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Comparison of Pilot Medical History and Medications Found In Postmortem Specimens

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16. Abstract

Introduction: Pilots are required by Federal Aviation Administration (FAA) regulations to report all medications and medical conditions to the FAA Office of Aerospace Medicine for review and consideration as to the overall suitability of the pilot for flight activities. **Methods:** Following a fatal aviation accident, specimens from deceased pilots are collected by local pathologists and sent to the Bioaeronautical Sciences Research Laboratory for toxicological analysis. The results of such tests are entered into the Bioaeronautical Sciences Research Laboratory, Forensic Case Management System (© 1998, DiscoverSoft Development, LLC, Oklahoma City, OK). 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. These medical conditions were selected because of their potential to rapidly incapacitate a pilot in-flight. It is important to note that some of the medications found may have been administered by health care workers as a part of emergency medical treatment after the accident. **Results:** Our laboratory conducted toxicological evaluations on 4,143 pilots during the study period. Psychotropic drugs were found in 223 pilots (5%). Cardiovascular medications were found in 149 pilots (4%). Neurological medications were found in 15 cases (0.4%). 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 on their medical application reported the psychotropic medication found after the accident. Cardiovascular disease was reported by 69 of the pilots found to have cardiovascular drugs in their system. The cardiovascular medications found in the pilots were reported by 29 of the 69 pilots reporting a cardiovascular condition. Additionally, two pilots reported taking cardiovascular medications, but no cardiovascular medications were found in the postmortem specimens tested. Only 1 of the 15 pilots reported having a neurological condition on their medical application; none of the pilots found with neurological medications had reported the medication on their medical application. The medical history of the pilots did not always specify the type of drugs being taken. **Conclusions:** Based on the drugs screened for by the laboratory, we successfully identified 93% of the medications reported by the pilots. One must consider the possibility that the remaining 7% of the pilots stopped taking the medication prior to the accident. Pilots involved in fatal accidents taking psychotropic or neurological medications rarely reported the medication or their underlying medical condition with the FAA Aerospace Medical Certification program, as required.

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Comparison of Pilot Medical History and Medications Found in Postmortem Specimens

INTRODUCTION

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 postmortem specimens taken from a pilot after a fatal 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.[1-6] A previous study investigated a small group of pilots, comparing their medical history with the drugs found after an accident.[7] The current study evaluated the ability of the FAA toxicology laboratory to identify 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 (NTSB) to be critical factors in the thorough evaluation of transportation accidents. The NTSB has issued safety recommendations[8] 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 cites, 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 postmortem examinations."[9]

The Bioaeronautical Sciences Research Laboratory utilizes state-of-the-art forensic toxicological analysis on all postmortem specimens to fulfill the need to understand the relationship of medications in accident causation.

MATERIALS AND METHODS

Biological fluids and tissues were collected by local pathologists from deceased pilots using procedures described at the FAA Internet Web site[10] following aviation accidents and sent to the CAMI Bioaeronautical Sciences Research Laboratory for analysis.[11] 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, DiscoverSoft 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 4,143 deceased pilots were rigorously analyzed for medications over the duration of this study. Only 3 classes of medication were considered in this study: psychotropic, cardiovascular, and neurological classes. Psychotropic medications were found in 223 pilot fatalities (5%). Cardiovascular medications were found in 149 pilot fatalities (4%). Neurological medications were found in 15 pilot fatalities (0.4%). Psychological conditions were reported by 14 (6%) of the 223 pilots found to be taking psychotropic drugs. Only 1 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 2 pilots were not actually found in postmortem 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 medications they were taking. No medications were 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 1 summarizes the findings. The pilots' reported medical history and records did not always specify the type of medications being given or taken. Table 2 provides a list of the medications found in postmortem specimens.

DISCUSSION AND CONCLUSION

The FAA's Bioaeronautical Sciences Research Laboratory was successful in identifying 93% of the medications that were reported by pilots (93% of the drugs the laboratory screens for). One must consider the possibility that the remaining 7% of the pilots 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 choose to not disclose such conditions and continue flying. Almost half of the pilots found to be taking cardiovascular medications reported their condition to the FAA Office of Aerospace Medicine (Figure 1).

REFERENCES

1. Soper JW, Chaturvedi AK, Canfield DV. Prevalence of chlorpheniramine in aviation accident pilot fatalities, 1991-1996. *Aviat Space Environ Med* 2000;**71**:1206-9.

2. Canfield DV, Hordinsky J, Millett DP, Endecott B, Smith D. Prevalence of drugs and alcohol in fatal civil aviation accidents between 1994 and 1998. *Aviat Space Environ Med* 2001;**72**:120-4.

3. Akin A, Chaturvedi AK. Selective serotonin reuptake inhibitors in pilot fatalities of civil aviation accidents, 1990-2001. *Aviat Space Environ Med* 2003;**74**:1169-76.

4. Shkrum MJ, Hurlbut DJ, Young JG. Fatal light aircraft accidents in Ontario: A five year study. *J Forensic Sci* 1996;**41**:252-63.

5. Canfield DV, Fleming J, Berky M, Hordinsky J. Drugs and alcohol found in fatal aviation accidents between 1989 and 1993. (Report No. DOT/FAA/AM-95/9). Washington, DC: Federal Aviation Administration.

6. Kuhlman JJ, Jr., Levine B, Smith ML, Hordinsky JR. Toxicological findings in Federal Aviation Administration general aviation accidents. *J Forensic Sci* 1991;**36**:1121-8.

7. Canfield DV, Fleming J, Hordinsky J, Veronneau S. Unreported medications, used in incapacitating medical conditions found in fatal civil aviation accidents. (Report No. DOT/FAA/AM-94/8). Washington, DC: Federal Aviation Administration.

8. National Transportation Safety Board. Establish a list of approved medications. Washington, DC: NTSB; Safety recommendation I-00-1 through 4. January 13, 2000.

9. McCormick MM. Joint Committee on Aviation Pathology: VIII. Medical investigator preparedness for aircraft accident investigation. *Aviat Space Environ Med* 1977;**48**:932-6.

10. Federal Aviation Administration. Collecting and shipping toxicology specimens. Washington, DC: FAA; Retrieved May 23, 2006, from the Internet: www.faa.gov/education_research/research/med_humanfacs/aeromedical/forensictoxicology/forms/index.cfm.

11. Chaturvedi AK, Smith DR, Soper JW, Canfield DV, Whinnery JE. Characteristics and toxicological processing of postmortem pilot specimens from fatal civil aviation accidents. *Aviat Space Environ Med* 2003;**74**:252-9.

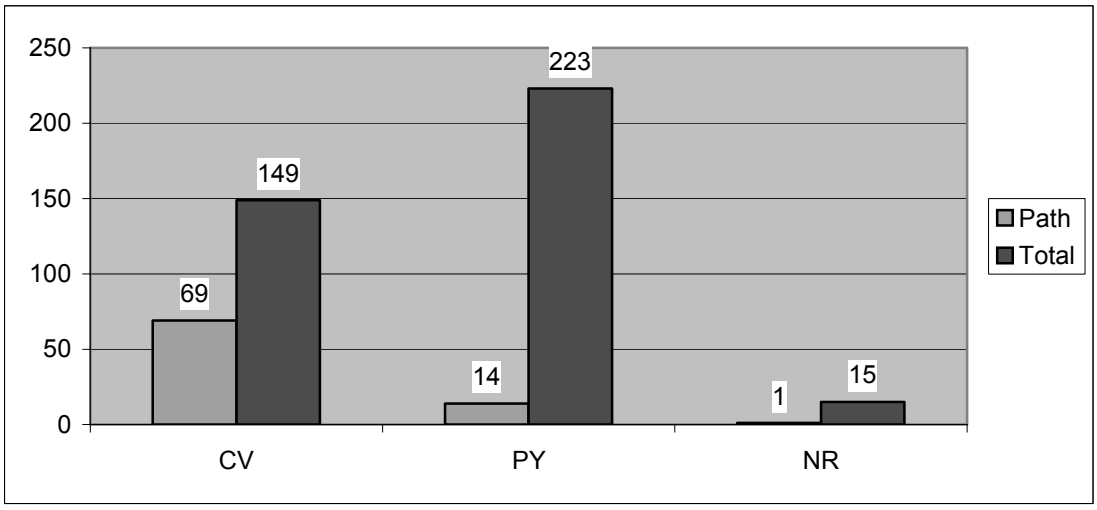
Table 1. Type of medications identified in pilot fatalities and pilot disclosures.

Medical Condition	Pilots With Medications	Medical Conditions Reported by Pilots	Medications Reported by Pilots
Cardiovascular	149	69	29
Neurologic	15	1	0
Psychological	223	14	1
Total	**387**	**84**	**30**

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

Table 2. List of psychotropic, cardiovascular, and neurological medications found in this study.

Pyschotropic	**#**	**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**				



CV=cardiovascular, PY=psychotropic, NR= neurological

Figure 1. Comparison of reported medical conditions to medications found postmortem.