



**National
Transportation
Safety Board**

Pilot Impairment Medications and Medical Conditions

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Medications Study Objectives

- Examine among fatally injured pilots
 - Prevalence of positive toxicology tests
 - Trends in positive toxicology tests
 - Comparison to the general population
 - Differences between categories of pilots

Why the Focus on Pilots?

- Fatally injured pilots
 - More than 1,300 drugs and metabolites
- DOT mandatory testing requirements
 - Urine specimen
 - 11 drugs
- Best opportunity to study trends in drug use by transportation operators

Data Sources: 1990-2012

- Bioaeronautical Research Laboratory at Federal Aviation Administration (FAA) Civil Aerospace Medical Institute (CAMI)
 - Toxicology test results database
- NTSB's Aviation Accident Database

Accident Selection

- Included
 - Accidents 1990-2012
 - Flying pilot died
- Excluded
 - Pilots in the aircraft but not flying
 - Intentional events
 - Toxicology not performed

Methods

- Metabolites
- Excluded
 - Duplicate results from metabolites or multiple specimens
 - Drug findings in urine only
 - Drugs from postaccident resuscitation

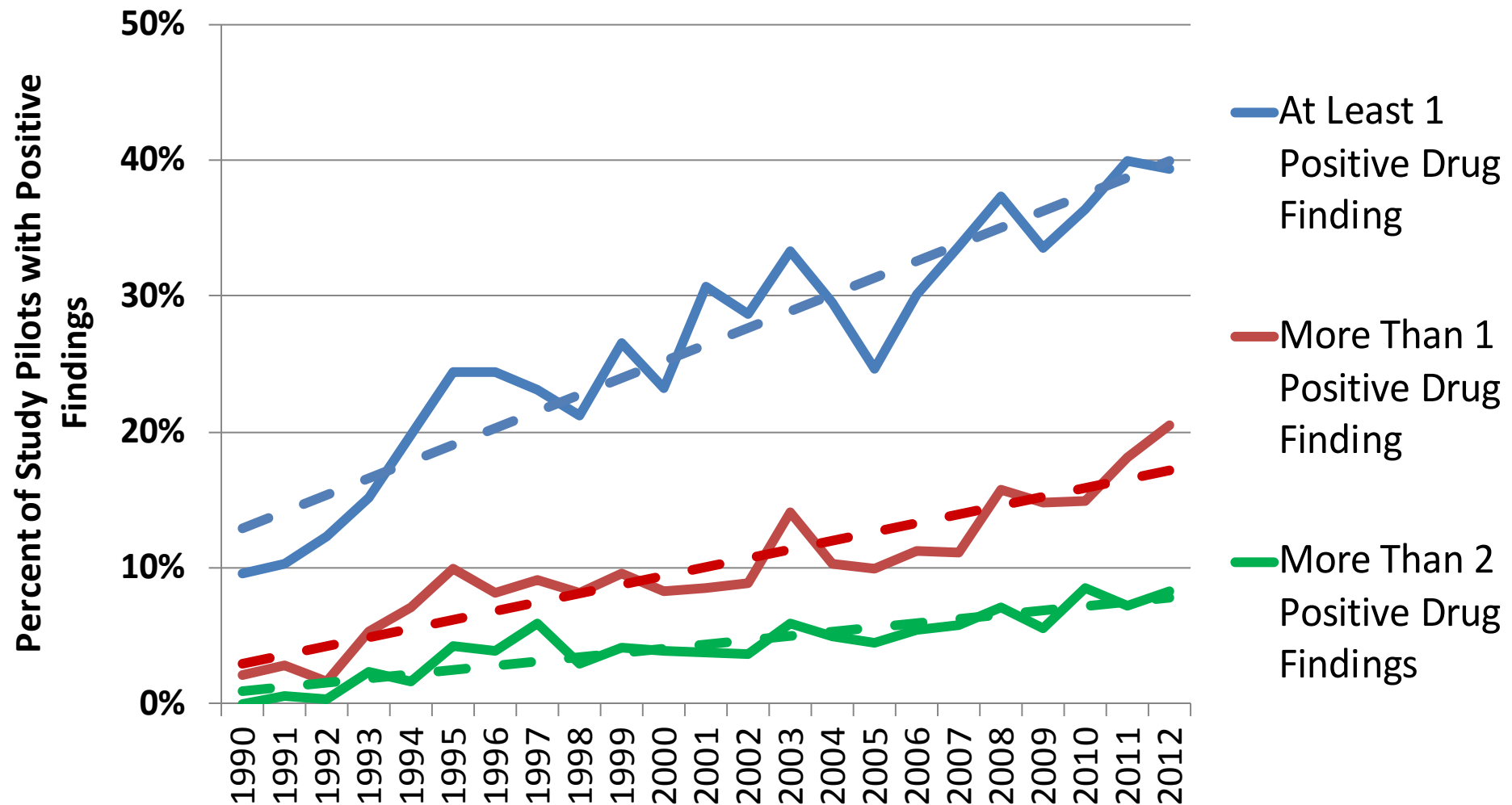
Study Dataset

- 6,677 fatally injured “study pilots”
- 96% general aviation
- Represents 87% of the domestic civil aviation accidents 1990-2012 with a pilot fatality

Demographics

- 98% male
- Ranged from 16 to 92 years old
- Average age increased from 46 to 57 during the study period

Toxicology Findings for All Drugs, 1990-2012



Definitions

- Drugs
 - Over-the-counter
 - Prescription
 - Illicit
- Controlled substances
 - DEA defines Schedules I-V
 - Schedule I: no medical use
 - Marijuana Schedule I

Potentially Impairing Drugs

- FDA warnings
 - Sedation
 - Hallucinations
 - Behavior changes
 - Driving or operating machinery
- Controlled substances
 - DEA Schedule II-V
- Illicit drugs

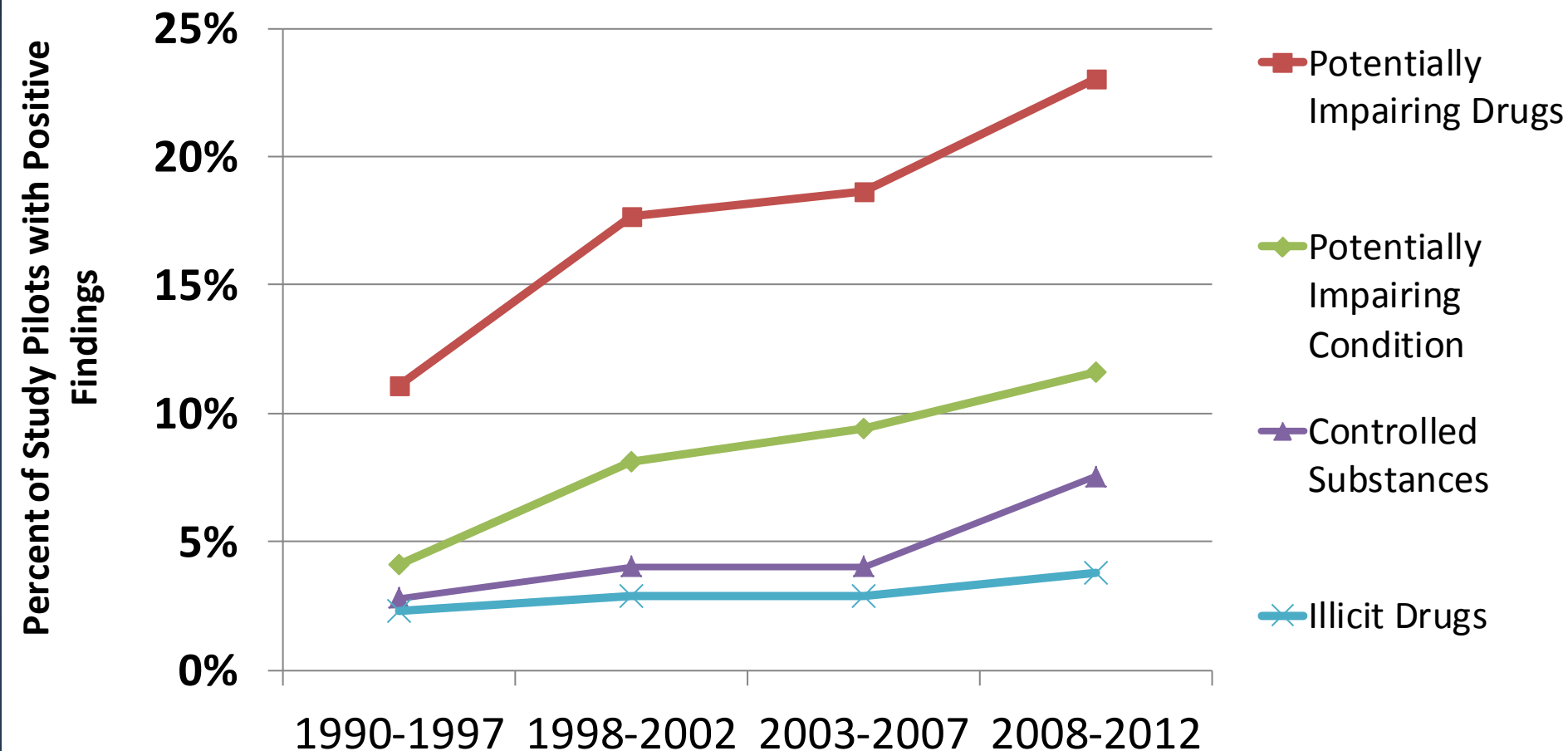
Illicit Drugs

- Schedule I
- Schedule II misuse
 - Cocaine
 - Amphetamine
- Toxicology tests cannot identify non-medical use of other drugs

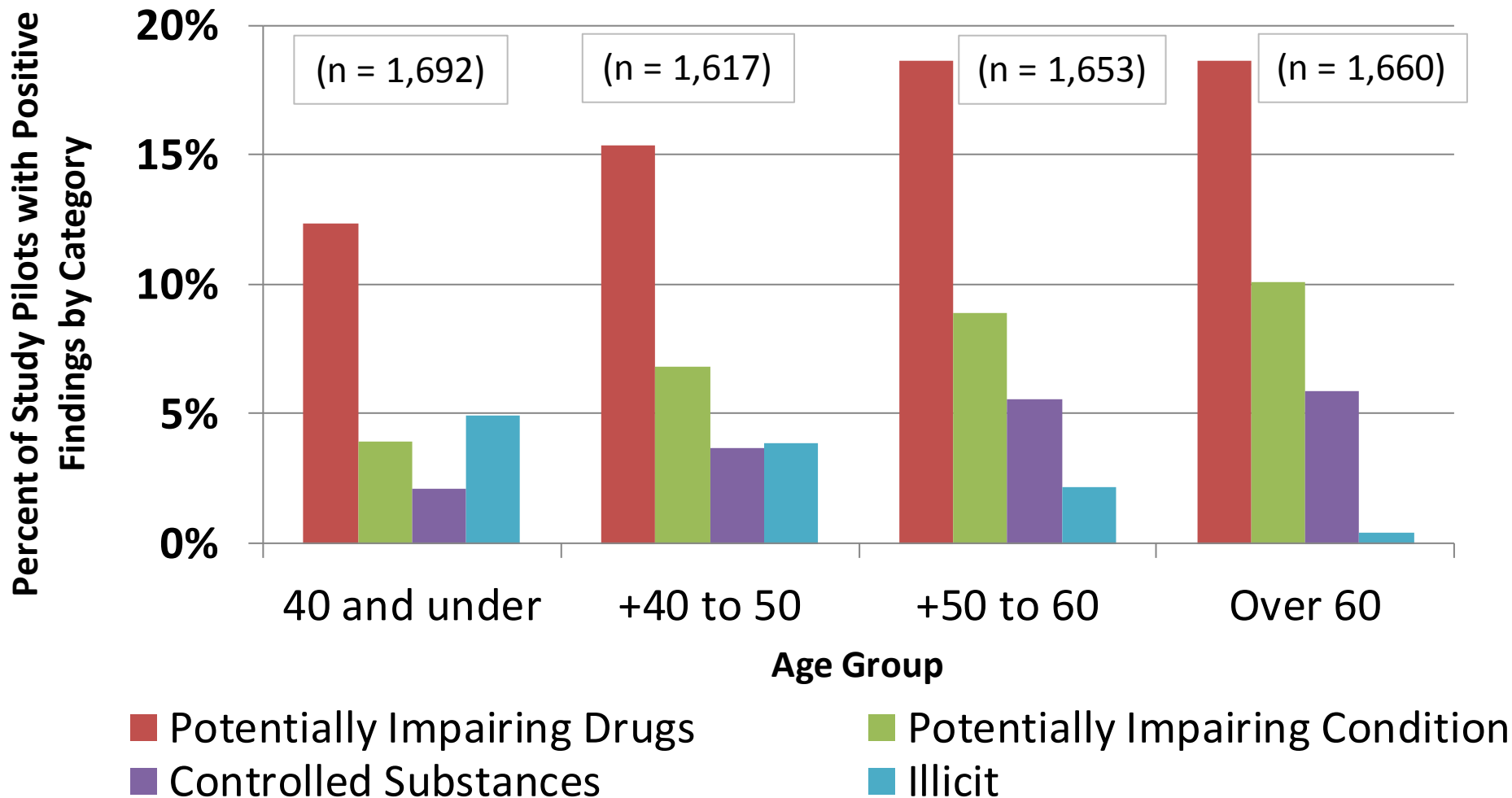
Drugs Indicating a Potentially Impairing Condition

- Drugs used primarily to treat
 - Psychiatric diseases
 - Severe pain
 - Neurologic diseases
 - Heart rhythm problems

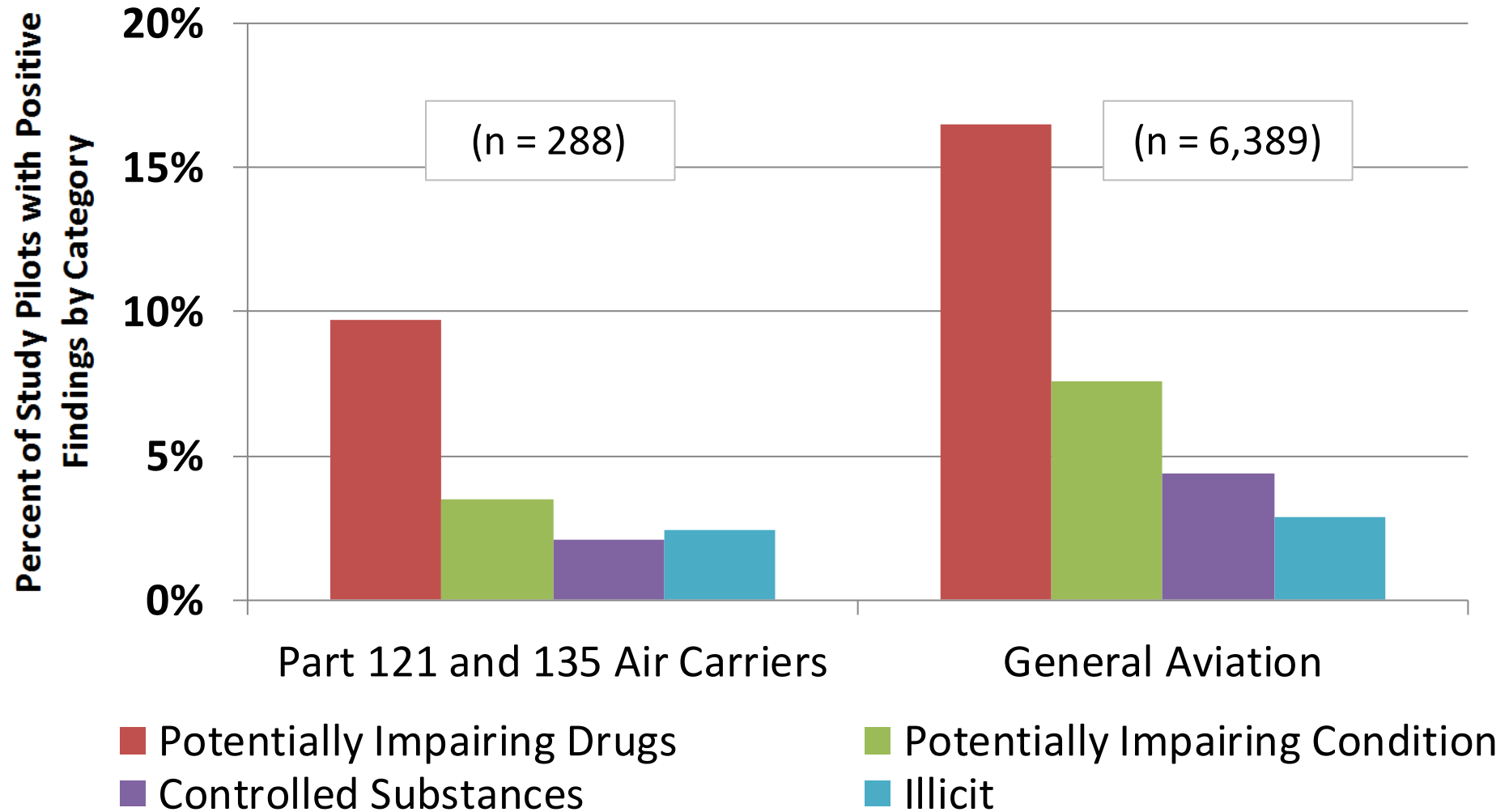
Toxicology Findings by Category, 1990-2012



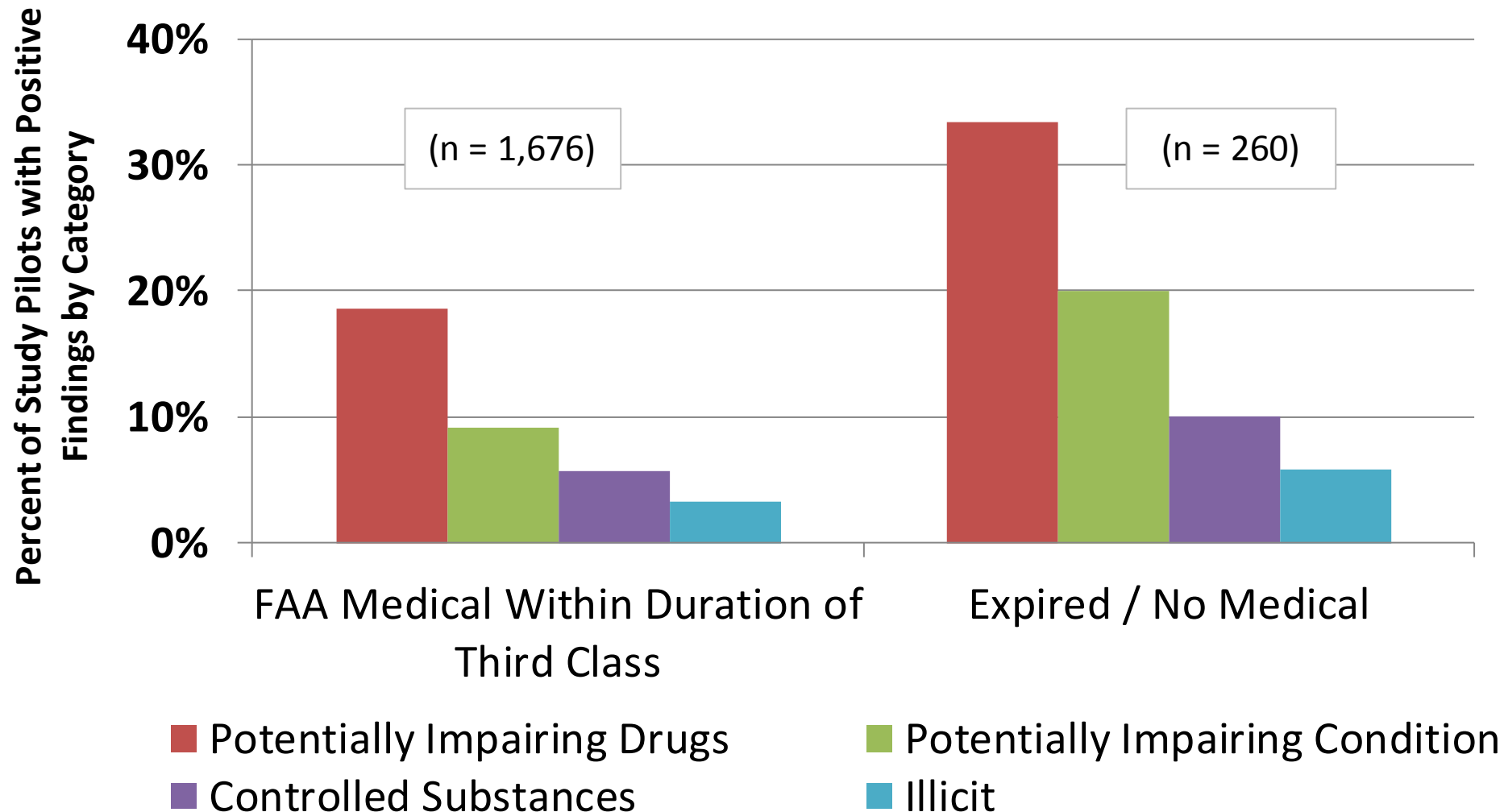
Toxicology Findings by Age Group, 1990-2012



Toxicology Findings by Operation Type, 1990-2012



Toxicology Findings by Medical, 2005-2012



Impairment and the Probable Cause

- Medical condition or drug with potential to cause impairment
- Impaired decision-making or behavior not reasonably predicted by skill and experience
- Associated with accident circumstances

NTSB Identification: ERA13LA076

- 14 CFR Part 91: General Aviation
- Accident occurred Sunday, December 02, 2012 in Collegedale, TN
- Aircraft: CASSUTT SPORT RACER, registration: N9CA
- Injuries: 1 Fatal.

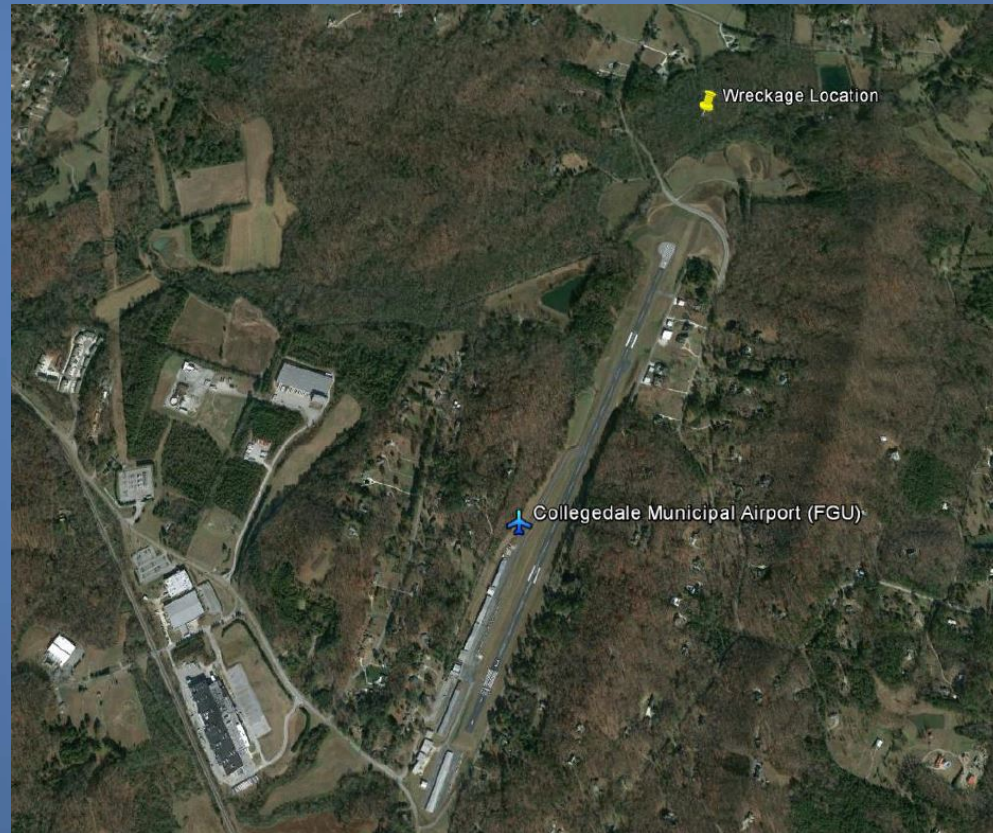


Flight

- Local VMC flight ~1600 to practice takeoffs and landings
- Wind 170 at 9 knots, 10 miles visibility, broken clouds at 5,500 feet and 25,000 feet, temp 21 C, dew point 9
- Departed runway 21- no further contact - ALNOT

Accident Location

Wreckage located December 4, 2012
1/4 mile north of the FGU runway 21
threshold



Accident site

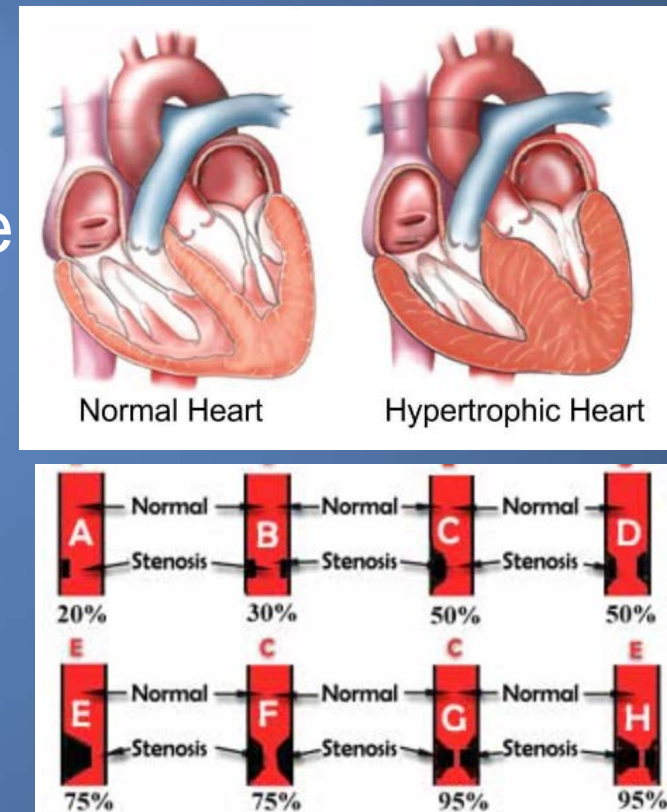


Pilot

- 82 year-old private pilot
 - airplane single engine land rating
 - 400 total flight hours in 2004
 - Deferred class 3 medical certificate April 2004
 - Severe coronary artery disease

Autopsy

- Cause of death – Multiple blunt force injuries
- Manner – accident
- Severe coronary artery disease
 - Significantly enlarged heart
 - 90-percent occlusion of the left anterior descending, circumflex, and right main arteries
 - Complete occlusion of the three bypass vessels



Toxicology

- Carvedilol and losartan
 - Blood pressure/cardiovascular medications,
- Fluoxetine and its metabolite, norfluoxetine
 - AKA – Prozac an anti-depressant
- Dextromethorphan
 - Cough medication
- Warfarin
 - AKA Coumadin – an anticoagulant

Toxicology

- Promethazine – above therapeutic level in blood
 - AKA Phenergan a sedating anti-nausea medication
- Diphenhydramine – therapeutic levels in blood
 - AKA Benadryl a sedating allergy medication
 - AKA Sominex a non-prescription sleep aid
- Combination
 - increased drowsiness, confusion, and memory problems.
- WARNINGS
 - “may impair mental and/or physical ability required for the performance of potentially hazardous tasks (e.g., driving, operating heavy machinery).”



Summary

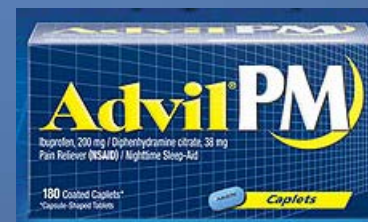
- Pilot likely had necessary skill and experience to safely complete flight
- No preexisting mechanical issues identified
- Combination - two sedating medications
 - Degrade ability to safely fly the airplane
- Severe Heart disease
 - High risk for a sudden cardiac arrhythmia

Probable Cause

- **Impact with trees and terrain during the landing approach likely due to the physiological incapacitation of the pilot**

Most Common Drugs

- Sedating antihistamines
 - Most common category
- Diphenhydramine
 - Most common individual drug
 - Most common potentially impairing drug



READ THE PACKAGE WARNINGS

Drug Facts	
Active ingredient (in each capsule) Diphenhydramine HCl 25 mg.....	Purpose Antihistamine
Uses ■ temporarily relieves these symptoms due to hay fever or other upper respiratory allergies: ■ runny nose ■ sneezing ■ itchy, watery eyes ■ itching of the nose or throat ■ temporarily relieves these symptoms due to the common cold: ■ runny nose ■ sneezing	
Warnings Do not use with any other product containing diphenhydramine, even one used on skin Ask a doctor before use if you have ■ a breathing problem such as emphysema or chronic bronchitis ■ glaucoma ■ trouble urinating or using an enlarged prostate gland Ask a doctor or pharmacist before use if you are taking sedatives or tranquilizers When using this product ■ marked drowsiness may occur ■ avoid alcoholic drinks ■ alcohol, sedatives, and tranquilizers may increase drowsiness ■ be careful when driving a motor vehicle or operating machinery ■ excitability may occur, especially in children Important or breast-feeding , ask a health professional before use Keep out of reach of children . If swallowed, get medical help or contact a Poison Control Center right away. (1-800-222-1222)	
Directions ■ take every 4 to 6 hours ■ do not take more than 6 doses in 24 hours	
adults and children 12 years and over	1 to 2 capsules
children 6 to under 12 years	1 capsule
children under 6 years	do not use this product in children under 6 years of age
Other information ■ store at 59° to 77°F in a dry place. Protect from heat, humidity, and light. ■ do not use if carton is open or blister unit is broken ■ see side panel for lot number and expiration date	



Prevention

- READ - ASK
- FAA Medications and Flying Brochure
 - <https://www.faa.gov/pilots/safety/pilotsafetybrochures/>
- FAA Do Not Issue - Do Not Fly
 - https://www.faa.gov/about/office_org/headquarters_offices/avs/offices/aam/ame/guide/pharm/dni_dnf/
- AOPA member's web site
- Other resources

Medication Advice (FAA)

- Rule of 5
- 5 x the maximum dosing interval
- If the dosing interval is every 6 to 8 hours then $5 \times 8 = 40$ hours after last dose.

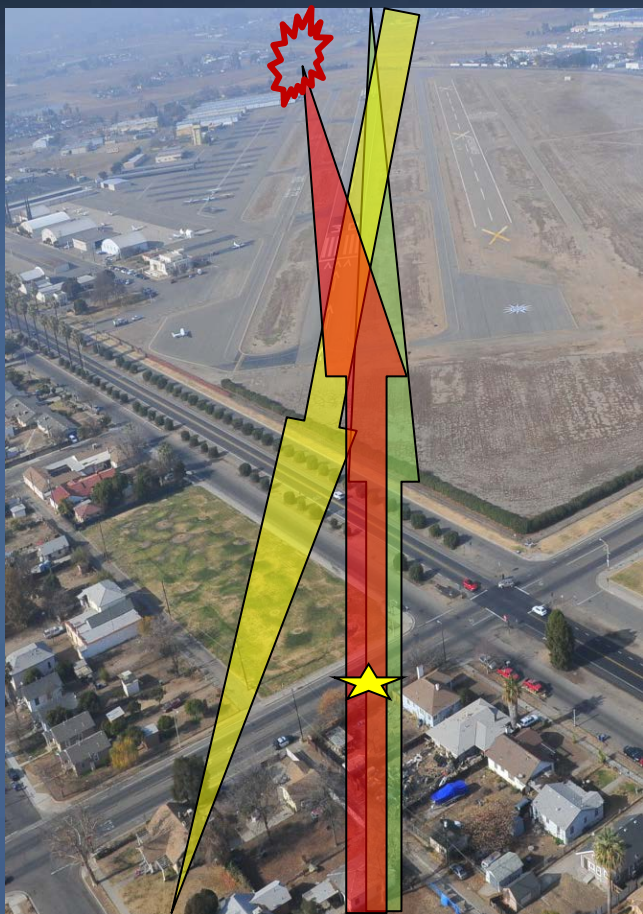
Accident – NTSB # WPR14FA078

- Fresno California
- December 26, 2013 at 1821
- Cessna 172K
- Dark night with haze

Example of 1970 Cessna 172 K



Accident Sequence



- 3 attempts to land on runway 30/12 at Fresno Chandler Executive (FCH)

Pass 1 

Pass 2 

Pass 3 

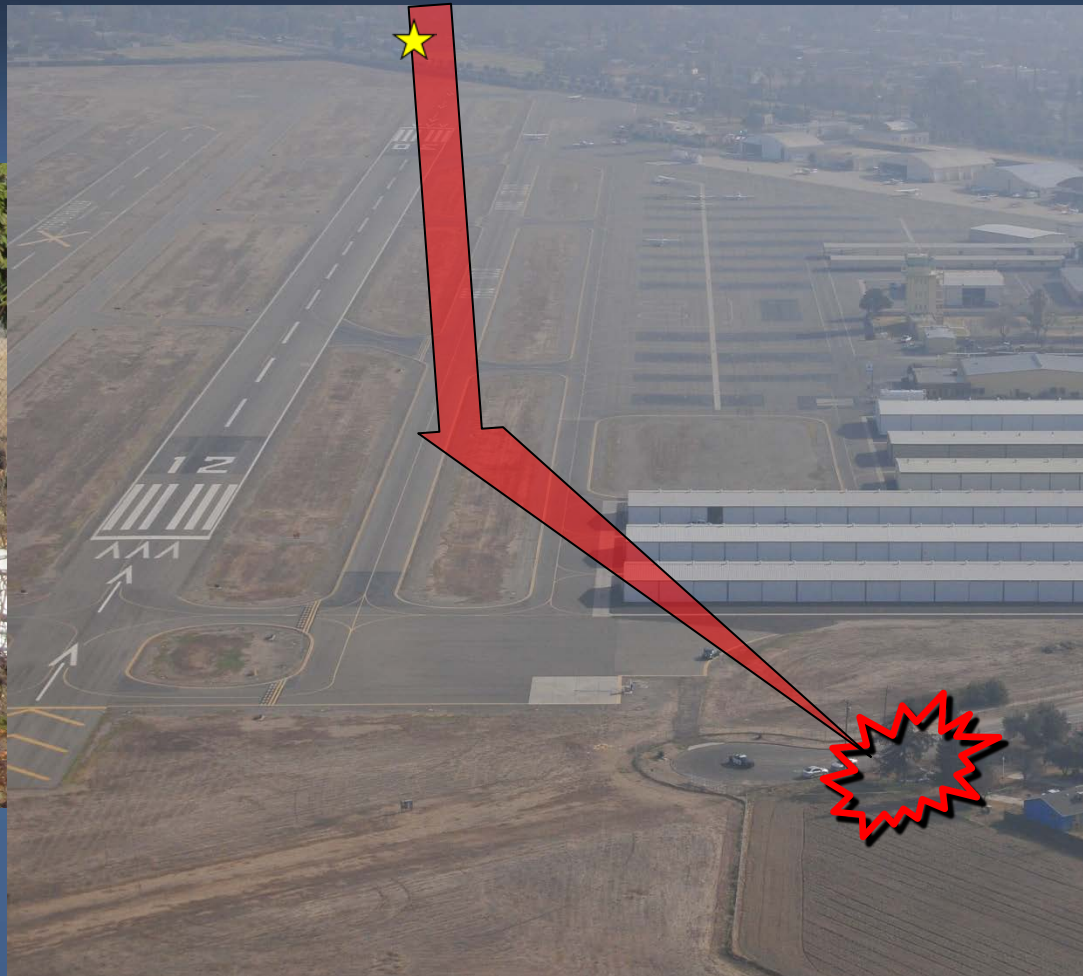
60 foot tree
damage at 40 feet



Crash Site



Accident Site Opposite Direction



2 FATAL

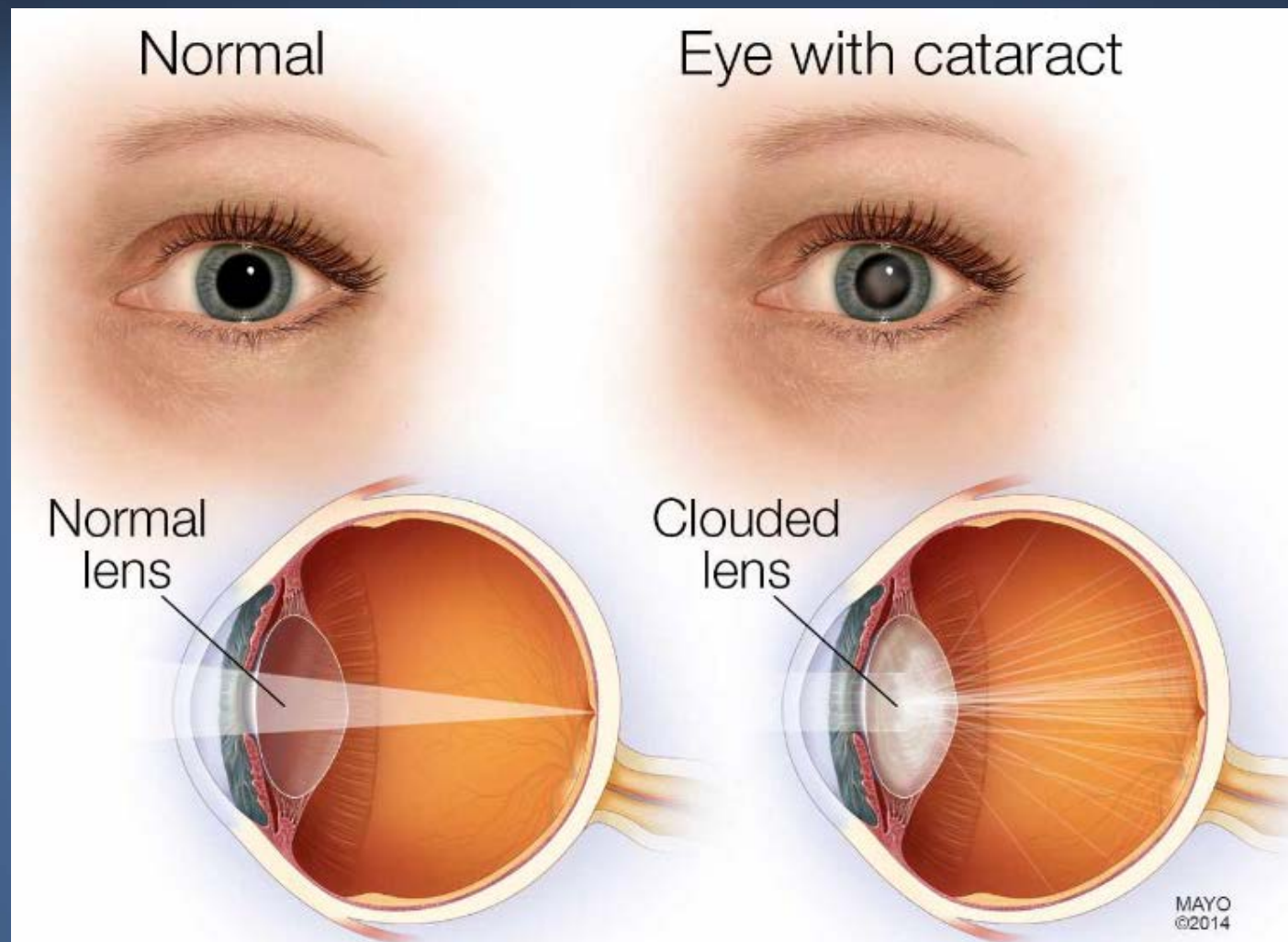
72-Year-Old Male Private Pilot

- 1,459.34 total hours, 25.3 at night
- FAA Medical Certification Exam – May 2013
 - No reported medications or medical conditions
 - No abnormalities recorded by examiner
 - DVA
 - Uncorrected 20/20 R,L,B
 - NVA corrected 20/25 R,L,B
 - Issued a Class 3 Medical Certificate
 - must possess glasses for near vision

Pilot Personal Records

- 5 optometry visits over 3 years
 - Primary complaint – halos around stars
 - Optometry Exam:
 - 5/10 - OD: NS Trace, OS NS1+
 - 9/11 - OD: NS1+, OS NS1+
 - 7/12 - OD: NS1+, OS NS1+
 - 8/13 - OD: NS1+, OS NS1+
 - 11/13 - OD: NS1+, OS NS1+, bilat floaters, right vitreous opacity, CDVA 20/20 OU
 - No other ocular disease recorded
- No other contributory natural diseases

Cataract



Autopsy and Toxicology

- No impairing natural diseases, medications, or toxins identified

Investigation

- 3 weeks prior to accident
 - Difficulty taxiing at home field at night
 - Unable to locate taxiway
 - Witness illuminated taxiway with truck headlights
- No problems identified with airport lighting
 - Other pilots had no problems taxiing at night

Discussion

- No mechanical or operational issues
- Pilot passed med cert exams
- Demonstrated no difficulty flying during the day
- Cataracts
 - Induced glare and diminished nighttime visual acuity
 - Impaired ability to safely control the airplane at night

NTSB Probable Cause

- The pilot's failure to maintain adequate clearance from trees while on approach, which subsequently led to a loss of airplane control
- Also causal was the pilot's continued operation of the airplane at night with a diagnosed medical condition that degraded his night vision

Cataract Risk

- By age 65 \approx 20% and by 70 \approx 50% of Americans affected
- \approx 60,000 active pilots over 65
 - \approx 12,000 or 4% of pilot population at risk for cataracts
 - Risk of progression and vision impairment
 - Possibly flight safety hazard (especially at night)
- Surgery effective at eliminating hazard

Pilot Specific Cataract Risk Guidance

- At the time of the investigation
 - No guidance for aviation medical examiners
 - No readily accessible pilot guidance

Recommendations

- Federal Aviation Administration
 - AME education - risks cataracts may pose to flight safety including a discussion of degraded vision at night; and referral of pilots with cataracts to eye care professionals
 - Pilot education on risk and need to communicate with eye care professionals
- Aircraft Owners and Pilots Association
 - Pilot education on risk and need to communicate with eye care professionals

QUESTIONS
&
SUGGESTIONS





National Transportation Safety Board