

RESEARCH ARTICLE

Pilot Medical History and Medications Found in Post Mortem Specimens from Aviation Accidents

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Introduction: Federal Aviation Administration (FAA) regulations require pilots to report all medications and medical conditions for review and consideration as to the overall suitability of the pilot for flight activities. **Methods:** Specimens were collected by local pathologists from aviation accidents and sent to the Bioaeronautical Sciences Research Laboratory for analysis. The results of such tests were entered into the Forensic Case Management System. This database was searched to identify all pilots found positive for medications used to treat cardiovascular, psychological, or neurological conditions over the period January 1, 1993, through December 31, 2003. **Results:** Toxicological evaluations were performed on 4143 pilots. Psychotropic drugs were found in 223 pilots. Cardiovascular medications were found in 149 pilots. Neurological medications were found in 15 pilots. Pilots reported psychological conditions in 14 of the 223 pilots found positive for psychotropic drugs. Only 1 of the 14 pilots reporting a psychological condition to the FAA reported the psychotropic medication found after the accident. Cardiovascular disease was reported by 69 of the pilots found with cardiovascular drugs in their system. Cardiovascular medications found in the pilots were reported by 29 of the 69 pilots reporting a cardiovascular condition. Only 1 of the 15 pilots reported having a neurological condition to the FAA; none of the pilots found with neurological medications reported the medication. **Conclusions:** Toxicology successfully identified 93% of the medications reported by the pilots. Pilots involved in fatal accidents taking psychotropic or neurological medications rarely reported the medication or their underlying medical condition to the FAA.

Keywords: aviation, toxicology, cardiovascular, psychotropic, neurological, psychological.

THE FEDERAL AVIATION Administration's (FAA's) Office of Aerospace Medicine (OAM) monitors the medical certification of pilots to verify their compliance with FAA medical certification aviation safety standards. This research compared the medical history reported to OAM by pilots on FAA Form 8500-8 (Application for Airman Medical Certificate or Airman Medical & Student Pilot Certificate) with the medication analytically identified by the FAA's Bioaeronautical Sciences Research Laboratory in post mortem specimens taken from a pilot after an aviation accident. The medical history includes reporting medical problems and the medications taken. Several papers have reported on the incidence of drugs and alcohol in victims of fatal aviation accidents (1,2,4,7,10,11). A previous study investigated a small group of pilots, comparing their medical history with the drugs found after an accident (3). The current study evaluated the ability of the FAA toxicology laboratory to identify drugs

found in pilots who had died in a fatal aviation accident with drugs reported by pilots on their medical applications. In addition, this study examined the reliability of the medical information provided by pilots regarding their reported medical condition(s).

Medical conditions and the medications used to treat these conditions are both considered by the National Transportation Safety Board to be critical factors in the thorough evaluation of transportation accidents. The National Transportation Safety Board has issued safety recommendations (9) based on the dangers of pilots using prescription and/or over-the-counter medications while performing safety-sensitive aviation activities. McCormick reported "The Safety Board's investigation must determine if a crewmember suffered from a preexisting disease, whether the crew had ingested drugs contraindicated with their flying duties, as well as a description of all injuries and all toxicological and histological findings for crew and passengers. During Safety Board investigations conducted in densely populated cities, over oceans, and in remote areas, both in the United States and overseas, many situations have developed which have caused much investigative effort due to less than complete post mortem examinations (8)." The Bioaeronautical Sciences Research Laboratory uses state-of-the-art forensic toxicological analysis on all post mortem specimens to fulfill the need to understand the relationship of medications in accident causation.

METHODS

Biological fluids and tissues were collected by local pathologists from pilots who died in an aviation accident, using procedures described at the FAA Internet web site (6) and sent to the Civil Aerospace Medical

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Institute's Bioaeronautical Sciences Research Laboratory for analysis (5). The results of such tests are entered into the laboratory's database. These data are readily organized and analyzed based on the class of drug, as defined by the individual researcher, using the "Forensic Case Management System" (© 1998–2004, Discover-Soft Development, LLC, Oklahoma City, OK). The toxicology database was searched from January 1, 1993, through December 31, 2003, to define all cases containing the major medications used in the treatment of cardiovascular, psychological, and neurological conditions. This selection was made since these medical conditions posed the greatest potential to incapacitate a pilot during flight. It is important to remember that some of the drugs found may have had their origin from emergency medical treatment administered immediately after the accident. The analytical methodology for each of the medications has been previously described and is well established.

RESULTS

Specimens from 4143 deceased pilots who died as a result of an aviation accident were rigorously analyzed for medications over the duration of this study. Only three classes of medication were considered in this study: psychotropic, cardiovascular, and neurological classes. Psychotropic medications were found in 223 of the pilots in this study (5%). Cardiovascular medications were found in 149 of the pilots in this study (4%). Neurological medications were found in 15 of the pilots in this study (0.4%). Psychological conditions were reported by 14 (6%) of the 223 pilots found to be taking psychotropic drugs. Only one pilot with a psychotropic medication had reported the medication on the medical application. Cardiovascular disease was reported by 69 (46%) of the 149 pilots found positive for cardiovascular drugs. Of the 149 pilots found to be using cardiovascular medications, 29 had reported this on their medical application. Cardiovascular medications reported by two pilots were not actually found in post mortem specimens tested. Only 1 (7%) of the 15 pilots taking neurological medications had reported a neurological condition on the medical application. None of the pilots found with neurological medications had reported the medication.

The accuracy of required reporting of medication on FAA Form 8500–8 by pilots was low. Of the 387 samples reviewed, only 30 (8%) had accurately reported the medications they were taking. No medications were

TABLE I. TYPE OF MEDICATIONS IDENTIFIED IN PILOT FATALITIES AND PILOT DISCLOSURES.

Medication Type	Pilots With Medications	Medical Conditions Reported by Pilots	Medications Reported by Pilots
Cardiovascular	149	69	26
Neurologic	15	1	0
Psychotropic	223	14	1
Total	387	84	27

Note: Table reflects specific medications and conditions of interest from 4143 individual samples.

TABLE II. LIST OF PSYCHOTROPIC, CARDIOVASCULAR, AND NEUROLOGICAL MEDICATIONS FOUND IN THIS STUDY.

Psychotropic	#	Cardiovascular	#	Neurological	#
Alprazolam	8	Amlodipine	8	Carbamazepine	3
Amitriptyline	10	Atenolol	33	Phenytoin	11
Bupropion	14	Bisoprolol	4	Selegiline	1
Buspirone	1	Clonidine	1	Total	15
Chlordiazepoxide	5	Diltiazem	23		
Citalopram	13	Doxazosin	1		
Clomipramine	1	Flecainide	1		
Desalkylflurazepam	3	Labetalol	4		
Diazepam	29	Metoprolol	24		
Doxepin	2	Moricizine	1		
Fluoxetine	40	Nadolol	4		
Imipramine	10	Procainamide	3		
Lorazepam	1	Propranolol	9		
Mirtazapine	2	Verapamil	33		
Nefazodone	1	Total	149		
Nordiazepam	16				
Norfluoxetine	1				
Oxazepam	2				
Paroxetine	21				
Sertraline	26				
Temazepam	5				
Trazodone	4				
Venlafaxine	6				
Zolpidem	2				
Total	223				

reported by 286 (74%) of the pilots found to be positive for drugs by post-accident toxicology, and 71 (18%) had reported medications different than what was detected by toxicological examination. Table I summarizes the findings. The pilots' reported medical history and records did not always specify the type of medications being given or taken. Table II provides a list of the medications found in post mortem specimens.

DISCUSSION

The FAA's Bioaeronautical Sciences Research Laboratory was successful in identifying 93% of the medications screened for by the laboratory that were reported by pilots in this study. The CAMI laboratory screens for most drugs, but cannot screen for all drugs (e.g., ACE inhibitors). Therefore, this study was restricted to those drugs routinely screened for by the laboratory. One must consider the possibility that the remaining 7% of the pilots taking drugs screened for by the laboratory stopped taking the medication previously reported in their medical applications. Not surprisingly, the accuracy of required reporting of medication usage by pilots was low, with 92% of pilots either failing to report medications they were taking or reporting a different medication than what was found during toxicological analysis. Pilots taking psychotropic or neurological medications rarely reported the medication or medical condition on their FAA medical application. Compared with cardiovascular disease, proportionately fewer Authorizations for Special Issuance (i.e., waivers) were granted by OAM for these two conditions; hence, one could speculate that pilots chose to not disclose such conditions in order to continue flying. Almost half of the pilots found to be taking cardiovascular medications reported their condition to the FAA Office of Aerospace Medicine (Table I).

Research is needed to determine the incident rates of reporting medications and conditions in pilots not involved in fatal accidents. This would allow researchers and regulators to compare fatal accident pilots with pilots not involved in accidents.

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