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THE EFFECTS OF INTERNATIONAL FLIGHT SCHEDULES ON PILOT FATIGUE

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Pilot fatigue is a critical safety issue for the aviation industry. Fatigue reduces human performance capability and can result in catastrophic error. International airline pilots are particularly susceptible to fatigue's effects due to sleep loss, long duty days, and jet lag. When fatigued, pilots make errors, which can lead to incidents and accidents. Flight schedules may add to pilot fatigue since they can involve long duty days, short rest periods and may not take into consideration past research on fatigue. Consequently, pilots may not get enough rest to prevent job fatigue. To better understand how pilot flight schedules affect fatigue, a qualitative research analysis was used for this study.

Introduction

Sleep is very important not only for the human body but for the mind as well. In fact, our bodies need sleep in order to survive just like they need food and water. When our bodies don't get enough sleep, we become fatigued and most of our human functions suffer. Some of the problems related to fatigue are decreases in physical, psychomotor, and mental performance. Although pilot fatigue has been studied a lot recently, it has plagued the aviation industry for decades.

Back in 1927, Charles Lindbergh described the effects of fatigue as he was attempting to become the first person to cross the Atlantic. He wrote, "Sleep is winning, my whole body argues dully that nothing, nothing life can attain is quite so desirable as sleep. My mind is losing resolution and control" (Rosekind, 1995, p.18).

Since Lindbergh's historic flight, technology and automation have improved immensely. Transport jets were developed that carried passengers to all corners of the globe. Unfortunately the human body has not progressed as much as the technology. With the advent of the jet came a new problem related to fatigue, one that the human body could not tolerate well. This is jet lag, a time zone change disorder. Jet lag happens from crossing multiple time zones in quick succession. Our bodies are slow to adjust to the new time and the result is we become fatigued.

As the aviation industry evolved, air travel became a popular mode of transportation and passenger airlines were soon competing for the business of thousands of travelers. Airline pilots were now responsible for the safety of up to hundreds of passengers at a time.

Safety can be compromised when pilots fly while fatigued. Airline pilots face a unique problem when it comes to safety because the airlines operate 24 hours

a day, year round. These pilots experience fatigue due to multiple time zone changes, long duty days, and night flying. Fatigue can cause pilots to make errors, slow reaction times, decrease alertness and degrade performance (Evans-Davis, 2000). When severely fatigued, pilots may simply fall asleep at the controls. Fatigue is such a problem that it is considered not only an aviation safety hazard but also the single most critical safety issue in the aviation industry (Evans-Davis).

In fact the National Transportation Safety Board (NTSB), an independent federal agency that is charged with investigating all civil air accidents has issued about 80 Safety Recommendations since 1972 that are related to fatigue (Fatigue Resource Directory, n.d.).

The U.S. government realized the importance of fatigue in relation to safety and in 1980 formed the NASA Ames Fatigue Countermeasures Group. The goals of this group were to determine the overall impact of fatigue on aviation safety and to develop solutions for the fatigue problem (Caldwell & Gilreath, 2002).

The extent of the problem with fatigue came to light in the 1990s following a series of accidents. In 1993, a cargo jet (DC-8) crashed while attempting to land at Guantanamo Bay, Cuba. The three pilots received minor injuries. The NTSB determined that the probable cause of the accident was impaired judgment, decision-making, and flying abilities of the crew because of the effects of fatigue. This was the first accident that had been specifically attributed to fatigue. Other accidents that involved fatigue were the 1997 crash of a Korean Airlines jumbo-jet (747) at Guam, which killed 228 people and the 1999 crash of an American Airlines jet (MD-80) at Little Rock, Arkansas, which killed 11 people (Caldwell & Gilreath, 2002).

When commercial airline pilots are fatigued, the number of errors they make increases, which can lead to incidents and accidents and may ultimately cost hundreds of lives. The problem with fatigue is that there is no cure. The only remedy is sleep (Rosekind, 1995).

Another problem with fatigue in the aviation industry is that no single solution to managing it has been found. In order to successfully manage fatigue, a comprehensive approach may be beneficial. This approach involves educating the pilots about the adverse effects of fatigue, limiting the duty day, increasing the amount of rest and addressing the flight schedules to determine that they provide enough rest to prevent fatigue (Fatigue Resource Directory, n.d.).

In the airline industry of today, each airline schedules its aircraft and pilots to optimize profits. This type of schedule may be designed with long duty days, long flight hours and short rest periods. These factors have each been scientifically determined to cause fatigue and when combined, may lead to potential safety problems.

In addition to long duty days, long flight hours and short rest periods, international airline pilots also face problems with jet lag. These pilots face fatigue from crossing multiple time zones as well as adjusting to the culture of a foreign country. In addition, the rest period may not be long enough for pilots to acclimate to the new time zone to prevent fatigue.

International pilots from a major U.S. airline participated in a qualitative study to determine if their flight schedules provide enough rest to prevent job fatigue. The information for this study was obtained from pilot interviews.

The flight schedules for pilots of a major airline based at John F. Kennedy International Airport in New York are not designed to optimize what is known about fatigue and the human sleep physiology. Furthermore, it is not known whether these schedules provide enough rest to prevent fatigue on the job. In addition, the international pilots do not have a federal aviation regulation for duty time, which may also lead to fatigue.

Much effort has been made to reduce fatigue in the aviation industry, but not a lot of research has focused on the effect that the pilots flight schedule has on fatigue. The flight schedules can include long duty days, long flight hours, and minimal rest. The purpose of this study was to determine if the flight

schedules provide enough sleep to prevent job fatigue for the pilots of a major airline based at John F. Kennedy International Airport, New York.

Method

A qualitative research method was used in this study of fatigue and pilot flight schedules. To better understand the problems of fatigue the pilots face with their schedules, interviews were conducted with the international pilots based in New York during their actual trips. This group was chosen since the researcher is employed at the same airline and is based in New York. The interviews were used to answer questions about how the pilot flight schedules affect job fatigue and if enough rest is provided to prevent fatigue. Also, questions were asked about sleep physiology and if incorporating information about sleep physiology is helpful in preventing job fatigue. Results from the interviews were interpreted to determine if there are any similarities and if there is anything that needs to be changed in order to prevent job fatigue.

Pilots were interviewed on three different aircraft, the 767, A300 and 777, since these were the primary aircraft used on international routes. Twelve pilots were interviewed over a three-month period, which included four pilots from each aircraft type. Since the researcher was able to fly to any destination, the researcher interviewed the pilots during their actual trips to obtain an accurate indication of the effects of fatigue. The researcher also changed the interview questions as needed and added other questions as the preliminary information emerged. Detailed notes were taken during the interviews and the results of the interviews were interpreted and analyzed to determine if flight schedules at JFK provide enough rest to prevent job fatigue. Also, the results were analyzed to determine if the schedules should incorporate sleep physiology during their design and whether a regulation for international duty time would help prevent job fatigue.

The interview questions were pretested by randomly choosing pilots in JFK flight operations and having them answer the questions. The researcher also asked for additional information and questions that might be helpful during the actual interview process. When this was completed, the actual interview process began.

For the interview process, the researcher selected trips based on destination. The pilots on the 767 were interviewed on trips to Zurich, Switzerland and Brussels, Belgium. The 777 is primarily used to London, England, so two different departure times

were selected. First, a departure time of 6:30 pm was selected since there are two pilots on this trip. A second departure time of 9:30 was selected since there were always three pilots on trips that depart after 9:00 p.m. The two trips were selected to determine if there were any differences in fatigue with two versus three pilots flying the aircraft. The A-300 is mostly used for destination to the Caribbean. Two different trips to two different destinations were chosen. One of the trips departed early in the morning, the other trip departed in the afternoon. The differences in times were chosen to determine if an early morning versus late afternoon departure had a bearing on fatigue.

Also, the researcher verified the results of the data by looking for a recurrence of themes. This showed that the pilots had similar ideas or answered the questions in a similar manner.

Results

Overall, there were many similarities between the groups of pilots interviewed. All of the pilots expressed the desire to help. They wanted to help the passengers arrive at their destinations safely and on time. Also, they wanted to contribute to the company by doing the best job they can and by making money for the company. Since the September 11 terrorist attacks, their job has become more stressful. There are new concerns about security and safety and the pilots have accepted significant pay and scheduling concessions to help the company from declaring bankruptcy. The airline is not hiring so there is not much of a chance to upgrade to another aircraft to improve pay or for first officers to upgrade to captains. The pilots are not able to improve their schedule choices, which are bid by seniority. The pilots realize their seniority will only improve once new hiring has begun. They accept that this is part of the cyclical nature of the airline industry and have had to make adjustments.

More specifically, these pilots had some common problems with international flying. The pilots all agreed that flying at night and adjusting to multiple time zone changes is hard for most pilots, but becomes more difficult as one ages. Pilots see this as being part of international flying. International flying pays more than domestic flying and these pilots like the extra money, like flying to destinations outside the United States, and possibly like the prestige that goes with being an international pilot for a major airline. A part of this whole experience is dealing with fatigue; something the pilots understand is a daily part of their jobs.

Another common theme is that the pilots are conscientious and like to be able to prepare for their flights. One way they can do this is for the schedules of each aircraft to be relatively uniform. Pilots like to trade their trips and arrange their schedules to suit their lifestyle. Having trips with similar layover times makes it easier for the body to adjust to the time change, especially when flying multiple trips each month.

Commuting by airline or driving to base can also add to fatigue, but part of the benefit of being in the airline industry is the ability to live and work where you choose. The pilots that commute long distances see this as part of the life they have chosen. Although this lifestyle may add to fatigue, each pilot has found a way to adapt. Some pilots commute in the night before a trip and stay at a hotel in order to be well rested. Other pilots commute in the day of their trip and sleep either on the aircraft during their commute or in the pilot operations area before their trip.

Something else the pilots had in common was a problem with the reserve system. The pilots thought that the worst part of being on reserve was not being able to plan a rest period since they didn't know when they would be called out to fly. Various solutions were offered, but the two mentioned most frequently were to split the reserve day in half so a pilot would be on call for either a morning or an afternoon shift. One of the problems with this method could be that the reserve list would increase, meaning that more senior pilots would be forced on reserve.

Another solution to the reserve problem would be to implement an international wrap. A wrap is used for domestic pilots on reserve where they are assigned an off-duty period of at least 8 hours. During the wrap the scheduling department cannot call the pilots for a trip. This way, the pilots are able to plan an uninterrupted rest period. This seems like a solution that would not force more pilots on reserve. The pilots with the lowest times could be assigned wraps so they would be able to plan a rest period and have an idea of when they could be called out for a trip.

Besides the similarities, there were several differences between pilots of different aircraft. The pilots on the 767 didn't seem to have many complaints about the flight schedules. Part of the reason for this may be that on the 767, there are always three pilots, and the layovers are all 24 hours, which provide enough of an opportunity to rest.

The pilots of the 777, specifically the two-man crews, seemed to be most concerned with adding a third pilot to

prevent fatigue. The pilots in general of the 777 thought that the layovers needed to be adjusted. A layover time that allotted for two periods of rest of approximately 7-8 hours each, plus another period of 7-8 hours for social activities seemed to be the preference. The pilots suggested that trips should all have layover times of uniform length, which would help them more easily adjust to the time change at the layover city.

The pilots of the Airbus were unique in that they were able to stay on their body clock so fatigue and jet lag were generally not a problem. This was the one group of pilots that did have early sign-in times, so the sign-in times were seen as problematic for those who had a long commute to base, or for those that simply were not morning people. The pilots of the Airbus were also mainly in favor of napping in the cockpit probably because this airplane was only staffed with two pilots, and it was the only one with early sign-in times.

Discussion

One of the things that surfaced from these interviews was the willingness of the pilots to talk. Most of them volunteered information and offered ways to improve the schedules. Many of the pilots looked at the interview process as a way to be heard. They were very open and honest with the information including how fatigue affected their job performance.

The problems with fatigue are not simple or easy to define. Surveys of airline pilots' perceptions of fatigue are almost nonexistent. To obtain information on fatigue, NASA had to turn to corporate pilots. From surveys of corporate pilots, it was determined that the main causes of fatigue were late-night arrivals and early-morning departures, delays from weather and the fact the pilots were not able to get sufficient sleep (Caldwell & Caldwell, 2003).

Dr. Merrill Mitler, an internationally recognized sleep expert noted that companies must recognize the dangers associated with sleep deprivation, long duty days and jet lag (Caldwell & Caldwell, 2003). He believes companies involved in the aviation industry should have policies dedicated to sleep loss and fatigue. Dr. Mitler has stated he would like companies to recognize the fact that the nonstandard work schedules can lead to sleep deprivation. When deprived of sleep crews suffer from poor crew coordination, lack of good judgment, and sleep lapses. Also, crew-scheduling practices should recognize that fatigue is most prevalent late at night and early in the morning. If the scheduling practices can't be modified to avoid work during these times,

staffing ratios should be increased late at night and early in the morning as an added safety measure (Caldwell & Caldwell, 2003).

These facts echoed the results obtained from these pilot interviews. Having three pilots on an airplane may help prevent against sleep deprivation. When sleep deprived, vigilance quickly degrades (Caldwell & Caldwell, 2003). Getting more than eight hours of sleep will prevent decreases in vigilance, but as the pilots have described, even with rest, just being on an airplane, especially at night, can be conducive to sleep. Providing a third pilot on all of the international flights to European destinations may help prevent fatigue and increase safety.

Another problem brought up in the interviews had to do with reserve. Reserve pilots usually receive sub-standard sleep; have psychological stress from not knowing when they will receive a call to fly, and experience other environmental factors, which may not relate to fatigue. On reserve a pilot may be called for a trip at any time of the day. Trips are assigned according to the number of hours a pilot has, not by his or her preference. Receiving a call to fly at any time does not allow a pilot to properly prepare a rest period, which can lead to sleep deprivation and fatigue. A modification of the reserve system that allows pilots to know what part of the day they will be called will help them to better prepare a rest period, thus reducing fatigue from lack of sleep.

The problem with fatigue is not new, not limited to one type of pilot, or one company. It is a problem associated with the 24/7 operations of the aviation industry. In order to help find solutions to the problems, airlines and other groups involved in the aviation industry need to work together and share information. By gathering information from the pilots that deal with the everyday problems of fatigue, perhaps better ideas for scheduling practices will emerge and lead to safer flights.

Conclusion

The results of these interviews indicate a few changes that could be made to the international flight schedules at JFK to prevent fatigue. One of these changes would be with the 777 schedules. Most of the layovers now are anywhere from 24 to 36 hours. The layover times should be changed so they are all approximately 24 hours. This will make it easier for the pilots to adjust when flying multiple trips a month. Another recommendation concerning the 777 would be to add a third pilot.

Another change would be to the reserve system. Pilots have indicated that they are unable to plan a rest period and obtain sufficient sleep since they never know when they will be called for a trip. Adding a wrap to the international operation is recommended. This way pilots have a period of at least eight hours to properly rest since crew scheduling cannot interrupt them during this time.

In addition, some team training or team concept exercises should be implemented since the pilots have admitted that captains and first officers are rarely paired for an entire month. This type of training could also concentrate on the smooth flow of communication and information between the pilots.

Finally, the pilots are the ones that know their job best. The pilots should be encouraged to state their opinions and give suggestions as how to best schedule their trips. Each airline should allow researchers to conduct personal interviews and surveys. These can be compared to determine what works well and what doesn't work. A comprehensive research project into the scheduling issues of the airline industry could possibly make for safer skies.

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Data Collection Device

Preliminary Interview Questions

1. Tell me some of the things that add to fatigue concerning your flight schedule.
2. Should schedules be designed that incorporate sleep physiology? Why or why not?
3. What are some of the things you would do to change your schedule?
4. What is the part of your job that causes the most fatigue?
5. What do you suggest to help alleviate fatigue?
6. Does fatigue hinder your job performance? How?
7. Is enough rest provided during layovers to help prevent job fatigue?
8. If more layover time is needed, how much more would be sufficient?
9. Is it important to establish international duty time regulations? Why or why not?
10. Is it important for reserve pilots to have duty time regulations? Why or why not?
11. Is there anything else that could help to alleviate fatigue?