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Study Suggests Longer Life Expectancy for Retired Pilots Than for Their General Population Counterparts

It has been said that stresses peculiar to the pilot's profession tend to cause premature death after retirement, and evidence purports to show that pilots often die shortly after their careers end. This study of one airline's pilots, retiring at age 60 during a 25-year period, provides contrary evidence.

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The life expectancy of the typical retired airline pilot has been pondered, discussed and argued for years in the cockpits, briefing rooms and negotiating tables of commercial aviation. The conventional wisdom has pointed to incidents where retired airline pilots were in excellent health and physical condition, yet died in the first few years, even a few months, after retirement. Many airline pilots can recount anecdotes of colleagues who died very soon after the mandatory retirement age of 60. Some people believe that factors associated with an airline pilot's career may have precipitating effects on mortality.

This study, although somewhat limited in scope and by no means definitive, suggests otherwise. The hypothesis that retired airline pilots die at younger ages than their general population counterparts was not supported by this study.

On the contrary, this study revealed a significantly longer life expectancy for this 25-year sample of retired pilots from American Airlines compared with their counterparts in the 1980 U.S. general population census of 60-year-old white males (which most closely resembles the pilot population and reduces extraneous variables). The airline pilots' median residual lifetime — the time by which half the pilots retiring at 60 are expected to have died — for this sample was more than five years longer than that of their counterparts in the U.S. white male population.

Professional airline pilots should be in far better health at all ages than the general population. Every six months, U.S. airline pilots must undergo a first-class flight physical examination, which is defined and required by the U.S. Federal Aviation Administration (FAA). To continue flying as pilots, they must pass the physical examination. Airline pilots reach age 60 (their mandatory-retirement date) after an entire career of active health monitoring and maintenance. Some people conclude that the life expectancy of a 60-year-old retired airline pilot should be considerably longer than the counterpart 60-year-old from the general population because of the ongoing medical scrutiny, early detection and treatment of disorders, and the removal from flight status of those with serious pathology. Nevertheless, the "flight line talk" of the aviation industry contends that pilots die at a younger age than the general population. Each time an airline pilot dies in the first few years after retirement, the hypothesis of airline pilots' premature death is reborn and reinforced in the minds of the observers.

The underlying basis of a lowered-life-expectancy hypothesis is believed to be the effects of factors to which airline pilots may have been excessively exposed. Several authors have pointed out physical and emotional stressors that may negatively affect the health and well-being of airline pilots.[1-5] In no particular order, some of the most frequently discussed factors are:

- Fatigue;
- Cosmic radiation and electromagnetic-field effects;
- Circadian dysrhythmia;
- Sound and vibration exposure;
- Lowered humidity, ambient pressure and mild hypoxia;
- Potential air contaminants;
- Questionable nutrition;
- Concerns about responsibility for passenger safety;
- Loss-of-career threat from corporate failure/ confrontational labor relations;
- Anxiety about possible disqualification through professional errors; and,
- Concerns about losing medical certification from occupational or other accidents, disease and aging.

If an early mortality trend is real, research into some or all of the factors listed above could reveal their precipitating potential. Epidemiological investigation (the study of the distribution of disorders in a population) could also provide critical information concerning such trends compared with a matching sample of the general population. Results of such analyses would be of interest to the FAA and other civil aviation authorities as indicators of health factors to be monitored in the pilot population.

Nevertheless, because of the requirement for complete anonymity in this preliminary study, that level of analysis could not be performed. This study was limited, therefore, to assessing the overall question of differential mortality for retired airline pilots. Future studies could explore the reasons for any differential effect noted.

Earlier Research Reviewed

The authors found little research that adequately addressed the question of whether retired airline pilots die younger or live longer than the general population. One article attempted to use statistical and actuarial data to address the question. In that report, Muhanna and Shakallis[6] postulated that retired airline pilots have a lower life expectancy than the general population. The authors assessed retired pilot mortality without accounting for the changing nature of the sample, i.e., taking into consideration all of the individuals who enter (i.e., retire) and leave (i.e., die or enter late in the study and leave at the close of the study, alive) during each year of the study period. Although the rates expressed as percentages presented the mortality data in an interesting manner, it was an inappropriate method for analysis of realistic trends; all of their data were presented as percentages. Neither actual sample sizes nor any survival statistics were reported.

Morgan assumed that the Muhanna and Shakallis conclusions were valid.[4] Their results prompted Morgan's discussion of recent changes in the professional aviators' environment that could explain some of the reputed shortened life expectancy. He pointed out many significant factors included in the previously cited list that might cause life-shortening stress to the professional airline pilot.

Kaji et al. found that the mortality rate from natural causes was lower in active Japanese airline pilots than in the general Japanese population.[7] Of their sample of 2,327 pilots, 191 had retired. They found that only 16 of the 191 retired pilots had died. Kaji et al. concluded that the improved health standard of the airline pilots explained their lower mortality and higher life expectancies. Nevertheless, these researchers did not have a large enough sample of retired pilots to reliably estimate differences in postretirement life expectancy between pilots and the general population.

Irvine and Davies conducted a proportional mortality study of active and retired British Airways pilots.[8] Irvine and Davies reported the conclusions of the actuaries to the British Airways Pension Schemes in an unpublished study for the period July 1986 to March 1989. Their emphasis primarily concerned causes of death, but they quoted the actuaries as reporting an increase in "life expectancy of about five years better than other reference pensioners [retirees]." No sample size, sampling plan or analytical methods were reported for the undocumented actuarial study. In their study, Irvine and Davies reported no survival data for retired pilots in their conclusions.

Salisbury et al. conducted an epidemiological study of deceased British Columbia pilots.[9] They reported an elevated proportional cancer mortality ratio (PCMR) for airline pilots. Band et al. studied causes of death in 891 Canadian Pacific Airlines pilots.[10] They reported elevated PCMRs for the pilots in their sample. Hoiberg and Blood, in a study of age-specific morbidity, concluded that U.S. Navy pilots are in much better health than the normal population.[11] The oldest pilots in their study were under 54. None of these authors studied survival patterns of retired pilots.

As part of the ongoing research program on mandatory retirement at age 60 for airline pilots, the FAA's Civil Aeromedical Institute (CAMI) has been investigating the relationship of age and performance in airline pilots. Hyland et al.

conducted an extensive literature review.[12] They did not specifically address the question of retired airline pilots' longevity, nor did they investigate the potential effects of a career-long exposure to the unique factors associated with a pilot's profession.

This study was proposed as a preliminary investigation of the distribution of age at death of retired airline pilots and to investigate a large enough sample of retired pilots to provide reliable and valid estimates of postretirement survival. Survival patterns of retired airline pilots have a far-reaching impact on pilots' careers, life insurance and retirement benefits (Mayhew;[13] Muhanna and Shakallis;[6] and U. S. Congress[14]). Survival patterns of retired flight crew members may also provide evidence that could lead to more research and epidemiological investigation of factors of unknown importance associated with the pilot's profession. The investigation could also provide the aviation community with evidence supporting or refuting the premature-mortality hypothesis and, it is hoped, to clear a way for sharing critical information contained in such data bases.

Some Variables Were Excluded

In the preliminary survey, no attempt was made to determine cause of death. This was decided to preserve anonymity of our sample and to secure the cooperation of the airline providing the data. Therefore, no attempt was made to conduct epidemiological investigation of such variables as smoking, diet, exercise, family history, current health status or cause of death. Dates in the corporate records were assumed to be accurate because the dates of hire, birth, retirement and death are critical for salary, seniority level and pension benefits for all flight crew members.

Cooperation was received from American Airlines (AAL), the U.S. Allied Pilots Association (APA) and the Grey Eagles (retired AAL pilots). The study was based on data for 2,209 pilots and flight engineers who had retired from active service with AAL during the 25 years between April 1968 and the end of June 1993. The records of the sample were kept on a computerized data base. Each flight crew member was identified by birth date, date of hire, date of retirement and date of death. No employee identification such as social security numbers or FAA certificate numbers were provided for the study. The records of an estimated 250 additional pilots who had retired before April 1968 were recorded on a microfiche data base, but the cost of retrieving these data prevented including these pilots in this survey.

Because both pilots and flight engineers have the same kind of exposure in terms of working environment and flying hours, it could be argued that they should be treated as one population for a study such as this. Nevertheless, because the flight engineers were not required to pass a first-class flight physical and they were not required to retire at 60, it was decided to treat them as a separate population from the 60-year-old pilot retirees.

Some of the pilots and flight engineers retired as early as 50. The reasons for the early retirements were not available. Because it was observed that many pilots retired early because of medical disqualification, the early retirees were not included in the sample of 60-year-old retirees. This group could potentially provide information concerning early incidence of the effects of career-related disability or mortality, but they were excluded from the sample. Hence, of the 2,209 retirees, 360 had retired before age 60 and 355 stayed with the airline in another capacity and retired after their 60th birthday. With the early and late retirees removed from the sample, 1,494 pilots retiring at 60 remained for analysis.

All the pilots in the sample retired at 60, in various calendar years. The survival status of each pilot was known at the close of the study in July 1993. The sample was still maturing at the cutoff date of study, because 1,298 pilots were still living. Thus, each pilot was in the study for a different length of time, beginning at the date of retirement.

Life Table Method Offered Advantages

One popular and practical technique for describing survival experience over time is the actuarial or life table method. The life table method has become the analytical method of choice for most survival studies. This method is described in detail by Griswold et al.,[15] and by Pearl.[16] Cutler and Ederer[17] have described one very important advantage of the life table method, which was the most suitable approach to analyze the pattern of mortality for this data set. It allows subjects to enter the study (i.e., retire), or leave the study (i.e., die) at different points of time during the 25 years of the study, as well as leave alive at the close of the study.

Life table analysis estimates the probability of surviving a given number of years after retirement, and benefits from including survival information on individuals entering the series too late to have had the opportunity to survive the full extent of the 25-year study. In addition, it estimates median residual lifetime or median remaining life expectancy for each year after retirement. Among pilots who survive a given number of years past retirement, half the survivors will die before the median life expectancy is reached and half will live beyond this median residual lifetime age.

Initially, the retired pilots were divided into two groups: those who retired through Dec. 31, 1979, and those who retired from January 1980 to June 1993. This was to determine if there were different mortality rates among pilots who retired in the early years of the study period vs. those who retired in the later years. These two groups were established to examine whether longer exposure to high-altitude flying by pilots retiring in the second half of the study period could be related to survival patterns after retirement.

It was found that the survival-rate difference between those two retired-pilot groups was not statistically significant. The two samples were combined and were analyzed as a single group of 1,494 retired pilots.

Because the sample was anonymous, the gender, race, socioeconomic status, health consciousness, previous health history, etc. of the pilots could not be verified. The high estimated percentage of white males in this pilot sample and the preliminary approach to analyzing the data required certain assumptions for comparisons with a sample of 60-year-olds from the general population. Hence, the survival rates of the pilots in the sample were compared with those from the U.S. life tables of 1980, 1985 and 1989 for 60-year-old white males.[18–20]

The survival rates of retired pilots and that of the U.S. white male population for the years 1980, 1985 and 1989 were plotted. There were no significant differences among the three years. The year 1980 was chosen for subsequent comparisons with retired pilots because it occurred almost in the middle of the 25-year span during which this sample of pilots had retired.

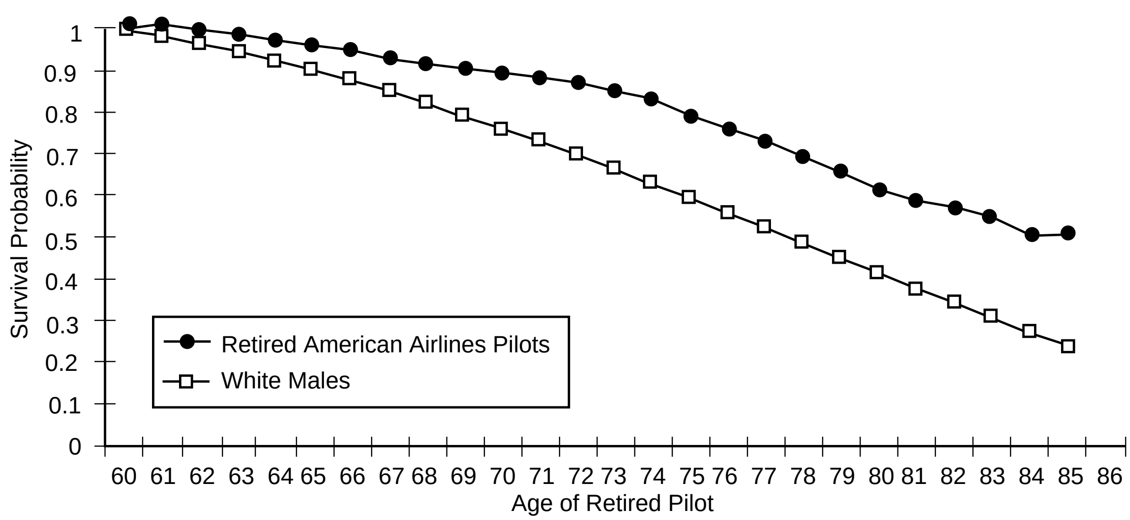
Retired Pilots Live 83.8 Years: Median Survival Age

Figure 1 shows that in the 1980 U.S. white male population, the survival probability curve is entirely below the median age of death for all of these pilots. The pilots in this sample live significantly longer than U.S. white males. The median survival age for the retired pilots in this sample is 83.8 years. For the 60-year-old U.S. white male, the median survival ages for the sampled years of 1980, 1985 and 1989 was 78.2 years. In this study, the retired pilots have more than a five-year advantage of median life expectancy compared with the 60-year-old U.S. white male population. It can also be seen in Figure 1 that by age 85, the probability of survival would be more than 49 percent for the retired pilot sample.

The hypothesis of premature mortality among retired airline pilots compared with their counterparts in the general population was not supported by the data in this study. Retired pilots in this sample appeared to enjoy a life expectancy more than five years longer than the 1980 U.S. general population of white males. Nevertheless, before it can be concluded that this is true for all retired airline pilots, the adequacy of this sample to represent the population of retired airline pilots should be determined. This sample represents only one airline.

Throughout the period in which the pilots in this sample were employed, the airline maintained stringent medical screening and high health standards, even at the initial hiring. The airline required an annual company flight physical in addition to the FAA flight physical. If there is any bias in the sample, it should be in the direction of better health and increased longevity of the entire population of the pilots compared with the general population. It could be hypothesized that an even greater increase in life expectancy should have been realized, but was not realized because of the purported effects of the environmental and personal stress factors associated with this occupation. This would, however, require much more information than was provided in the data sample.

Survival Probability Curve of Pilots Retired During April 1968 Through June 1993, Compared with 60-year-old U.S. White Males in General Population



Source: U.S. Federal Aviation Adminstration

Figure 1

The adequacy of the general population sample could also be questioned. Because the pilot sample was anonymous, personal characteristics (e.g., socio-economic status, education, health consciousness, family history or specific health attributes) that could promote longevity could not be compared with those of the sampled general population.

We recommend investigating these questions, and that a follow-up or updated survey of AAL pilots be conducted regularly to track changes in the median residual lifetime estimates of the surviving pilot population. As the age of this sample matures, more accurate life expectancies for each year following retirement will become available. If mortality dates in the survival distribution prove to be earlier than projected, more precise epidemiological studies could be proposed to assess the relationships of the potential stress factors associated with this career.

A practical next step would be to conduct a more exhaustive survey of airline pilots, including all of the major U.S. airlines and international airlines. Worldwide, there is a very high number of pilots who have retired from major airlines. A follow-on study, which would obtain a larger sample of these pilots and contain data on causes of death and reasons for early retirement, would certainly yield information to verify and refine the results found in this study.

An anonymous and confidential program, which would use the data bases on flight crew members in the current major U.S. airlines, should result in a sample of more than 10,000 retired pilots. By calling on the data bases in all departments of the airlines (at least the flight, medical, personnel and benefits departments), the data on health history, causes of death and reasons for early retirements should be available. The data needed for this type of survey would not require personal identification or references, such as names or Social Security numbers. This type of survey could yield a more definitive answer to the question of retired pilots' longevity.♦

Editorial note: This article was adapted from *A Longevity and Survival Analysis for a Cohort of Retired Airline Pilots*. U.S. Federal Aviation Administration, Report no. DOT/FAA/AM-95/5. February 1995.

The original report provides a more technical and detailed account of the study's methodology.

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