; Chlor-Tripolon; Chlorate; Chloropiril; Cloropiril; Efidac 24 Chlorpheniramine Maleate; Gen-Allerate; Haynon; Histadur; Kloromin; Mylaramine; Novo-Pheniram; Pediacare Allergy Formula; Phenetron; Piriton; Polaramine; Polaronil; Pyridamal 100; Telachlor; Teldrin, and many other combination medications

- Similar side effects to diphenhydramine
- Caution: anticholinergic side effects and dehydration
- Elimination half life is 27.9 +/- 8.7 hours
Antihistamine

- Ruidoso NM, Beech E90, nighttime VFR, medivac flight
- ATP with 2,775 hours, multiple ratings, current in instrument flying
- Child patient, mother, nurse, paramedic and pilot fatally injured
- Class II physical Jan 2007—denied allergies, no limitations
- Presumed cause of mishap—overstress of aircraft
- Toxicology: chlorpheniramine and acetaminophen
- Probable cause: compromised judgment

NTSB Case DEN07MA134, August 5, 2007
Staten Island Ferry Andrew J. Barberi

- October 15, 2003, collided full speed with pier at St. George ferry terminal
- 10 dead, (1 other fatality 2 months later), 70 injured
- Damages awarded to victims: $18.3 million
- Cost $6.9 million to repair ferry, $1.4 million to repair the pier
- Assistant captain (in command) pleaded guilty to lying about his medical history and admitted he was taking Tramadol and Tylenol PM (contains diphenhydramine)
Not Permitted for Allergies

- Zyrtec (cetirizine)
- Astelin (azelastine)
  - Require grounding for 24 hrs after last dose
- Phenylpropanolamine (now off the market)
- Combination medications containing other antihistamines or alcohol
- Cough medications containing codeine – requires 72 hour grounding
- PM formulations
- All others: dextromethorphan, Benadryl, chlorpheniramine
- Must wait twice the dosing interval before flying—generally 8-12 hours
Should Not Fly with a Cold or Significant Allergy Symptoms

- Potential for sinus/ear block
  - Vertigo
  - Incapacitating pain
  - Ruptured ear drum
- Hearing loss
- General malaise
- Temptation to take non-permitted medications
Insulin Episode

- February 2002 incident Crews suffered a diabetic seizure while conducting an air taxi flight from Vineyard, Mass., to Hyannis for Massachusetts-based Cape Air. One of the four passengers on board the twin-engine Cessna 402 air taxi flight was a student pilot, who subsequently took control of the aircraft, according to the FAA’s aviation safety information and analysis sharing brief report.

The student pilot, Melanie Oswalt, had the other three passengers restrain Crews, who was incoherent and had pushed her aside while she tried to move into the co-pilot seat, reports the Cape Cod Times. Oswalt landed gear up at Provincetown Municipal Airport in Provincetown, Mass. No one was injured, and the airplane sustained minimal damage.

After the February Cape Air incident, two more incidents were attributed to Crews’ medical condition, and he was fired and lost his pilot certificate.

“It is imperative that pilots not lie on their medical application or continue flying when they know they aren’t fit for flight,” said Andy Cebula, AOPA executive vice president of government affairs. “While this incident is extremely rare, it is a strong warning to all pilots.”
FAA Diabetes Policy

- All diabetes certificates issued by the FAA as a special issuance
- Must submit evidence of satisfactory control of DM after a minimum of 60 days control on medication without significant side effects or clinically significant hypoglycemic episodes
- No evidence of CV, neuro, renal or eye disease
- If medication or dose is changed, must stop flying and consult with AME or AMCD
- 3rd Class may be issued for insulin use under very limited circumstances
Underlying Condition Plus Incapacitating Medications

- Linden NJ, Beechcraft S35 (single engine, 6 seats), daytime IFR
- ATP with 5,800 hrs and multiple ratings current in instrument flying
- Pilot and two passengers received fatal injuries, and 27 on ground injured to various degrees, with > $1.1 million building damages + autos destroyed
- Pilot reported non-specified gyro problem to ATC
- On his FAA medical exam denied medical conditions or use of any medications.
- Post mishap investigation revealed pilot was being treated for “severe migraine” headaches—during 1999 was dispensed 800 Fiorinal, which he was taking every 4-6 hours.
- Toxicology: Butalbital levels estimated to be about 3 times therapeutic level
- Potential causes of mishap: spatial disorientation, dizziness/vertigo, drowsiness, acute incapacitation by pain, visual field cut

NTSB Case NYC00FA039, November 26, 1999
Impaired Judgment

- Fitchburg, MA, Beechcraft B200, King Air, daytime IFR
- ATP, CFI with >5,600 hrs total flight experience, with >1,300 in mishap aircraft
- Pilot and 4 passengers received fatal injury when plane virtually collapsed a sheet metal factory injuring one person inside
- Pilot’s radio transmissions indicated lack of concentration and poor memory
- Between Jan 2002 and March 2003 was treated for “incapacitating” shooting pains in his right side, seizures, explosive headaches, viral meningitis and MRSA abscesses on right upper extremity
- On FAA medical exam 4/16/2002 denied taking medications, neurological disorders and visits to a health professional within last 3 years.
- Toxicology detected desipramine, imipramine, carbamazepine, morphine and salicylate
- Potential causes of mishap: failure to recover from a stall, spatial disorientation, failure to recall and operate within published aircraft parameters
Impaired Judgment

- Shelby Gap, KY, Cessna 150K flight into IFR by non-instrument rated pilot
- Private pilot with 1,200 hrs was fatally injured when he collided with terrain
- FAA medical on August 27, 1991 reported no medical history or medications—no current medical
- Autopsy revealed 3 vessel CABG; wife noted pilot had chronic pain from MVA and work
- Toxicology: Propoxyphene
- Cause: altered judgment due to propoxyphene causing inadvertent flight into IFR?

NTSB Case NYC06LA214, September 2, 2006
Multiple Medications
Actual Cause Unknown

- Wolf Lake Airport, Alaska, Cessna 170, daytime VFR
- Private pilot with 105.8 hrs in mishap aircraft
- Pilot received fatal injuries
- Airplane departed and climbed to 200 feet, lost power and collided with trees
- Some fuel contamination in evidence
- FAA medical certificate issued July 1, 2003 with no limitations
- Toxicology demonstrated hydrocodone, dihydrocodeine, hydromorphone, THC, ranitidine

NTSB Case ANC07FA037, May 4, 2007
Unanticipated Medication Effect Affecting Heart Condition

- Piper PA-28, Daytime VF—aircraft crashed into the Salton Sea
- Pilot did not hold currently hold a FAA pilot certificate or current medical certificate—he had reapplied for medical certificate July 15, 1997—possible special issuance pending
- 800 hrs claimed/100 in past 6 months
- Pilot and wife sustained fatal injuries
- Prior history of persisting myocardial ischemia with multiple PACs and PVCs following acute inferior and posterior MI in 1978—no medical issued for several years.
- Autopsy demonstrated thrombus in the RCA 0.5 cm in length
- Toxicology demonstrated ephedrine and pseudoephedrine
- Airplane was flying at 6,000 ft, causing some hypoxemia

NTSB Case LAX99LA068, December 25, 1998
Poor Judgment/Polypharmacy

- Mayville NY, Taylorcraft BC 12-D, day VFR
- CFI pulled power simulating engine failure for the student, then took over aircraft and stalled
- CFI with 3,300 total hours was fatally injured, and student pilot was seriously injured
- FAA 2\textsuperscript{nd} class medical was dated July 14, 2005—ibuprofen was listed as only med and no medical history revealed
- Toxicology: fluconazole, trimethoprim, fentanyl, meprobamate, carisoprodol, fluconazole, metaclopramide, gabapentin
- History of narcotic dependence, chronic low back pain and prior detoxification
- Cause: poor judgment due to multiple medications

NTSB Case NYC06LA144, June 13, 2006
Ocular Issues

- Middletown, RI, PA 28-161, 7:30 p.m. EDT
- Impacted trees during the climb out after a missed approach
- 63 yo CFI had 2,650 hrs with instrument and multiple other ratings
- Pilot, passenger received fatal injuries and student pilot sustained serious injuries.
- Third class medical was issued Jan 2008—pilot denied medications and recent visits to a physician
- Had been treated for rheumatoid arthritis with methotrexate, prednisone, hydroxychloroquine and ibuprofen—visual fields pending
- Toxicology found hydroxychloroquine and ibuprofen
- Cause?

NTSB Case NYC08FA237, July 3, 2008
Idiosyncratic Reactions

- 46 yo old 737-200 airline captain
- Started on pravastatin
- Severe headaches behind the right eye that totally dominated his thought process
  - “I was hardly able to comprehend or even care about anything in my immediate environment”
- Associated with cabin altitudes above 6,000 ft
- 100% O2 did not provide relief
- Headaches are reported in 2.1-9.3% of patients
- Incapacitating headaches could have been fatal in single pilot aircraft

Ramsey C & Snyder Q, Altitude-Induced Migraine Headache Secondary to Pravastatin: Case Report, Aviat Space Environ Med 1998;69:603-6
Ground Testing

- General guidance: 2 dosing intervals
- Detection of side effects that may be disabling
- Detection of idiosyncratic reactions
- Period varies depending on the drug
What If This Pilot Had Been Impaired?
Medication-Assisted Sleep Periods May Help Manage Fatigue

- Fatigue is a chronic problem in aviation
  - Crew rest rules
  - Trans-meridian travel
- OTC sleep preparations require 12-24 hours before flight
- FAA allows Ambien, but not within 24 hours of flight
- Research Study: Prophylactic 6 hr sleep period with zolpidem followed by use of caffeine or modafinil during 18 hour extended work period sustained performance
  - Note: modafinil is not approved for FAA pilots

Summary

• Many pharmaceuticals, both prescription and OTC, may degrade or negatively impact critical aviation skills
• The pilot may not recognize subtle impairments or effects of disease or medications
• Pilots have a vested interest in continuing flying
• Pilots may have too much confidence in their flying skills even when affected by illness or medications
• Pilots frequently are not forthcoming with AMEs, and the FAA about illness/medications
• Pilots may not be willing to ground themselves during illnesses or while using prohibited medications
Resources

• http://www.leftseat.com/medcat1.htm
• http://www.aviationmedicine.com/medications/index.cfm?fuseaction=displayMedications&contentID=26&navID=26
• http://www.faa.gov/about/office_org/headquarters_offices/avs/offices/aam/ame/guide/media/guide.pdf
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