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The Role of Aviation Medicine in Improving Flight Safety

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Abstract **Review Article**

Human factors are cited as the most common factor in aviation accidents, with 79% of 2006 U.S. fatal accidents attributed to human error. In a Finnish study, human errors were involved in 84% of serious accidents and 94% of fatal accidents. Fatigue, tiredness, and Individual medical issues are the Personal factors incriminated in which we can act to prevent aviation accidents. Moroccan medical standards are put in place to prevent hazards during a flight that could be caused by the physical, medical, and psychological conditions held by the pilot or the crew following the International Civil Aviation Organization (ICAO) signed at the Chicago Convention in 1944. Aeromedical expertise for aircrew in Morocco has gone through several stages to reach its current situation. The periodic medical assessment of a commercial pilot has two main purposes. The first is to assess the functional ability of the pilot and to ascertain whether he is physically able to exercise safely the privileges of his license in all routine and emergency situations. The second is to assess his risk of incapacitation during the period of validity of the medical certificate for which he has applied. Aeromedical medical expertise is one of the key pillars of flight safety, applying strict medical standards that vary depending on the specific aviation specialty. The emergence of new specialties requires the adaptation of medical standards.

Keywords: Aeromedical Expertise, Aviation Safety, Human Factors, Medical Examination, Pilot Incapacitation.

INTRODUCTION

Airspace is a hostile environment characterized by oxygen depletion, a drop in barometric pressure leading to relative hypoxia, and a drop in temperature. In addition to these inherent environmental constraints, there are those related to aircraft operation (accelerations, vibrations, noise, heat, reduced humidity) and piloting (stress, fatigue, external operations, etc.)(*Manual of Civil Aviation Medicine.pdf*, s. d.).

All these constraints, partially mitigated by constantly evolving protective measures, justify the need to preserve the integrity of vital functions (cardiac, respiratory, neurological, etc.) and sensory functions (vision, hearing), giving rise to the field of aeromedical expertise.

However, civil and military aviation have developed rapidly, driven by the pressures of armed conflict and inseparable commercial exploitation (*Evolution of clinical military aviation medicine and fitness assessment in France*, s. d.). The victories in the conquest of air and space justify the need for expertise. Aeromedical expertise aims to verify the match between an individual's physical capabilities and operational readiness to fly and to assess his risk of incapacitation during the period of validity of the medical certificate for which he has applied.

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This paper aims to describe the role of aeromedical expertise and its contribution to maintaining air safety.

History of Aeromedical Expertise in Morocco

Aeromedical expertise for aircrew (pilot and non-pilot) in Morocco has gone through several stages to reach its current situation:

- In 1962, the expertise was provided by French doctors at the Aeromedical Expertise Centre (AMC) of the Rabat Military Hospital.

- In 1980, aeromedical expertise was provided by Moroccan doctors trained at IMASSA in France.
- Since 2009, the expertise has been provided by Moroccan doctors specializing in aviation medicine at the Aviation Medical Expertise Centre (AMC) of the Mohamed V Military Training Hospital.

Contribution of Medical Expertise to Maintaining Aviation Safety

Periodic Medical Examinations:

There are few studies in the literature on the contribution of routine medical examinations to maintaining aviation safety(A. D. Evans *et al*., 2009). However, regulatory authorities require all license holders to have a medical certificate that must be renewed periodically(*Manual of Civil Aviation Medicine.pdf*, s. d.). The purpose of this medical examination is to ensure that the crew member can perform his duties in all routine and emergency situations, that there is no risk of sudden or subtle incapacitation during the flight due to a medical condition or pharmacological side effects of treatment, and that the crew member's health will not be adversely affected by the act of flying (*Manual of Civil Aviation Medicine.pdf*, s. d.).

Sudden incapacity is defined as the rapid onset of a physical, psychological, or sensory anomaly that results in the loss of operational capabilities of the aircrew member. The most finite form of sudden incapacitation is sudden death. Subtle incapacity refers to the brief occurrence of a physical, psychological, or sensory anomaly that leads to a temporary and often quickly reversible deterioration in performance and attention, which may go unnoticed by others. Medical standards are put in place to prevent such events during a flight that could be caused by the physical, medical, and psychological conditions held by the pilot or the crew. ICAO set a goal of less than 1% risk of pilot incapacitation per year to guide the standards for medical examinations.

The process of an aeromedical examination follows a pre-determined protocol, which includes a clinical examination to obtain information on the individual's medical history (especially any medical events that have occurred between the two visits) and the results of the physical examination, as well as biological and radiological tests. The frequency of the physical examination varies according to the type of aviation specialty and the age of the crew member. Pathological conditions are more common after the age of 40, especially cardiovascular diseases such as coronary heart disease (S. Evans & Radcliffe, 2012), which have been associated with several aviation incidents and accidents and cerebrovascular diseases. Table 1 lists some examples of commercial aviation accidents and incidents over the past 40 years related to cardiovascular events(DeJohn *et al*., s. d.). Despite the presence of multiple crew members, cardiac events still have a significant impact on flight operations, it accounts for 50% of all pilot licences declined or withdrawn for medical reasons in Western Europe(Nicol *et al*., 2019). Gastrointestinal problems, earache, fainting, headache, and dizziness are also the most common causes of incapacitation after cardiovascular disease. Earache, fainting, headache, and vertigo are also the most common causes of disability after cardiovascular disease (Dhaliwal & Carter, 2024). Therefore, screening for these risks is important.

In the general population before the age of 40, psychological disorders such as anxiety and depression (as seen in the accident of Germanwings Flight 9525 on March 24, 2015, caused by the suicide of the co-pilot and other cases of suicide by aircraft) and Behavioral problems such as alcoholism and illicit drug use are more prevalent among younger crew members (Dhaliwal & Carter, 2024). Therefore, mental health is also extremely important and must be actively assessed by the medical examiner during the aeromedical evaluation due to its significant impact on aviation safety.

Rigorous Medical Requirements:

The International Civil Aviation Organization (ICAO) agreed at the Chicago Convention in 1944 to standardize practices where uniformity would improve air navigation (*Manual of Civil Aviation Medicine.pdf*, s. d.). The Kingdom of Morocco acceded on November 13, 1956. Therefore Moroccan standards for civilian flight refer to ICAO standards (*Order of the Minister of Equipment and Transport No. 1209-09.pdf*, s. d.).

Medical standards are established to prevent hazards during flight that could be caused by the physical, medical, and psychological conditions of the pilot or crew (Dhaliwal & Carter, 2024). Civilian and military aviators have a separate set of guidelines for active duty aviators, with military rules generally being more stringent. In general, military aviators must be physically fit for duty as a military officer and meet the requirements for aviation. In MOROCCAN Royal Armed Forces, aviators are first and foremost military personnel, subject to the general fitness standards for military personnel set by official regulations, with a SIGYCOP medical profile. This profile must be compatible with the minimum required profile set by each branch of the armed forces.

Military aviator's standards define the aviation profiles in the four health domains involved in aviation:

- **SGA**: General aviation standards, ratings from 0 to 2.
- **SCA**: Color vision standards for aviation, ratings from 0 to 2.
- **SVA**: Vision standards for aviation, ratings from 0 to 5.

- **SAA**: Hearing standards for aviation, ratings from 0 to 3.

A rating of 0 indicates unfitness. For certain specialties, anthropometric and spinal criteria determine specific standards: A (ejection seat), H (pilot and helicopter mechanic), or B (no ejection seat). These standards are very strict and operate within a framework of selection (unfitness), prediction (assessment of the risk of unfitness), rehabilitation (assessment of acceptable risks and sequelae), and even prevention, which justifies the need for periodic and synergistic medical follow-up between aircrew doctors at the various Royal Air Force bases and doctors at the AMC.

These standards are applied differently according to the type of medical examination: admission or periodic career review. Indeed, it is commonly accepted that "experience and acquired skill can sometimes compensate for certain physical deficiencies," as long as flight safety is respected. The admission examination is therefore very selective for pilots entering the Royal Air Force Academy, as it necessarily requires a combat profile.

CONCLUSION

Aeromedical medical expertise is one of the key pillars of flight safety, applying strict medical standards that vary depending on the specific aviation specialty. The emergence of new specialties related to remotely piloted aircraft (RPAs) requires the development of specific standards tailored to these technologies to maintain high levels of aviation safety. These new standards must take into account the unique operational and physiological demands of remote piloting, ensuring that aircrew members operating RPAs meet the necessary health and fitness criteria to perform their duties safely.

Table 1: Examples of Aviation Accidents or Incidents Caused by Coronary Events

Standards

Table 1 Examples of aircraft accidents and incidents related to coronary events

Date/year	Aircraft/airline	Fatalities	
1962	Flying Tiger Superconstellation	8	Pilot incapacitation on final
1966	American Flyers Lockheed Electra	83	Pilot incapacitation due to MI during landing
1967	South African Airways Vickers Viscount	25	Pilot incapacitation, co-pilot unable to recover
1972	BEA/Trident 1	118	Possible contributing coronary event in pilot
18 June 2009	Continental Airlines 777–200	Captain died en route Brussels-Newark	Emergency declared, landed by F/O
14 October 2010	Qatar Airways A300-300	Pilot captain died due to massive MI, on the flight deck	Successful diversion to Kuala Lumpur by co-pilot
20 January 2012	UTair 757	Co-pilot died on the flight deck	
15 February 2012	Czech Airlines ATR	Captain died on the flight deck	Flight diverted. Co-pilot recovered
26 September 2013	United Airlines 737	Pilot died on the flight deck	First officer recovered
6 October 2015	American Airlines A320	Captain died on the flight deck	Co-pilot recovered

REFERENCES

- DeJohn, C. A., Wolbrink, A. M., & Larcher, J. G. (2004). *In-flight medical incapacitation and impairment of us airline pilots: 1993 to 1998* (No. DOT/FAA/AM-04/16). United States. Department of Transportation. Federal Aviation Administration. Office of Aviation. Civil Aerospace Medical Institute.
- Dhaliwal, S., & Carter, R. E. (2024). Aerospace Assessment of Fitness for Duty. In *StatPearls*. StatPearls Publishing. http://www.ncbi.nlm.nih.gov/books/NBK538481/
- Evans, A. D., Watson, D. B., Evans, S. A., Hastings, J., Singh, J., & Thibeault, C. (2009). Safety Management as a foundation for evidence-based aeromedical standards and reporting of medical events. *Aviation, space, and environmental medicine*, *80*(6), 511-515.
- Evans, S., & Radcliffe, S. A. (2012). The annual incapacitation rate of commercial pilots. *Aviation, space, and environmental medicine*, *83*(1), 42-49.
- Evolution of clinical military aviation medicine and fitness assessment in France..pdf. (s. d.).
- Manual of Civil Aviation Medicine.pdf. (s. d.).
- Nicol, E. D., Rienks, R., Gray, G., Guettler, N. J., Manen, O., Syburra, T., ... & Davenport, E. D. (2019). An introduction to aviation cardiology. *Heart*, *105*(Suppl 1), s3-s8.
- Order of the Minister of Equipment and Transport No. 1209-09.pdf. (s. d.).