

**MOTION SICKNESS FOR FLIGHT PILOTS:
STATISTICS AND THERAPEUTIC SOLUTIONS**

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Summary

Flight pilot schools observe a smaller graduation rate for students that encounter motion sickness problems. This study concerns tests, on student pilots with air-sickness symptoms during flight, with transdermic use of Scopolamine and psychiatric support. In a recent study, after selecting 100 first-time flight pilot students, we observed a series of more than 10 flights for examination purposes. All the subjects eat a light meal with no alcohol consumption prior to testing. The subjects understood the rudimentary elements of flying, such as controlling air pressure in the cabin. This examination concentrated particularly on those subjects that regurgitated during or soon after flights concluded. Our study showed that 34 out of 100 students regurgitated, in which 20 students completed the test flight series (59% regurgitated). Of the 66 students that did not regurgitate, 51 completed the test series (77% non-regurgitated). The investigation found that overall 71 students completed all flights and 29 students were not able to participate in the total series of more than 10 flights (71% overall). It is evident that those students that encountered regurgitation difficulties had a much smaller completion rate than those students with no regurgitation issues. In another test, 20 new students, that were not part of the previous study, with prior regurgitation issues, were chosen to participate. The test was conducted specifically to monitor the ability of the chosen subjects to finish the flight test series successfully. After similar prerequisites, the test students were given transdermic Scopolamine 1.5mg twice a week for the month of the test series. Also psychiatric support was given to monitor student's success levels. Of the 20 students, 14 successfully concluded their test flight series (70% new test). After the administration of Scopolamine to our 20 new students, their completion rate (70% new test) closely approached the non-regurgitated levels of the prior students tested (77% non-regurgitated). Accordingly, the new students that were given Scopolamine and psychiatric support, far exceeded, in terms of completion rate, those that were not administered with the drug and the psychiatric support (59% regurgitated). In addition, we observed the following collateral effect for 15 out of 20 selected students: dry jaws. In conclusion, because there could be certain unascertainable issues with the administration and collateral effects of drugs, we recommend first attempting psychiatric counselling (helping the student to solve his problems or to create conditions that will induce him to improve his behaviour, character or values) or using the modern rehabilitation programs than can have high therapeutic results.

Keywords: pilot; flight; sickness; regurgitation; successfull.

Introduction

The “motion sickness” is a common problem in travelers by automobile, train, sea and air, caused by continued stimulation of the tiny portion of the inner ear, which controls the sense of balance. The stimulation causes a discrepancy between what the eye sees and what the inner ear feels. Sensation of head position and movement is generated in the semicircular canals (angular acceleration or rotation) and otolith organs (vertical acceleration) in the inner ears and carried to the central nervous system via cranial nerve VIII. The signs and symptoms of motion sickness occur when sensory information about the body's position in or movement through space is contradictory or contrary to prior experience, and the resulting signs and symptoms include dizziness, nausea, vomiting, pallor, and cold sweats. In this condition the endolymph (the fluid found in the semicircular canals of the inner ears) becomes 'stirred up', causing confusion for the difference between apparent perceived movement (none or very little) and actual movement. Depending on the cause, the motion sickness is referred to carsickness, seasickness, spacesickness or airsickness. Airsickness is the sensation of nausea which is induced by air travel and is a very common form of motion sickness. Also the air sickness is considered normal response of healthy individuals when exposed to an environment characterized by unfamiliar motion and orientation clues. It usually causes mild to moderate discomfort but in severe cases can be incapacitating. The most common symptom of motion sickness is the nausea; in fact, nausea in Greek means seasickness (naus=ship). If the motion causing nausea is not resolved, the sufferer will frequently vomit within twenty minutes. Air sickness is a frequent event during the first part of instruction, especially for first-time pilots, when flight movements are encountered at the beginning of instruction. This symptom besides the symptomatic and physiological problem, can be an obstacle in successfully completing the course. Some experiments already completed by the “Department of Aeronautical and Special Medicine” of Pratica di Mare in Italy confirmed these obstacles. In addition, in this study we compared these results with ones obtained using the drug called Scopolamina 1.5mg and psychological counseling.

a) Italian Air Force Pilot Screening.

The experiments, made at the “Department of Aeronautical and Special Medicine” of Pratica di Mare – Italy, were based on data accumulated from student pilots of the Italian Academy of Aeronautics. These students arrived at flight school of Latina – Italy for the screening and to obtain the basic flight license. The flight school, the 70th Squadron of Latina, is a military flight unit of the Italian Air Force, responsible also for the screening of the Academy students using the acrobatic airplane “SF 260 AM”. The process of screening is necessary to detect individual aptitude; the initial training is the baseline for the individuals future achievement for the military pilots license. The screening is the first experience for the student in military flying. The first-time pilot should have good physical and psychological qualities, a desire to learn, perseverance, self confidence and ability to make quick

decisions to successfully fulfil the requirements for obtaining the military license. The purpose of the flight program is to allow the instructor pilots to analyze the disposition of the student during every phase of instruction. In order to adopt the screening to the Italian Air Force requirements, a program was created based on achievement of particular performance during the execution of flight manoeuvres.

At the end of the course the student, upon successfully completing, receives the basic flight license. The program is divided into three instructional parts and every part consists of four flight missions:

part 1: familiarization of the airplane, procedures and flight customs;

part 2: basic flight training, introduction to the acrobatic movements and flight traffic patterns;

part 3: reinforcement of the part 1, part 2 and show the ability to fly securely and autonomously.

At the end of every flight mission, the instructor pilot gives a grade for every manoeuvre. The grades range from:

Excellent	30
Good	29-27
Above Average	26-23
Average	22-18
Below Average	17-15
Failing	14-1

After evaluating every single manoeuvre, the instructor pilot gives the overall grade, based also on progress demonstrated by the student and the potential to achieve requisite standard by the end of instructional part. In circumstances where the student was unable to achieve the requisite grade by the end of each part, a process is initiated to verify his ability to successfully complete the failed part. In circumstances where the student was able to achieve the requisite grade, the student flies the "14th mission", which is a check examination flight with the instructor. If the flight is successful, the student can fly "solo" and receives the basic flight license. The "solo flight" (15th mission) is successful completion of training, is useful for reinforcement of the student self-confidence and has been considered by generations of pilots to be the most rewarding flight in their lifetime.

- b) Flight training in the aeroclub and in the other non-military Italian schools.

There is a different purpose for the non-military flight schools; they usually aim to encourage the use of the airplane in private and professional transportation, so the flight courses are designed to be more flexible.

In fact, the duration of the flight school depends on the availability and perseverance of the flight student.

The main objective is for the student to learn to fly safely and technically efficiently.

Usually the aeroclubs fly for sport, scenic tours and civilian training, and also to promote aeronautics to a higher level.

These clubs are entitled to organize flight courses to obtain all flight licenses.

This is the program for the private flight license:

-theory: knowledge of aeronautical regulations, functionality of the airplane, flying performance and planning, individual performance during the flight, meteorology, navigation, operation procedures, flight principles and communication;

-practice: performance of the program theory is made under the responsibility of the flight instructor. After a basic training period, which lasts approximately 15 flight hours, following a flight check, the student is cleared by the flight instructor to fly by himself (solo). The training continues with other flights until the student is in full control of the airplane. The flight practice is coordinated between the student and instructor. Overall, the achievement of the flight license takes a period of one year; of course, this period can fluctuate depending on the aptitude and diligence of the student.

The practice flights must contain the following:

- 1) pre-flight operations;
- 2) operation procedures in flight patterns, precautions and procedures to avoid collisions;
- 3) flight control using external visual references;
- 4) flight at low critical speeds, recognition of various stalling predicaments and recovery;
- 5) flight at high critical speeds, recognition of spins and recovery;
- 6) take offs and landings, with and without side wind;
- 7) take offs and landings on short fields;
- 8) flight with only instrumental references;
- 9) visual and radio guided flight navigation;
- 10) emergency operations including system failure simulations;
- 11) flight to, from and through controlled airport terminals, following all air traffic and communication procedures.

The total flight time for achievement of the private pilot license is 45 hours of flight time, including at least 25 hours with the instructor pilot and at least 10 hours of solo flying.

The physical requirement to fly is controlled by the “Italian Air Force Legal Medical Institute”.

For the release of the student pilot certificate, the student must fly 12 hours and afterwards must fly a solo flight.

Subjects and methods

In the first study 122 individuals were used between the ages of 18 and 24 years old, new to flying and actually all were flight screened for the first time.

This study ended with 16 students failing and not participating further (we considered only students that flew at a minimum 10 flights with a duration of 55 to 65 minutes).

Statistical results of Lt.Col.M.Lucertini (2001) were used and in addition data was used from 100 out of the 106 students participating (82 male, 18 female).

The second study was made using 20 students with current problems with air sickness. They were given “scopolamina 1,5 mg” 2 times a week and they had psychological support.

Statistics

The results obtained were valued using the “t-test Student” ($P < 0.05$).

Results

1st study:

only 71 students successfully terminated the flight training (57 male and 14 female);

29 students were unsuccessful (25 male and 4 female).

Figure 1 shows the percentage of student pilots, according to sex, that completed or were unsuccessful in completing the flight training.

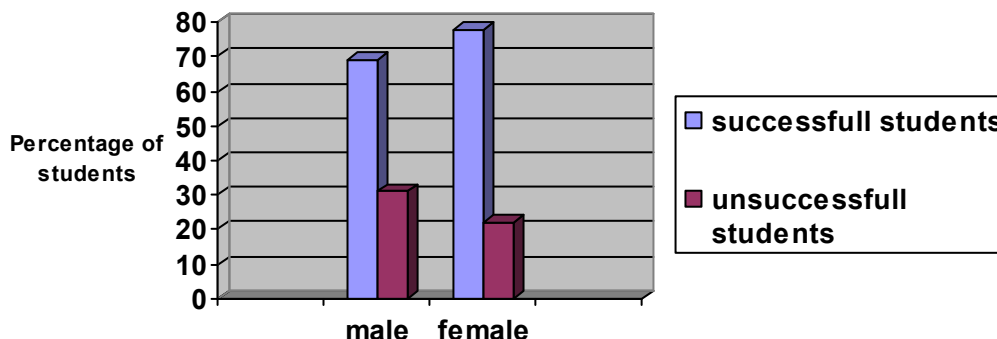


Figure 1: Percentage of successfull – unsuccessful students.

Overall 34 students (29 male and 5 female) had air sickness problems during the flights. The females showed greater capacity to fly even though results were not supported statistically.

Fig.2 Incidence of air sickness based on sex

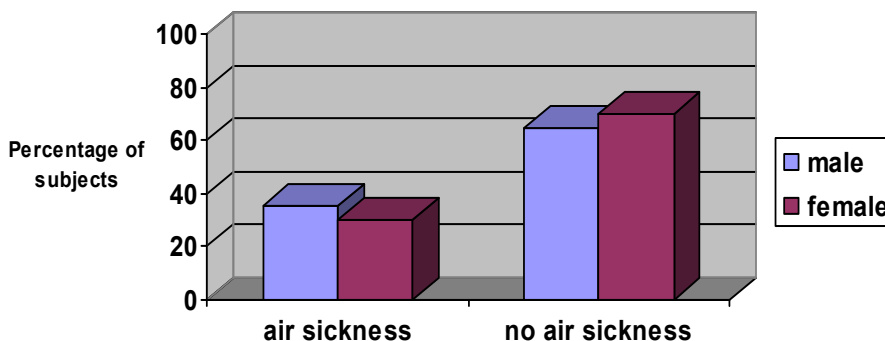


Figure 2 showed the incidence of air sickness base on sex. Evidence shows, contrary to some data regarding sea sickness, no significant difference between male and female testing. Considering air sickness and positive results in flight training and screening, we observe a higher unsuccessful rate in cases of air sickness, particularly in multiply incidents. The trend confirmed data observed from 1995-1999 and from 2000-2001. Figure 3 shows the success rate with and without air sickness.

Fig. 3 Percentage of successful and unsuccessful students with and without air sickness symptoms



We observed a higher unsuccessful rate for students with air sickness symptoms. Considering only students with air sickness problems, we have no significant statistics according to the number of episodes of regurgitation. The number of episodes were not significant to predict a test rate, even if air sickness significantly influences the flight capacity of the student pilot.

We have interesting data regarding the possibility of interrupting flights due to air sickness problems:

10 individual students (8 male and 2 female) had to interrupt one or more flights due to air sickness;

5 students all male successfully completed the flight screening; this number would change to 4 (reducing to 44% the positive percentage) if we excluded the students that were treated with specific rehabilitation program by the “Aeronautical and Special Medicine Department of Experimental Flight Section” of Pratica di Mare – Italy.

This student had 18 regurgitation episodes and all the flights before the rehabilitation program were interrupted. After a short rehabilitation program (4 day program), we observed only 3 regurgitation problems in the 10 missions flown.

Excluding this rehabilitated student, we have a high unsuccessful rate (56%).

Another criteria, that can be considered later, but may not be relevant, is based on ratio:

$(\text{number of regurgitation symptoms} \times 100) / (\text{number of flights flown})$.

This ratio in percentage permits us separate the student pilots into 2 sub groups, using 15% as a threshold value. In fact, only 2 students with a percentage lower than this value did not finish the flight course. The 2 students had to interrupt the flight mission because of regurgitation symptoms.

2nd study:

We observed reduction of air sickness symptoms for the students treated with “scopolamine 1,5 mg” and supported with psychological care.

Overall 14 out of 20 treated successfully complete the flight training (70%) and 6 failed (30%). In 15 of the 20 students treated with scopolamine, there were evidence of dry mouth.

Fig. 4 Successful rate.

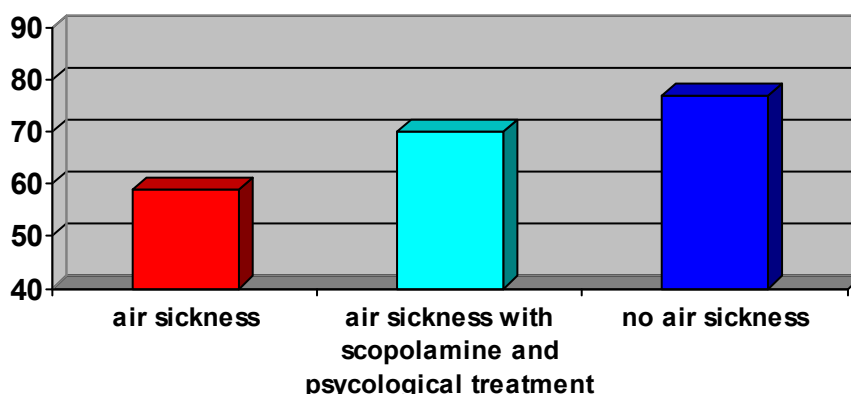


Figure 4 shows the success rate for students with regurgitation problems with no scopolamine treatment, students with scopolamine and psychological treatment and students with no regurgitation problems.

Conclusion

The study of the data and the experiments confirmed an influence of the student pilots' performance.

It was demonstrated that the air sickness problem can be solved. With the use of medicine we can solve part of the air sickness problem, but there can be collateral effects which are incompatible with flying safely, as confirmed by the studies made by the "Aeronautical and Special Medicine Department of Experimental Flight Section" of Pratica di Mare – Italy.

The only observation that showed interesting correlation between air sickness and flight suitability was the ratio between regurgitation and flight mission interruption.

This methodology is the most reliable prediction for successfully finishing the course, contrary to the ratio between regurgitation x100 and the number of flight mission flown. The subdivision of severe and light air sickness problems does not predict if the students will achieve satisfactory results.

It shows that the students who interrupt their flight missions due to air sickness symptoms are subject to the risk of unsuccessfully completing the course.

For this reason more supervision is necessary for these students.

Due to limits of the all predictive methods, the "Aeronautical and Special Medicine Department of Experimental Flight Section" of Pratica di Mare – Italy is organizing (like USA, England, Canada and the Netherlands) rehabilitation programs, with high percentage of therapeutic success. These programs use an approach made by a synthesis (adopted by the Italian Air Force needs and the local availability of personnel and instruments needed) between different methods used in foreign centers, with an instrumental of success percentage of 100% and a real success percentage of 78%.

Since this therapeutic approach is new, there is no significant data concerning the programs effectiveness. Due to the uncertainty of the rehabilitation program and the long duration of completing the programs, we must look at different medical and psychological solutions.

In the medical studies side effects showed incompatibility with all flight missions.

Psychological solutions must all be considered, because these solutions show no tangible side effects, and for this reason they can support the Italian and foreign rehabilitation programs, that have been developed in the current years.

Discussion

In all cases it was determined that, because of motion sickness, a large number of students were unable to successfully complete the requisite for the flight test series. Especially in instances where drugs could be administered to flight pilots, it is necessary a strict precaution for the collateral effects due to safety reasons. The tests that we conducted were in compliance with the highest safety requirements and

in supervised flights. The subjects that were administered with the transdermic Scopolamine were found to have a significantly higher success rate than the non-Scopolamine subjects. Improvements were also noted due to psychiatric support for the students. Because there could be certain unascertainable issues with the administration and collateral effects of drugs, we recommend first attempting psychiatric counselling (helping the student to solve his problem or to create conditions that will induce him to improve his behaviour, character or values) or using the modern rehabilitation programs (no drug programs used for pilots in Italy, USA, UK, Netherlands, Canada, etc.) that can have high therapeutic results.

Aknowledgments

The authors are grateful to “Aerolub Salerno Pontecagnano - Italy” and to the “Aeronautical and Special Medicine Department of Experimental Flight Section” of Pratica di Mare – Italy for providing the necessary assistance for the present work.

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