

General Aviation Pilots Over 70 Years Old

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- BACKGROUND:** Currently it is not unusual for general aviation pilots in the United States to continue to fly beyond the age of 70, even into their 80s and 90s. Pilots have regular examinations according to protocols which do not specify special or additional requirements for pilots over 70 yr of age. Additionally, the third class medical reforms passed by the U.S. Senate on 15 July 2016 could potentially result in even less stringent medical certification requirements for general aviation pilots.
- METHODS:** Accident rates, medical parameters, autopsy findings, and toxicological findings from the U.S. National Transportation Safety Board (NTSB) general aviation (GA) accident database were analyzed to assess potential risk factors with accident outcomes.
- RESULTS:** During 2003–2012, there were 114 (113 men, 1 woman) general aviation fatal accidents involving pilots ages 70 to 92 yr. A combination of 3 or more drugs were found in 13 (13%) of deceased pilots. The most frequent drugs were first generation antihistamines and antidepressants represented the next highest proportion of possible performance-affecting medications.
- CONCLUSION:** This study indicates that there are critical medical factors that may contribute to fatal accidents among elderly pilots. Polypharmacy use should be taken into consideration, especially during periodic health examinations and fatal aviation investigations involving elderly pilots.
- KEYWORDS:** accident, fatal, drugs, polypharmacy, antidepressants.

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Currently it is not unusual for general aviation pilots in the United States to continue to fly beyond the age of 70, even into their 80s and 90s. The number of pilots over 70 yr of age with an active pilot certificate in the United States have been increasing particularly during the last decade with about 29,000 pilots in 2011 and 32,000 pilots in 2015.^{8,9} In developed countries, about 10% of the general population is 60 yr or older and the fastest growing portion of the population is people over 80 yr of age. It is recognized that adults 60 or 70 yr of age are generally healthier than their counterparts were in the past.

Pilots have regular examinations according to protocols which do not specify special or additional requirements for pilots over 70 yr of age.¹⁰ Originally, periodic examinations had their roots in military aviation medicine. Thereafter, they have been modified for the general pilot population, but not necessarily for an elderly pilot population. In addition, the recent medical reform in the United States could exacerbate this situation, as some pilots (who have had an FAA medical license within the 10 yr prior to 15 July 2016) will not need to see an aviation medical examiner (AME) any more, and there will be a greater need for proper guidelines for GPs (rather than just a checklist) when they see these pilots once every 4 yr.²

Periodic pilot medical examinations are typically performed by physicians who do not themselves participate in the pilot's routine health care, and thus they may not be fully informed of the medical history of the pilot. Self-reported medical history declarations are currently employed to identify clinical problems, but disclosure is often inaccurate or absent.¹¹

Until recently, in commercial aviation, flying was limited to 60 yr of age. This rule has been modified; for example, in the European Union a commercial pilot can continue his/her career up to 65 yr if the other pilot in the cockpit is not over 60 yr of

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age.⁷ The potential health problems associated with aging are well considered among professional pilots by strict medical evaluations and health requirements. In fact, active pilots are healthier than the general population, but also in the population of active pilots there is a larger variation in medical fitness as they age.¹⁶

In the aging general aviation population, the situation is different. Current data suggest that general aviation pilots over 60 yr old, despite usually having more experience, were more likely to be involved in a fatal accident compared with younger pilots.³ Our research question was whether fatal individual accident cases are affected by age-related health status and/or medication use. These aspects are important because there is a lack of studies on pilots over 70 yr of age and studies associating flight performance and medical causes in fatal accidents involving senior citizens.

A pilot may lose partial or complete ability to perform optimally during flight because of medical causes. This loss may occur gradually or suddenly. The absolute or partial inability to perform normal duties related to flight is known as incapacitation. Most studies have focused on sudden incapacitation. Pre-existing medical conditions, which may have a progressive and even subtle effect in causing potential deterioration in performance, may cause a fatal accident among elderly pilots over 70 yr, requiring further evaluation.

METHODS

This study was exploratory in nature and the design was a cross-sectional study on fatal aircraft accidents among older pilots. All fatal aircraft accident reports involving pilots 70 yr and older in general aviation operations between 2003–2012 in the United States were identified using the National Transportation Safety Board (NTSB) database.¹⁴ Data on age, gender, event year, cause of accident, autopsy, toxicological studies, and medical history were collected. For comparison, similar data were collected on pilots in the age range of 60 to 63 yr old during the same period. The comparison group represented the oldest pilot group in related studies.^{4,12}

The cause of accident was categorized as technical, human (errors in performance, skill, perception), medical (disease, drugs), or undetermined. Distributions are reported as numbers and proportions. Proportion ratios (PR) and their 95% confidence intervals (CI) were calculated using the standard formula for risk ratios. The proportion ratio is the ratio of the proportions among older vs. younger pilots. If the 95% CI did not contain the null value (1.0), the respective proportion ratio was considered statistically significant.

RESULTS

During 2003–2012, there were 114 (113 men, 1 woman) fatal aviation accidents involving pilots ages 70 to 92 yr and 85 fatal accidents (all male) involving pilots 60 to 63 yr of age. Autopsies

were carried out in 103 (91%) older and in 79 (93%) younger pilots (PR 0.98, 95% CI 0.90–1.07) (**Table I**). Similarly, toxicology studies were performed in 101 (89%) older and in 79 (93%) younger pilots (PR 0.95, 95% CI 0.87–1.04). According to the accident reports, the probable causes of accidents were related to pilots' performance in 64 (58%), to technical failures in 29 (26%), and to medical issues in 7 (6%) among the older pilots, and in 64 (75%), 14 (17%), and 2 (2%), respectively, among the younger pilots.

In autopsy reports, a disease that may have had a potentially causal association with the accident was found in 20 (19%) older and in 5 (6%) younger pilots (PR 3.04, 95% CI 1.19–7.74). In toxicological studies, drugs which may impair performance and were not allowed for pilots when flying were detected in 27 (27%) older and in 19 (24%) younger pilots (PR 1.11, 95% CI 0.67–1.85). A combination of three or more drugs was found in 13 (13%) older and in 3 (4%) younger pilots (PR 3.39, 95% CI 1.00–11.49). The most frequent drugs were first generation antihistamines, which were detected in 17 (17%) older and in 6 (8%) younger pilots (PR 2.22, 95% CI 0.92–5.36). Antidepressants represented the next highest proportion of possible performance-affecting medications and were detected in 7 (7%) older and in 3 (4%) younger pilots (PR 1.83, 95% CI 0.49–6.83).

DISCUSSION

The regulations related to periodic medical examinations for pilots in general aviation do not provide any special

Table I. Comparison of Accident Investigation Data Revealed from NTSB Reports in General Aviation Operations Between 2003–2012 in the United States of 60 to 63 yr Old Pilots to 70 yr and Older Pilots.

CHARACTERISTIC	AGE GROUP (yr)	
	60–63 N(%)	70–92 N(%)
N	85	114
Event year		
2003–2004	1 (1)	1 (1)
2005–2006	8 (9)	9 (8)
2007–2008	23 (27)	38 (33)
2009–2010	25 (29)	34 (30)
2011–2012	28 (33)	32 (28)
Examinations		
Autopsy	79 (93)	104 (91)
Toxicology	79 (93)	101 (89)
Cause in NTSB report		
Technical	14 (16)	29 (25)
Human	64 (75)	64 (56)
Medical	2 (2)	7 (6)
Undetermined	5 (6)	11 (10)
Medical findings		
Disease*	5 (6)	20 (19)
Medication		
Any	19 (24)	27 (27)
≥3*	3 (4)	13 (13)
Antihistamine	6 (8)	17 (17)
Antidepressant	3 (4)	7 (7)

NTSB = National Transport Safety Board; * = significant difference.

requirements for those pilots who continue flying after 70 yr of age. Fatal aviation accidents involving pilots 70 yr and older have increased in recent years in the United States. Both contemporaneous and coincidental disease and medications appear to be associated with increased risk for these fatalities. Deficiencies in performance related to medication use may be contributing factors in accidents even if they cannot be identified during an autopsy. Examples that belong to this group are errors of perception and judgment as well as errors in reaction. Traditionally, medical causative or contributing factors and operational causes have been separate. As an example, Chaplin⁵ postulated that in single-pilot operations, the risk of operational error is greater than the medical incapacitation risk. Pre-existing medical conditions may be of importance, even if they only cause partial incapacitation or performance impairment, as is suggested by the results of this study.

The most frequently used medications among pilots over 70 yr of age (17% of cases) were first generation antihistamines, and these drugs can exert hypnotic effects and impair flight performance.¹⁵ It is likely that in the elderly pilot population antihistamines are used as a sleep medication because of their sedative effect. The problem is that these antihistamines reduce rapid eye movement sleep and impair performance. This problem in the elderly pilot population is underreported or underestimated. In an earlier study, between 4% and 11% of fatal aviation accidents within a 16-yr period (1990–2005) reported first-generation antihistamines in the pilot autopsy reports, but no conclusions were derived from this information.¹⁷

The second most frequently used medications (7%) were antidepressants among pilots over 70 yr of age. It is noteworthy that pilots were forbidden to use antidepressants at the time of the present study period.¹⁸ The problem with this hidden use of antidepressants is threefold. First, in these cases the disease for which these drugs were administered is unknown. Second, there are available antidepressants that may be used with aviation and some which are not acceptable in aviation because of their side effects. Third, these cases were examined solely by an aeromedical examiner. The use of antidepressants among these elderly pilots was noteworthy. From a diagnostic point of view, it is important to consider that major depression often shows atypical symptoms among the elderly. In addition, elderly people are at increased risk of adverse outcomes when they consume antidepressants. Road traffic accidents have been shown to increase after recent use of antidepressants.¹³

In the present study 12% of older pilots consumed three or more drugs at the time of the accident. Among the elderly, comorbidities may increase the risk of drug interactions. The use of multiple medications also has been shown to be associated with land vehicle crashes.¹ Furthermore, the studies of road traffic accidents have shown that age-related cognitive impairment has been an important exacerbating factor contributing to those accidents.⁶

Our analysis found that in several fatal accidents older pilots received medical certification to fly despite medications or diseases possibly affecting flight performance. These pilots should have been prohibited from flying and civil aviation safety

authorities should have been notified. Flight safety profiles of older pilots could be improved by incorporating a pilot's general practitioner, who performs periodic medical examinations on the pilot. It would be advisable to require a statement of current medical treatment from the attending general practitioners regarding health status and medications. This deficiency explains why there are not many screening tests carried out in medical periodic examinations. Nonetheless, the situation could be improved regarding elderly pilots.

Because older individuals are physiologically and mentally heterogeneous, it is challenging to target medical restrictions to those pilots who need them. This may be a reason for the lack of additional screening requirements. This challenge could be exacerbated after the recent third class medical reform in the United States.² This study provides evidence that there are critical medical factors to consider regarding fatal accidents among elderly pilots.

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