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AEROMEDICAL SERVICES

Fundamentals of aviation medicine, including its history, principles, and regulatory framework

Aviation Medicine Training Programme for Aviation Medical Assessors & Examiners

Aeromedical Services, Civil Aviation Authority of Sri Lanka.

Aviation medicine

Aviation medicine is a specialized branch of medicine and a subspecialty that focuses on the health and safety of individuals involved in aviation, including pilots, aircrew, and passengers.

It has various disciplines, such as

History of Aviation Medicine

- Aviation medicine has evolved alongside the development of aviation itself.

Key milestones

- Early Years (late 19th to early 20th century): The initial focus was on understanding the **physiological effects of altitude** and **rapid acceleration**, as well as combating issues such as **motion sickness.**
- World War I: The first large-scale use of aircraft in combat highlighted the need for understanding the **physiological stresses** of flight and **developing countermeasures to improve pilot performance and survivability.**
- Interwar Period: Aviation medicine continued to advance, with research into topics such as **hypoxia, decompression sickness, and the effects of sustained acceleration**

History of Aviation Medicine

- **World War II: Further advancements were made in understanding the effects of high-altitude flight, G-forces, and the development of protective equipment like oxygen masks and pressure suits.**
- **Post-WWII: Aviation medicine expanded into civilian aviation, with increased focus on passenger safety and the establishment of regulatory bodies to oversee aviation medical standards.**

Key Principles of Aviation Medicine

- **Physiological Effects of Flight: Understanding how altitude, G-forces, acceleration, and other factors affect the human body.**
- **Preventive Medicine: Identifying and mitigating risks associated with flying through measures such as medical screening, vaccinations, and lifestyle recommendations.**
- **Occupational Health: Addressing health issues specific to aviation professionals, such as fatigue management, sleep disorders, and exposure to cosmic radiation.**
- **Human Factors: Studying the psychological and behavioral aspects of aviation to enhance safety and performance, including crew resource management and decision-making under stress.**
- **Medical Certification: Establishing standards for the medical fitness of pilots and aircrew, including criteria for obtaining and maintaining medical certificates**

Regulatory framework

- Aviation medicine is governed by various regulatory bodies at both national and international levels.
- International Civil Aviation Organization (ICAO): Sets international standards and recommended practices related to aviation medicine through Annex 1 to the Chicago Convention, which covers personnel licensing.
- National Aviation Authorities (NAAs): Each country has its own regulatory authority responsible for implementing and enforcing aviation medical standards in accordance with ICAO guidelines.
- Medical Certification: Pilots and aircrew must undergo periodic medical examinations to ensure they meet the required health standards for safe operation of aircraft. Different classes of medical certificates may exist depending on the type of flying (e.g., commercial, private, airline transport).

Regulatory framework

- **Aeromedical Training: Aviation medical examiners (AMEs) are healthcare professionals trained and authorized to conduct aviation medical examinations and issue medical certificates.**
- **Research and Development: Regulatory bodies and aviation organizations invest in ongoing research to address emerging health issues and improve aviation medical standards and practices.**

Overall, Aviation Medicine plays a crucial role in ensuring the safety and efficiency of air travel by addressing the unique health challenges associated with aviation and promoting the well-being of those involved in flying.

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Human Physiology and Psychology in Aviation

Aeromedical Services, Civil Aviation Authority of Sri Lanka.

- **Human physiology and psychology play critical roles in the aviation environment, influencing both the safety and efficiency of flight operations.**
- **Understanding how the human body and mind respond to the unique stressors and demands of aviation is essential for AMEs & MAs training, pilot training, crew resource management, and aircraft design.**

AVIATION HUMAN PHYSIOLOGY

How the body and mind function in flying environment.

It includes;

- **How human organs function**
- **What keep them functioning in an abnormal aviation environment**
- **What a Pilot can do to protect these functions**

Aviation human physiology, is integral part of human functions, safe flight and human performance.

REMEMBER

Knowing aviation physiology, being aware of its effects on performance and maintaining high index of suspicion when applicant has comorbidities and even his/her performance become poor will continue to have a safer flight environment for all.

Objectives of understanding aviation physiology

To prevent incapacitation risks or impairment of vital functions whether mental or physical.

Mental incapacitation

Is mind's inability to use proper judgment, reasoning and decision making.

This can lead to -

Neurological incapacitation – signals from brain fail to use sensory information and data from the eyes, ears, touch and smell.

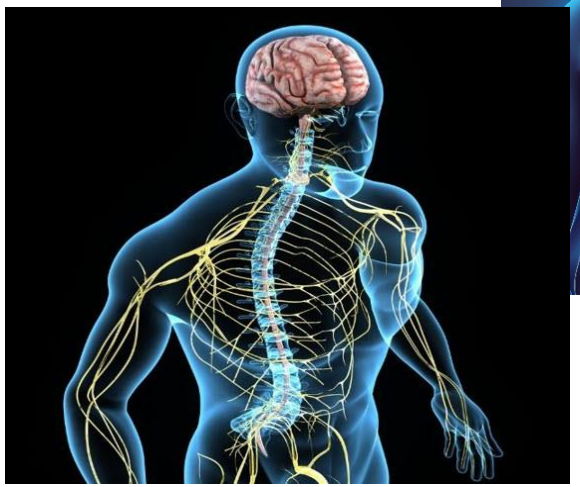
Physical incapacitation

Body's inability to function in an expected way

END RESULT OF BOTH MENTAL AND PHYSICAL INCAPACITATIONS CREATE UNSAFE SITUATION IN AVIATION.

There are 3 main body systems affect or react to these aviation physiological changes.

- Respiratory
- Cardiovascular
- Nervous systems



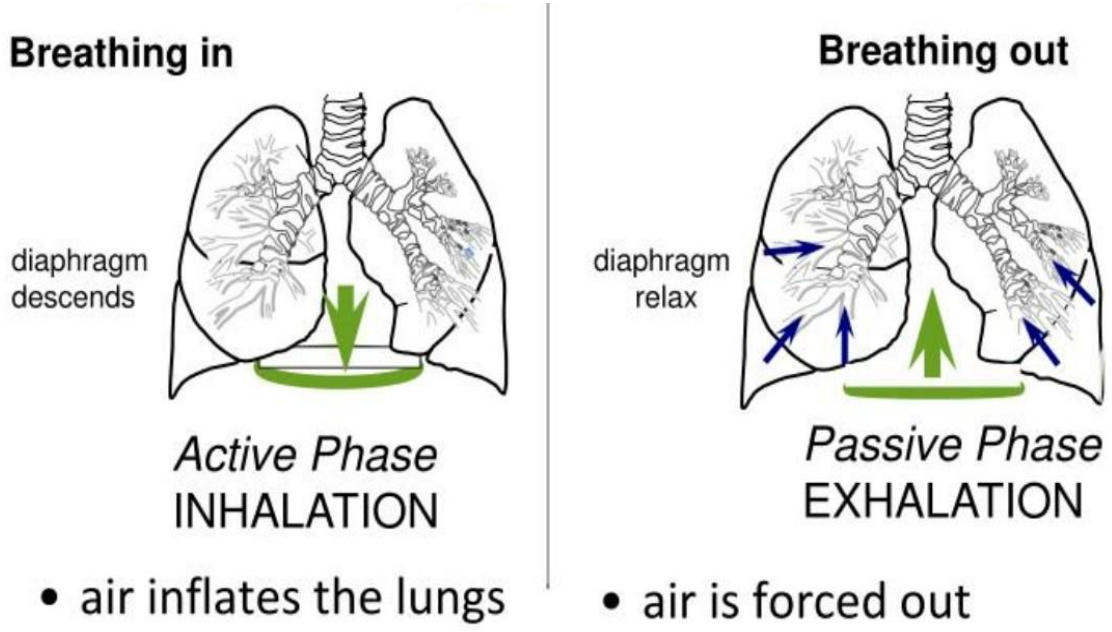
Respiratory system

Main functions

- Intake Oxygen
- Removal of Carbon dioxide
- Maintenance of body heat balance
- Maintenance of body acid balance

Main functions of human Lung

- Transport of Oxygen to rest of the body
- Exchange Oxygen and Carbon dioxide



At high altitudes, there will be increased rate and depth of breathing in order to get enough Oxygen into the lung.

Effects of reduced pressure in high altitudes

As aircraft ascend to higher altitudes, the decrease in atmospheric pressure leads to a reduction in oxygen availability, resulting in **hypoxia**.

What is Hypoxia

State of blood when it is **deficient in Oxygen** for the requirements of the tissues and body cells.

This can cause impairment of functions of the BRAIN mainly.

Even death can occur if Oxygen lack continues.

Cardiovascular system

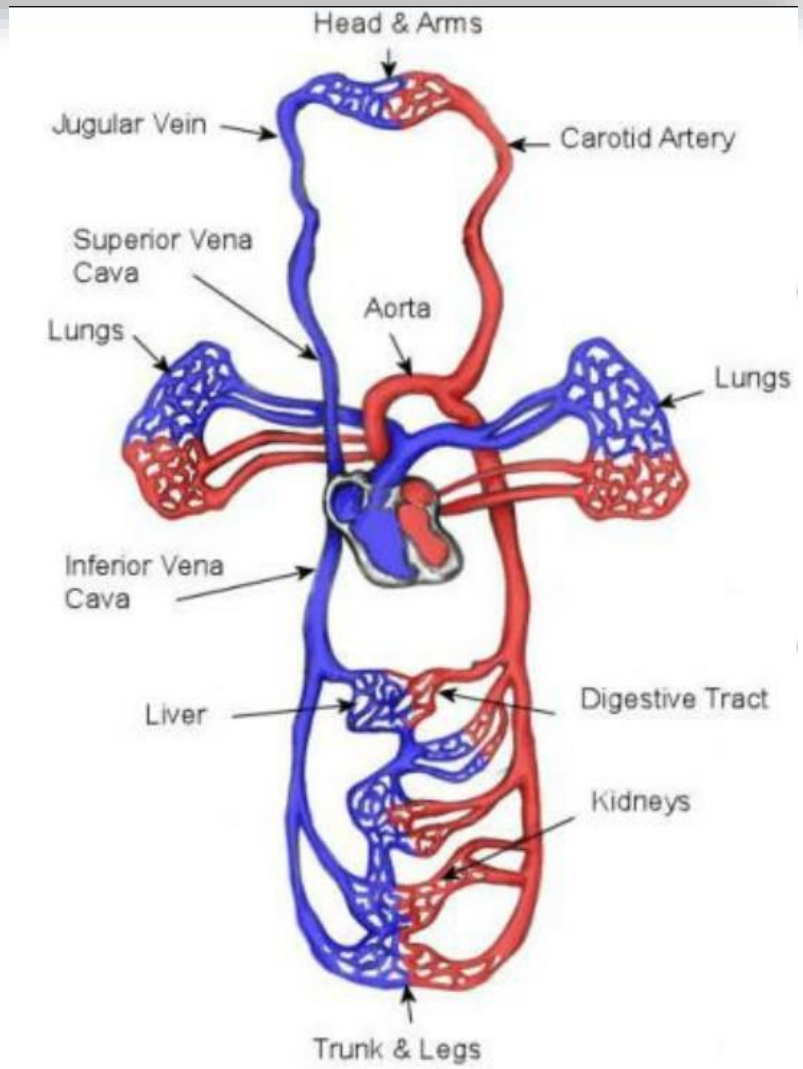
Functions

- Transport gases, nutrients, hormones, vital substances, and waste products.
- Assist thermo regulation
- Clotting + infection control

Main organ is Heart > work as a pump

Vascular system has sensors

- Chemoreceptors – sense pO_2, pCO_2, pH
- Baroreceptors – sense the the level of stretch on vascular walls



Heart at high altitudes

In high altitudes, the body develop **inefficient physiological changes** due to pressure change & hypoxia.

End result - Rapid breathing, ↑ Heart rate, ↑ Blood pressure, ↑ Cardiac output

As Heart muscle suffers from **reduced O_2** lead to reduced energy to function properly → can fail or become less efficient to meet the requirements.

May develop **ischemia** of certain parts of the heart muscle, lead to infarction.

These stressful events are directly lead to incapacitation if a Pilot has a **weak** heart.

Brain

Effects of lack of Oxygen to brain

- Inability to perform normal physical activities
- Distorted vision
- Difficulty in memorizing
- Difficulty in judgment, & decision making
- Loss of rational thinking ability
- Fail to communicate or write

Hypoxia results various adverse conditions which lead to risk of incapacitation and affect flight safety.

The DANGER of hypoxia is that Pilot may not suspect that he/she is hypoxic.

Keys to flying safe in high altitudes are-

- **Need to recognize the conditions under which you will be hypoxic.**
- **Identify the physical & mental symptoms early.**

How to prevent Hypoxia

- **Reduce tolerance to altitude(descend)**
- **Enrich inspired air with Oxygen**
- **Mainrain comfortable safe Cabin Pressure**

Aeromedical significance

- Understand the hypoxic environment Pilots are working
- Understand and relate this physiological changes and its effects to Pilot's health
- Use knowledge of physiological effects on Pilot’s 3 main systems when performing the medical examination.
- When assessing Pilot’s fitness give more significance to these physiological adverse effects specially when you do a evidence based risk assessment.
- Health promotion
- Kick off researches at CAAs to the development of safety, risk mitigation and management areas.

Other Physiological factors-

❖ G-Forces:

During maneuvers such as turns, climbs, and descents, pilots and passengers experience gravitational forces (G-forces).

High G-forces can lead to physiological effects such as blood pooling in the lower extremities, decreased blood flow to the brain, and loss of consciousness.

Proper training and the use of G-suits help mitigate these effects.

Other Physiological factors

❖ **Acceleration and Deceleration:**

Rapid acceleration and deceleration, as experienced during takeoff, landing, and turbulence, can affect the vestibular system, leading to motion sickness and disorientation.

Pilots must develop strategies to manage these sensations and maintain situational awareness.

- ❖ **Stay Calm and Focus on Breathing**
- ❖ **Anticipate Changes**
- ❖ **Maintain Proper Body Positioning**
- ❖ **Use Supportive Equipment: handrails, seat belts, or harnesses to secure yourself**
- ❖ **Monitor Your Physical Condition: Pay attention to any physical discomfort or signs of motion sickness**

Other Physiological factors

❖ **Temperature and Humidity:**

Extreme temperatures and low humidity levels in aircraft cabins can cause dehydration, fatigue, and discomfort.

Proper hydration and climate control are essential to maintaining crew and passenger well-being

❖ **Noise and Vibration:**

Prolonged exposure to noise and vibration in the cockpit can lead to fatigue, stress, and hearing loss.

Noise-canceling technology and ergonomic cockpit design help mitigate these effects.

HUMAN PSYCHOLOGY

➢ Stress and Fatigue:

Pilots and aircrew often face high levels of stress and fatigue due to long duty hours, irregular schedules, and the responsibility of ensuring the safety of passengers and cargo.

Effective stress management techniques and fatigue countermeasures, such as adequate rest and workload management, are critical for maintaining performance and decision-making ability.

➢ Situational Awareness:

Maintaining situational awareness, or understanding the current state of the aircraft and its surroundings, is essential for safe flight operations.

Factors such as workload, distractions, and information overload can impact situational awareness, highlighting the importance of effective communication, crew coordination, and training.

HUMAN PSYCHOLOGY

- **Decision Making:**

Aviation psychology examines the cognitive processes involved in decision-making, particularly under time pressure and uncertain conditions.

Pilots must be able to analyze information quickly, prioritize tasks, and make sound decisions to ensure the safety of flight operations.

- **Crew Resource Management (CRM):**

CRM emphasizes effective communication, teamwork, and leadership skills among flight crew members to enhance safety and performance. Training in CRM principles helps mitigate human error and promotes a culture of collaboration and accountability within aviation organizations.

Overall, an understanding of human physiology and psychology is essential for ensuring the well-being of individuals in the aviation environment and optimizing the safety and efficiency of flight operations.

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Explanation:

Vasoconstriction is the narrowing of blood vessels, which helps to prevent blood from pooling in the lower extremities during sustained periods of sitting. This physiological response increases vascular resistance and helps maintain blood pressure, ensuring that blood returns to the heart more efficiently, even when in a seated or inactive position for long periods.

Qu

Whi g in
the
airc

a) V

b) V

c) D

Vasodilation (option b) would have the opposite effect, causing blood vessels to widen and potentially leading to more pooling in the legs.

Decreased heart rate (option c) does not directly address the pooling issue and could, in fact, reduce circulation further

Explanation:

The vestibular system is responsible for maintaining balance and orientation in space by detecting changes in head movement and position. In aviation, it plays a crucial role in helping pilots and crew members sense spatial orientation, especially during complex maneuvers or in environments with limited visual cues, like flying through clouds or at night.

b) Maintenance of balance and orientation.

Option a) (regulation of blood pressure) relates more to the cardiovascular system, Option c) (control of respiratory rate) is managed by the respiratory centers in the brain, not the vestibular system.

Explanation:

At higher altitudes, the body compensates for the decreased partial pressure of oxygen by increasing the production of red blood cells. This process, known as erythropoiesis, enhances the oxygen-carrying capacity of the blood, allowing more oxygen to be transported to the tissues despite the lower oxygen levels in the air.

Option b) (decreasing the sensitivity of the respiratory center) is incorrect because the body typically increases sensitivity to maintain adequate oxygen levels,
option c) (increasing the rate of gas exchange in the lungs) is not a direct compensation mechanism at high altitudes.

Explanation:

Decision fatigue refers to the deterioration of decision-making quality after an extended period of decision-making, which can be aggravated by stress. Under significant stress, pilots can experience symptoms such as tunnel vision, auditory exclusion, and decreased cognitive function, which are related to mental overload and fatigue in making decisions.

b) Decision fatigue

Option (a) Cognitive dissonance is the mental discomfort from holding conflicting beliefs, and

Option (c) hypoxia refers to a lack of oxygen, which impacts physical and mental performance but is a physiological issue, not directly psychological.

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Aeromedical factors and their impact on flight safety

Safety in the aircraft requires knowledge of the factors that could have negative consequences if we were not aware of them and how to identify them.

Aeromedical factors which could give negative consequences;

~~Hypoxia~~
Hyperventilation
Middle Ear and Sinus Problems
Spatial Disorientation
Motion Sickness
Carbon Monoxide
Poisoning
Fatigue and Stress
Dehydration
Alcohol and other Drugs
Nitrogen and Scuba Diving

Hyperventilation - Abnormal increase in volume of air breathed - reduces excess CO_2 from body

Can occur subconsciously during stressful situations

Symptoms:

Lightheaded, dizzy sensation, tingling in extremities, hot and cold sensations, muscle spasms, visual impairment, unconsciousness

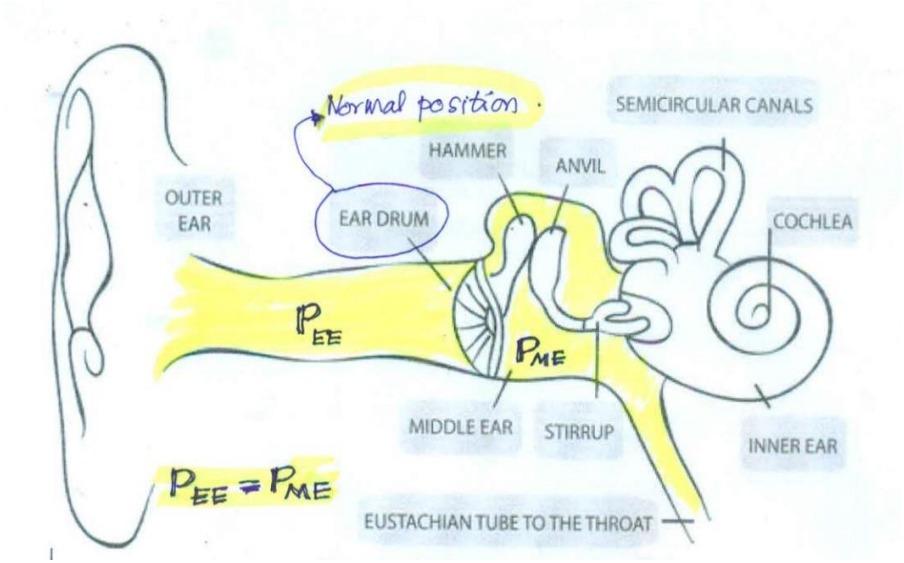
Pilot may react with greater hyperventilation

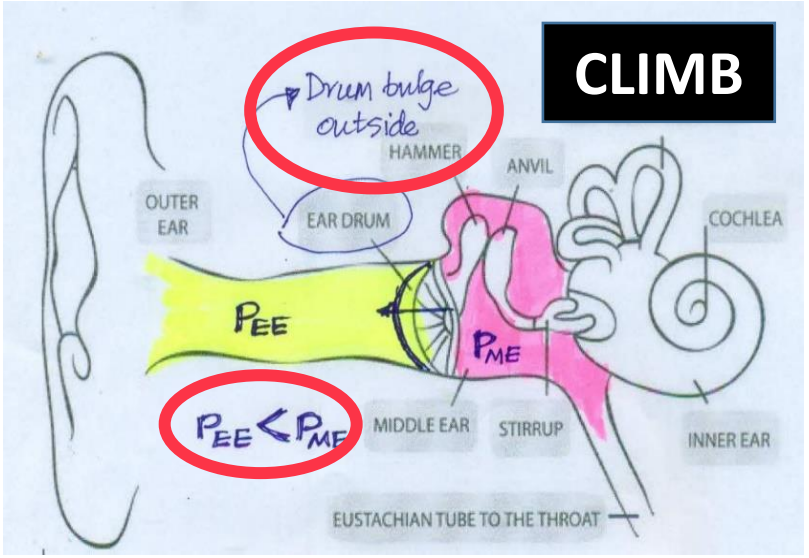
Symptoms subside within few minutes after rate of breathing is brought under control, use paper bag to rebreathe, talk slowly

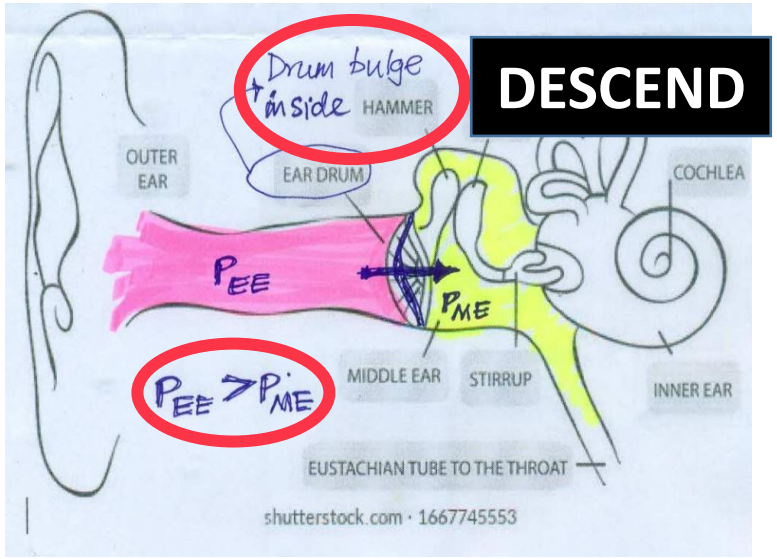
Middle Ear Problems

Normally there is no pressure difference between outside world and middle ear as it is equalized by the Eustachian tube.

The difference between the Pressure of the air outside the body, and the air inside the Middle ear & nasal sinuses can be extremely painful and can damage the ear drums, temporary reduced hearing.







Treatment

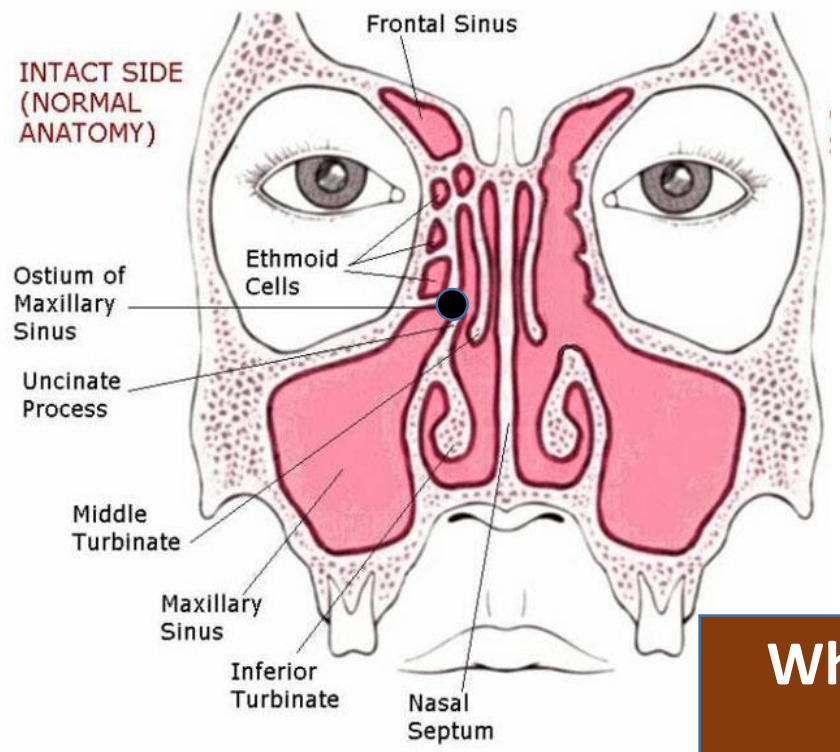
May be difficult to relieve—partial vacuum tends to constrict the walls of the Eustachian tube.

Pinch nostrils shut, close lips/mouth, blow slowly and gently in mouth and nose - forces air through the Eustachian tube into the middle ear. May not be possible to equalize pressure in ears if the pilot has a cold, an ear infection, or a sore throat.

If experiencing minor congestion, nose drops or nasal sprays may reduce the chance of painful ear blockage.

Sinus problems

Air pressure of the sinuses usually equal to the pressure outside as the sinus openings are connected to the nose.



Increase/decrease pressure inside the sinus

Symptoms

Severe pain over the sinus area

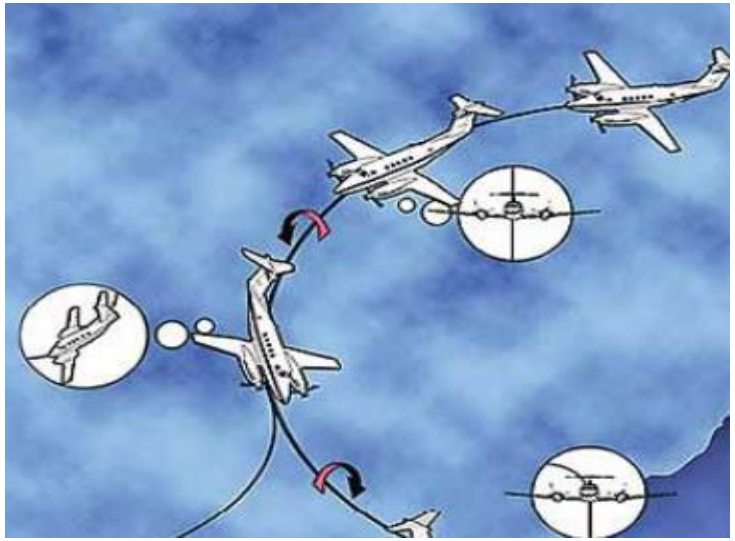
Maxillary sinus block mat cause upper teeth ache

Mucus with blood may discharge from nostrils

When pressure gradient increases, sinus may block and it is frequent when descending.

Spatial Disorientation

- The lack of orientation with regards to the position, attitude or movement of the aircraft in space.
- The body uses 3 systems to ensure awareness of orientation and movement in space – **Visual, postural and vestibular systems**
- Flying can cause that the 3 systems provide conflicting information to the brain leading disorientation.



Motion sickness

Caused by the brain receiving conflicting messages about the state of the body. May also can cause by anxiety and stress.

Symptoms

General discomfort, nausea, dizziness, paleness, sweating and vomiting.

Can be reduced the discomfort by open fresh air vents, focus on objects outside the aircraft and avoiding unnecessary head movements.

Carbon Monoxide poisoning

Aircraft heater and defrost vents provide a passageway into the cabin for CO, especially if the engine exhaust has a leak or is damaged.

CO attaches to hemoglobin more than 200 times than O_2, preventing hemoglobin carrying O_2 to cells, resulting in hypemic hypoxia.

Disposal of CO – may take up to 48 hours.

Effects

Headache, blurred vision, dizziness, drowsiness, Loss of muscle power

Stress

the body's reaction to physical and psychological demands placed upon it.

When you are stressed - The body will reacts to it by releasing stress hormones (e.g. adrenaline, cortisol) into the blood, increasing metabolism to provide more energy to the muscles, and increasing blood sugar, heart rate, respiration, blood pressure, and perspiration.

Stressors

- Physical stress (noise, vibration, cold temperature)
- Physiological stress (fatigue, decreased pO_2, barometric pressure changes)
- Psychological stress (difficult work or personal situations, unrealistic expectations)

Stress can be acute (short term) or chronic (long term).

Acute stress -involves an immediate threat that is perceived as danger. Triggers a "fight or flight" response from an individual. Normally, a healthy person can cope with acute stress and prevent stress overload.

On-going acute stress can develop into chronic stress.

Chronic stress is a level of stress that presents an intolerable burden, exceeds the ability of an individual to cope, and causes individual performance to fall sharply.

Can be caused by unrelenting psychological pressures (loneliness, financial worries, relationship or work problems).

Pilots experiencing chronic stress are not safe and **shall** not exercise their privileges as a Pilot.

Fatigue in aviation

A physiological state of reduced mental or physical performance capability resulting from sleep loss or extended wakefulness, circadian phase, or workload (mental and/or physical activity) that can impair a crew member's alertness and ability to safely operate an aircraft or perform safety-related duties.

Effects of fatigue

1. degradation of attention and concentration,
2. impaired coordination, and
3. decreased ability to communicate.

Fatigue can be **acute (short term) or chronic (long term).**

Fatigue in the cockpit cannot be overcome through training or experience

To prevent fatigue, get adequate rest and avoid flying without a full night's rest, after working excessive hours, or after an especially exhausting or stressful day.

Skill fatigue

is a special type of acute fatigue that affects performance.

- **Timing disruption—appearing to perform a task as usual, but the timing of each component is slightly off. Makes the operation pattern less smooth, and each component is performed as if it is separate instead of part of an integrated activity.**
- **Perceptual field disruption—concentrating attention upon movements or objects in the center of vision and neglecting those in the periphery, may be accompanied by loss of accuracy and smoothness in control movements.**
- **Can be caused by mild hypoxia, physical stress, psychological stress, or depletion of physical energy resulting from psychological stress**

How to prevent it,

- **maintain a proper diet to prevent the body from having to consume its own tissues as an energy source, and**
- **get adequate rest and sleep to maintain the body's storage of vital energy.**

Chronic fatigue

Fatigue extending over a long period of time; usually has psychological roots, although an underlying disease can be sometimes responsible.

<u>Symptoms:</u>

weakness, tiredness, palpitations of the heart, breathlessness, headaches, irritability, stomach/intestinal problems, generalized aches and pains throughout the body, emotional illness.

Usually requires treatment by a physician. Having rest is not enough.

Dehydration - Critical loss of water from the body.

First noticeable effect is fatigue, making top physical and mental performance difficult, if not impossible.

Flying for long periods of time during hot summer temperatures or at high altitudes increases the susceptibility of dehydration—dry air at altitude tends to increase the rate of water loss from the body.

If the fluid is not replaced, fatigue can progress to **dizziness, weakness, nausea, tingling of the hands and feet, abdominal cramps, and extreme thirst.**

To prevent,

carry and use water frequently on any long flight, whether thirsty or not. If the airplane has a canopy or roof window, wear light colored and porous clothing and a hat. Keep the cockpit well ventilated

Alcohol and other drugs

Hangovers can impair pilots, by making them more susceptible to disorientation and hypoxia. “Eight hours bottle to throttle.”

Medications can affect pilot performance.

Side effects of medication

may impair judgment, coordination, and vision.

Anything that depresses the nervous system can make the pilot more susceptible to hypoxia.

Do not fly while taking any medication, unless approved by the CAA.

Scuba diving

Provide the body with enough time to rid itself of excess nitrogen absorbed from diving, otherwise decompression sickness can occur, **creating an in-flight emergency.**

Bubbles can end up in the bloodstream causing respiratory and cardiac issues.

Wait at least 12 hours after a dive which did not require a controlled ascent before flight altitudes up to 8,000', and

At least 24 hours after a dive that required a controlled ascent for flights above 8,000'.

Understanding and addressing Aeromedical Factors are essential for promoting flight safety and mitigating risks in aviation.

There are many factors pilots & AMEs needs to be aware of in order to ensure a safe flight, and to understand the medical risks involved in flying.

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Explanation:

The primary concern regarding hypoxia in flight is its effect on the pilot's decision-making and cognitive function. Hypoxia occurs when there is insufficient oxygen in the body, particularly at higher altitudes. It can lead to confusion, impaired judgment, slower reaction times, and poor decision-making, which are critical for flight safety.

a) Decreased engine performance.

Option a) (decreased engine performance) and Option c) (increased risk of turbulence) are unrelated to the physiological effects of hypoxia on pilots and flight crew.

Explanation:

Hypoxia can lead to spatial disorientation, which affects a pilot's ability to accurately perceive their position and orientation in space. When the brain and sensory systems receive insufficient oxygen at high altitudes, it can impair cognitive and sensory processing, leading to disorientation and incorrect perception of the aircraft's attitude, altitude, or speed.

b) Hypertension

Option b) Hypertension generally affects long-term cardiovascular health,
Option c) hypoglycemia refers to low blood sugar, which can impair cognitive function but is not directly related to spatial disorientation in flight.

Explanation:

Fatigue is a critical aeromedical factor that negatively affects flight safety by impairing decision-making, judgment, and performance. Fatigue can slow reaction times, reduce situational awareness, and increase the likelihood of errors, particularly during complex or prolonged flight operations. It can also lead to decreased cognitive function, making it difficult for pilots to handle unexpected situations effectively.

b) It impairs decision-making, judgment, and performance

Option a) is incorrect because fatigue decreases, rather than increases, reaction time and situational awareness.

Option c) is incorrect because fatigue has a significant impact on flight safety.

Explanation:

The **primary concern** with hyperventilation in flight is its impact on cognitive function and the ability to focus. Hyperventilation leads to a drop in carbon dioxide levels in the blood, which can cause dizziness, confusion, lightheadedness, and impaired concentration, all of which are critical to flight safety.

Option a) decreased alertness can be a secondary effect but is not the primary concern,

b) increased risk of engine failure is unrelated to the physiological effects of hyperventilation.

Explanation:

Dehydration negatively impacts flight safety from an aeromedical perspective by impairing cognitive function, increasing fatigue, and reducing overall physical and mental performance. Even mild dehydration can lead to slower reaction times, impaired concentration, and diminished decision-making abilities, which are critical during flight operations.

b) It impairs cognitive function, increases fatigue, and decreases

Option a) dehydration "enhances cognitive function" is incorrect,
Option c) dehydration does have a significant impact on aeromedical factors, making option c) three incorrect as well.

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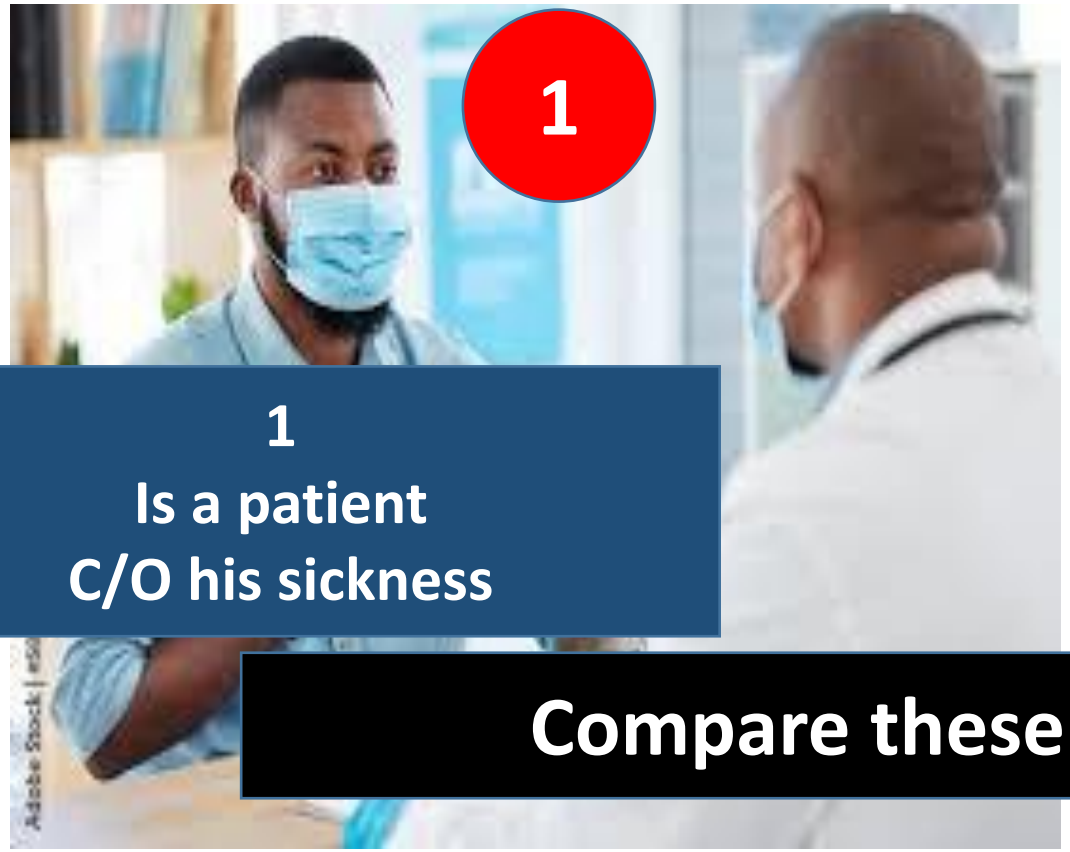
Conducting Aeromedical Examinations

Application of techniques and approaches while performing medical examination.

Comprehensive evaluation needed. Why?



1
Is a patient
C/O his sickness

2
Is a Pilot
No C/O

Compare these two pictures

1. Comprehensive Medical History:

Begin by obtaining a thorough medical history, including details about past illnesses, surgeries, medications, allergies, and family medical history.

Inquire about any current or chronic medical conditions, as well as any recent changes in health status.

Review the individual's flying history, including any previous aeromedical issues or incidents.

TIP – Check flying hours since last routine medical examination

	(16) Date of licence/Medical expire: Date:	
y Card No:	(18) Aviation licence(s) held (type): Licence number:	
r revoked	(20) Total flight time hours:	(21) Flight time hours since last medical:
	(22) Aircraft presently flown:-	
	(24) Type of flying intended:	

2. Physical Examination:

Perform a comprehensive physical examination, including assessments of vital signs (blood pressure, heart rate, respiratory rate), general appearance, cardiovascular system, respiratory system, neurological function, and musculoskeletal system etc.

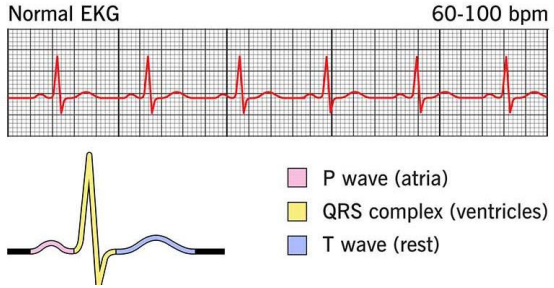
Assess visual acuity, color vision, depth perception, and peripheral vision to ensure adequate visual function for safe aviation activities.

Evaluate hearing acuity and auditory function, particularly for individuals involved in communication-dependent roles such as air traffic controllers.

3. Specialized Testing:

Other than the routine required testing, conduct specialized testing as necessary based on individual risk factors or medical history. This may include electrocardiography (ECG), pulmonary function testing, audiometry, or laboratory investigations.

Assessments for specific conditions such as sleep apnea, diabetes, cardiovascular disease, or neurological disorders may require additional testing or consultations with Specialists.



4. Psychological Assessment:

Consider psychological factors such as stress, anxiety, depression, and cognitive function during the examination.

Use standardized assessment tools or questionnaires to screen for psychological conditions and evaluate the individual's mental fitness for aviation duties.

Assess factors such as decision-making abilities, coping mechanisms, interpersonal skills, and overall psychological well-being.

YOU CAN USE CUSTOM MADE TOOLS.

Screening tools are often questionnaires completed by clients. Screening tends are quick to administer but results are only indicative

5. Risk Assessment and Counseling:

Evaluate the individual's overall risk profile for aviation activities based on medical history, physical examination findings, and specialized testing results.

Provide counseling and guidance regarding any identified medical concerns, including recommendations for treatment, lifestyle modifications, or restrictions on aviation activities.

Discuss potential risks and limitations associated with specific medical conditions, medications, or treatments relevant to aviation safety.

6. Documentation and Reporting:

Document all findings from the aeromedical examination in a comprehensive medical report, including details of the medical history, physical examination findings, specialized test results, and any recommendations or restrictions.

Ensure accuracy, clarity, and confidentiality in medical documentation, adhering to regulatory standards and guidelines for medical reporting in aviation.

Communicate findings effectively with the individual undergoing the examination, as well as relevant aviation authorities, medical certification boards, or employers.

7. Continuing Education and Training:

Stay updated on current aeromedical standards, guidelines, and regulatory requirements through ongoing education and training.

Participate in relevant aeromedical conferences, seminars, and professional development activities to enhance knowledge and skills in aviation medicine.

Collaborate with other healthcare professionals, aviation authorities, and industry stakeholders to exchange best practices and promote continuous improvement in aeromedical examination techniques and approaches.

By applying these techniques and approaches, aeromedical examiners can effectively assess the medical fitness of individuals involved in aviation activities and contribute to the safety and well-being of the aviation community.

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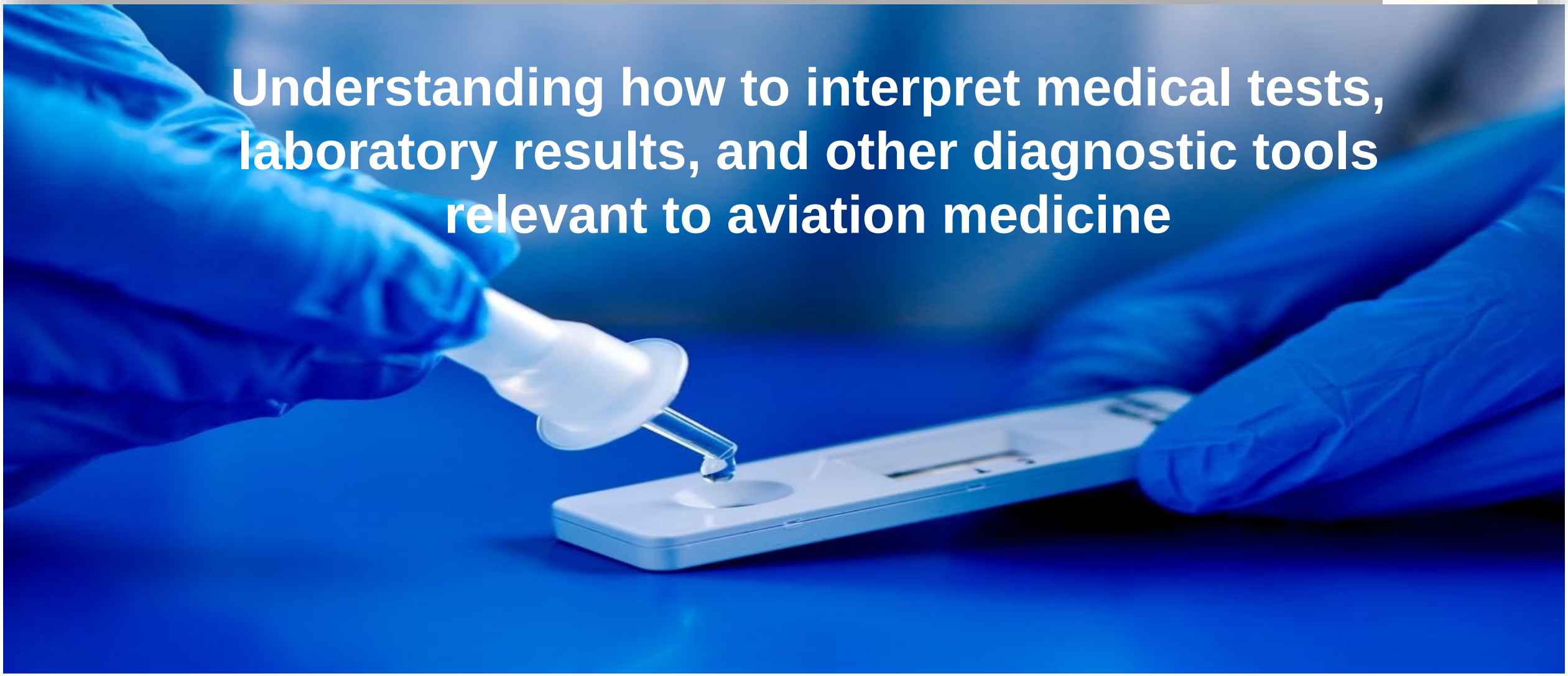
Understanding how to interpret medical tests, laboratory results, and other diagnostic tools relevant to aviation medicine



Aeromedical Services, Civil Aviation Authority of Sri Lanka.

Interpreting medical tests, laboratory results, and other diagnostic tools is a crucial aspect of aeromedical examinations in aviation medicine.

- **Understanding normal ranges**

Familiarize yourself with the normal reference ranges for various medical tests and laboratory parameters. These ranges may vary depending on factors such as age, sex, and population demographics.

Interpret test results in the context of these normal ranges, recognizing deviations that may indicate underlying medical conditions or physiological abnormalities.

- **Clinical Correlation:**

Consider the individual's medical history, symptoms, and physical examination findings when interpreting test results.

Evaluate the significance of abnormal findings based on clinical context, recognizing that some abnormalities may be incidental or benign while others may be clinically significant.

- **Consultation with Specialists:**

Seek input from Specialists or Consultants when interpreting complex or unfamiliar test results, particularly for specialized investigations such as cardiac stress testing, pulmonary function testing, or neuroimaging studies.

Collaborate with Specialists in relevant fields such as cardiology, pulmonology, neurology, or psychiatry to ensure comprehensive evaluation and interpretation of diagnostic findings.

- **Consideration of Aviation-Specific Factors:**

Recognize the unique physiological demands and operational requirements of aviation activities when interpreting test results.

Assess the potential impact of medical conditions or abnormalities on flight safety, taking into account factors such as altitude effects, G-forces, and cognitive function during flight.

- **Regulatory Standards and Guidelines:**

Familiarize yourself with regulatory standards and guidelines for medical certification in aviation, such as those established by the International Civil Aviation Organization (ICAO) or National aviation authorities.

Interpret test results in accordance with these standards, ensuring compliance with medical certification requirements for pilots, aircrew, and other aviation personnel.

- **Risk Assessment and Decision Making:**

Evaluate the implications of test results for flight safety and operational performance, considering factors such as the risk of sudden incapacitation, impaired cognitive function, or exacerbation of medical conditions during flight.

Use a risk-based approach to guide decision-making regarding medical certification, fitness for duty, and recommendations for aeromedical assessment or intervention.

- **Documentation and Reporting: VERY IMPORTANT**

Document all test results, interpretations, and clinical impressions in a clear, concise, and comprehensive manner.

Communicate findings effectively in medical reports, ensuring accuracy, relevance, and adherence to regulatory requirements for aeromedical documentation.

Provide appropriate recommendations, restrictions, or follow-up plans based on the interpretation of test results and clinical assessment.

- **Continuing Education and Training:**

Stay updated on advances in diagnostic testing technologies, medical guidelines, and regulatory standards relevant to aviation medicine through continuing education and professional development activities.

Participate in case discussions, peer review sessions, and interdisciplinary collaborations to enhance proficiency in interpreting medical tests and diagnostic tools in the context of aviation medicine.

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AEROMEDICAL SERVICES

Targeted Clinical Examination

Main domains we have to target

Decision of fitness for duties

Neurological

Respi

General Health & Wellness

Aeromedical risk assessment

Cardiovascular System:

History:

Assess for symptoms of cardiovascular disease (e.g., chest pain, dyspnea, palpitations), past medical history, family history, and risk factors (e.g., hypertension, diabetes, smoking).

Physical Examination:

Evaluate blood pressure, heart rate, heart sounds, peripheral pulses, signs of heart failure, and evidence of cardiac murmurs or arrhythmias.

Specialized Testing:

Consider additional tests such as electrocardiography (ECG), echocardiography, stress testing, ABP screeing or Halter monitoring as indicated.

Respiratory System:

History:

Inquire about symptoms of respiratory disease (e.g., cough, dyspnea, wheezing), past respiratory infections, smoking history, occupational exposures, and history of asthma or chronic obstructive pulmonary disease (COPD).

Physical Examination:

Assess respiratory rate, lung auscultation for breath sounds, signs of respiratory distress, and evidence of clubbing or cyanosis.

Specialized Testing:

Consider pulmonary function testing (spirometry), arterial blood gas analysis, chest imaging (X-ray or CT scan), or sleep studies for evaluation of sleep apnea if indicated.

Neurological System:

History:

Review for symptoms of neurological conditions (e.g., seizures, syncope, headaches, dizziness), past head injuries, history of strokes or transient ischemic attacks (TIAs), and medication use.

Physical Examination:

Evaluate mental status, cranial nerves, motor strength, coordination, reflexes, sensation, and gait.

Specialized Testing:

Consider neuroimaging (MRI or CT scan), electroencephalography (EEG), or other neurological tests based on clinical suspicion or specific aeromedical concerns.

Visual System:

History:

Inquire about visual symptoms (e.g., blurred vision, double vision), history of corrective lenses, past eye surgeries, and family history of eye diseases.

Physical Examination:

Assess visual acuity, visual fields, color vision, pupillary reflexes, ocular motility, and signs of ocular pathology (e.g., cataracts, glaucoma).

Specialized Testing:

Consider additional tests such as fundoscopic examination, visual field testing, or optical coherence tomography (OCT) for further evaluation of Eye health by an Eye Specialist as and when required.

Hearing and Vestibular Systems:

History:

Screen for symptoms of hearing loss, tinnitus, vertigo, or balance disorders, history of ear infections, noise exposure, and use of hearing aids.

Physical Examination:

Perform otoscopic examination, assess hearing acuity (audiometry), and evaluate vestibular function through tests like the **Romberg test or Dix-Hallpike maneuver.**

Specialized Testing:

Consider Pure Tone audiography, Tymapanograpy,, or caloric testing for further assessment of vestibular function if indicated or refer to ENT Specialist for further evaluation.

Psychological and Cognitive Function:

History:

Inquire about symptoms of psychological distress (e.g., anxiety, depression), past psychiatric diagnoses, medication use, substance abuse history, and cognitive complaints.

Mental Status Examination:

Assess mood, affect, orientation, memory, attention, judgment, and insight.

Specialized Testing:

Consider neuropsychological testing, psychiatric evaluation, or cognitive screening tools (e.g., Montreal Cognitive Assessment) for further assessment of psychological or cognitive function by a Specialist.

General Health and Wellness:

History:

Obtain a comprehensive medical history including medications, allergies, immunizations, and lifestyle factors (e.g., diet, exercise, sleep habits).

Physical Examination:

Perform a general physical examination including assessment of height, weight, body mass index (BMI), and overall appearance.

Laboratory Testing:

Order appropriate laboratory tests such as complete blood count (CBC), lipid profile, fasting glucose, and other relevant investigations based on individual risk factors or medical history.

Fitness for Aviation Duties:

Synthesize findings from the targeted clinical examination to assess overall fitness for aviation duties, considering regulatory standards, operational requirements, and potential risks to flight safety.

Provide recommendations for medical certification, fitness for duty, and any necessary follow-up assessments or interventions to optimize the individual's health and well-being in the aviation environment.

By conducting a targeted aeromedical clinical examination across these main domains, aeromedical examiners can comprehensively evaluate the medical fitness of individuals involved in aviation activities and promote safety in flight operations.

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AEROMEDICAL SERVICES

Psychological factors

Psychological factors can significantly impact cognitive function, decision-making abilities, and overall mental well-being, all of which are essential for safe and effective performance in aviation

Stress Management:

The ability to manage stress effectively is essential for maintaining performance and safety in aviation roles.

High levels of stress can impair cognitive function, attention, and decision-making abilities, leading to errors or lapses in judgment.

Pilots and aircrew must develop coping strategies for managing stressors such as workload, time pressure, and challenging flight conditions.

Emotional Stability:

Emotional stability is important for maintaining composure and professionalism in high-pressure situations.

Individuals with mood disorders, anxiety disorders, or other psychological conditions may be at risk of experiencing emotional distress that could affect their ability to perform aviation duties safely

Cognitive Functioning:

Cognitive abilities such as attention, memory, problem-solving, and multitasking are critical for safe aviation operations.

Factors that may impact cognitive function include fatigue, sleep deprivation, medication side effects, and underlying neurological or psychiatric disorders.

Decision-Making Skills:

Sound decision-making skills are essential for assessing risks, solving problems, and adapting to changing circumstances in aviation.

Individuals must be able to make timely and effective decisions, even under conditions of uncertainty or high workload.

Situational Awareness:

Maintaining situational awareness, or understanding the current state of the aircraft and its environment, is critical for safe flight operations.

Psychological factors such as **distraction, complacency, or fixation** can impair situational awareness and increase the risk of errors or accidents.

Communication Skills:

Effective communication is essential for coordinating actions, sharing information, and resolving conflicts within flight crews and between air traffic control and pilots.

Poor communication skills or interpersonal conflicts can compromise teamwork and decision-making in aviation settings.

Resilience and Adaptability:

Resilience, or the ability to bounce back from setbacks or challenges, is important for coping with adversity and maintaining performance in aviation roles.

Individuals must demonstrate **flexibility and adaptability** in response to unexpected events or changes in flight conditions.

Psychological Screening and Support:

Psychological screening tools and assessments may be used to evaluate candidates for aviation roles and identify potential risk factors.

Aviation organizations should **provide access to psychological support services, counseling, and resources** to help individuals cope with stress, trauma, or mental health concerns.

Regulatory Compliance:

Regulatory authorities establish standards and guidelines for psychological fitness for aviation roles, including requirements for medical certification and ongoing monitoring of mental health.

Pilots, aircrew, and other aviation personnel must comply with these regulations to ensure their continued fitness for duty and safety in flight operations.

By addressing psychological factors and promoting mental well-being, aviation organizations can enhance safety, performance, and overall quality of life for individuals involved in aviation roles. Regular training, support programs, and access to mental health resources are essential components of a comprehensive approach to managing psychological factors in aviation.

AMEs & MAs have significant role in this regard.

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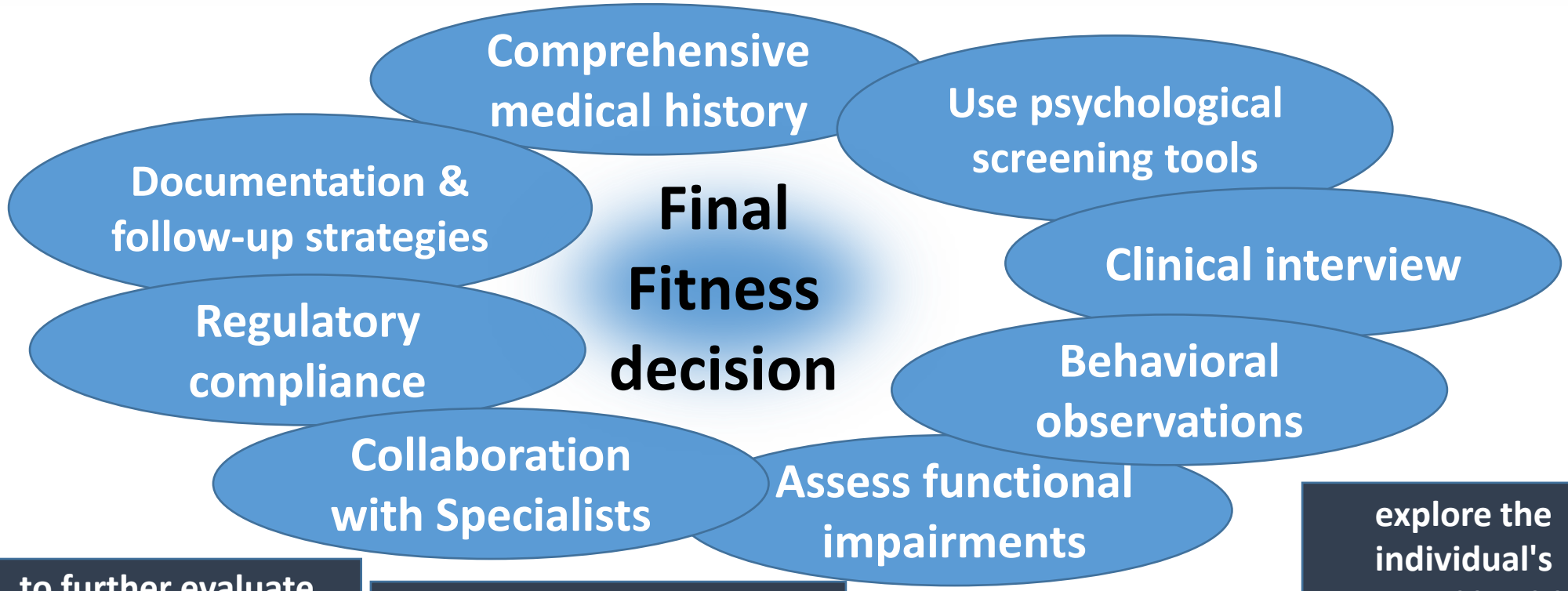
AEROMEDICAL SERVICES

Evaluation of mental health and stress management

Aeromedical Services, Civil Aviation Authority of Sri Lanka.

Prior making decisions about the certification of mental fitness, it is important to evaluate:

- The presence of a mental disorder and potential comorbidities in the history of the applicant;
- The presence of a mental disorders and potential comorbidities in the current timeframe;
- The risks related to the treatment;
- The Incapacitation risk level (including an evaluation of the impairment in performing flight duties and of the level of social dangerousness);
- Personal protective and risk factors (psychosocial circumstances, physical health, etc.)



Past mental health issues- mood swings(depression , PTSD) Stressors(family, social, environmental)

Tools to assess mood, anxiety, stress, and overall psychological well-being.

to further evaluate mental health concerns or provide additional support and intervention.

Affects to cognitive function, decision-making abilities, and situational awareness during flight operations.

Observe the individual's behavior, character, and interactions

explore the individual's mental health history, symptoms, coping mechanisms, and sources of stress

The key challenges reported by AMEs with respect to the current procedures for the aeromedical mental fitness assessment,

- Applicants' opposing attitudes to disclose information
- Difficulties in identifying symptoms
- Insufficient of training on mental health
- Lack of legal definition or basis of implementation Mental Health Assessment in the different CAA
- Absence of clear, robust, and validated questionnaires and interviews
- Impossibility to access the applicant psychosocial and medical history; no access to earlier AME's record
- Insufficient of cooperation among AMEs and mental health specialists
- Too little time allocated to assess mental fitness of applicants

Aviation Medical Examiners can identify potential risk factors by integrating mental health and stress management assessments into the aeromedical examination process,

- **promote early intervention, and**
- **support the well-being of individuals involved in aviation roles.**

Effective evaluation and management of mental health contribute to overall flight safety and operational performance in the aviation environment.

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AEROMEDICAL SERVICES

Medical certification processes and guidelines for aviation personnel.

Aeromedical Services, Civil Aviation Authority of Sri Lanka.

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AEROMEDICAL SERVICES

Pilots

Initial Medical Examination - before beginning flight training or operating as a pilot.

Classes of Medical Certificates: Different classes of medical certificates are available, Class 1 - the most stringent and is required for CPL & ATPL , Class 2 – SPL.PPL

Periodic renewals – Class I annually etc..

Special Issuance: Pilots with certain medical conditions may be eligible for a special issuance medical certificate, subject to additional evaluation and clearance by the Aviation Authority.

Air Traffic Controllers (ATCs)

Initial Medical Examination: All Air traffic controllers undergo an initial medical examination prior to training.

Periodic Medical Assessment: The frequency of assessments may vary based on age and jurisdictional requirements.

Medical Standards: Medical standards for air traffic controllers typically include requirements for visual acuity, color vision, hearing, cardiovascular health, Mental Health and other relevant medical conditions that may affect job performance.

Cabin Crew

Initial Medical Assessment- undergo an initial medical assessment to evaluate their fitness for duty, including physical health, mental well-being, and ability to perform safety-related tasks.

Periodic Medical Examinations – The frequency of examinations may vary based on CAA requirements.

Medical Standards:
Medical standards for cabin crew typically include requirements for general health, fitness, vision, hearing, and communicable disease screening.

Guidelines and Standards:

ICAO Annex 1:

Provides international standards and recommended practices for medical certification of aviation personnel, including pilots, air traffic controllers, and cabin crew.

National Regulations:

Each country's NAA establishes regulations and guidelines for aeromedical certification, which may include specific requirements, procedures, and documentation standards.

Medical Examiner Training:

Aviation medical examiners are trained and authorized by the NAA to conduct medical examinations and issue medical certificates in accordance with established standards and guidelines.

Ongoing Monitoring and Oversight

Surveillance Programs:

NAAs may implement surveillance programs to monitor the health and fitness of aviation personnel through periodic medical assessments, random screenings, or reporting of medical conditions.

Medical Records:

Aviation personnel are required to maintain accurate medical records and report any changes in health status or medical conditions to the appropriate authorities.

NAA's responsibility to maintain medical records while keeping confidentiality.

Collaboration with Healthcare Providers:

Aviation authorities may collaborate with healthcare providers, medical specialists, and aviation industry stakeholders to promote aeromedical safety and address emerging medical issues.

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Aeromedical Services, Civil Aviation Authority of Sri Lanka.

Question 01

Who is responsible for establishing medical certification requirements for pilots and aviation personnel in a State?

a) Federal Aviation Administration (FAA).

b) International Civil Aviation Organization (ICAO).

c) State Civil Aviation Authority(CAA)

d) European Union Aviation Safety Agency (EASA).

Question 02

What is the primary class of medical certificate required for airline transport pilots in most jurisdictions?

a) Class 1

b) Class 2

c) Class 3

d) No Class

Question 03

What is the maximum duration of validity for a Class 1 medical certificate for pilots under 40 years of age in the ICAO standards?

a) 6 months

b) 12 months

c) 24 months

d) 48 months

Question 04

What is the purpose of the Aviation Medical Examiner (AME) in the medical certification process?

a) To conduct medical examinations and issue medical certificates.

b) To review flight logs and verify flight hours.

c) To provide flight training to pilots.

d) To conduct medical assessments prior to issuance of Medical Certificate.

Question 05

ICAO Medical standards are published in

a) ICAO Annex 6, Chapter 01

b) ICAO Annex 01, Chapter 02

c) ICAO Annex 01, Chapter 06

d) ICAO Doc 8984

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AEROMEDICAL SERVICES

Aeromedical research and its significance.

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AEROMEDICAL SERVICES

Why Aeromedical Research is very important?

Enhancing Aviation Safety

Preventing Aviation Accidents and Incidents

Facilitating International Collaboration

Improving Aeromedical Standards and Guidelines

Supporting Evidence-Based Practice

Optimizing Pilot Health and Performance

Advancing Aerospace Medicine

mitigate factors that may compromise flight safety, such as physiological stressors, cognitive impairments, or medical conditions

Research findings inform the development of preventive measures and interventions to reduce the risk of aviation accidents and incidents

knowledge sharing among researchers, healthcare professionals, Aviation Authorities

guiding clinical decision-making, medical assessment processes, and interventions.

develop strategies for optimizing pilot health, well-being, and performance.

research provides empirical evidence to support the establishment of aeromedical standards, guidelines, and regulations

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AEROMEDICAL SERVICES

.Importance of Aviation Public Health and implementation of public health measures at Points of Entries.

Aeromedical Services, Civil Aviation Authority of Sri Lanka.

Aviation public health is a

- critical aspect of global health security and
- involves the implementation of measures to prevent the spread of infectious diseases and protect public health at points of entry (POEs) such as airports and border crossings.

Importance of Aviation Public Health

Global Disease Control:

Air travel facilitates the rapid spread of infectious diseases across borders. Implementing effective public health measures in aviation helps prevent the international spread of diseases, including pandemics like COVID-19.

Protecting Passenger Health:

Ensuring the health and well-being of passengers and aviation personnel by adhering to Public health measures will help to minimize the risk of disease transmission within aircraft cabins and at airports.

Border Health Security:

POEs serve as key entry points for travelers from around the world. Public health measures at these locations help identify and respond to health threats, including emerging infectious diseases, bioterrorism, and other public health emergencies.

Importance of Aviation Public Health

Surveillance and Early Detection:

Monitoring health indicators and implementing surveillance systems at POEs enable early detection of infectious diseases and timely public health interventions to prevent outbreaks and mitigate risks.

Collaboration and Coordination:

Aviation public health requires collaboration and coordination among multiple stakeholders, including government agencies, public health authorities, airlines, airports, and international organizations. Effective communication and cooperation are essential for a coordinated response to health threats.

Implementation of Public Health Measures at Points of Entry

Health Screening:

Conducting health screenings, including temperature checks and symptom assessments, for arriving and departing passengers to detect potential cases of infectious diseases.

Travel Restrictions:

Implementing travel restrictions or quarantine measures for individuals traveling from regions with active outbreaks or high transmission rates of infectious diseases.

Health Declarations:

Requiring passengers to complete health declaration forms or provide information about recent travel history, exposure to sick individuals, and current health status.

Implementation of Public Health Measures at Points of Entry

Testing and Diagnosis:

Offering on-site testing facilities for infectious diseases, such as COVID-19 testing, to identify cases quickly and initiate appropriate public health interventions.

Contact Tracing:

Collecting contact information from passengers to facilitate contact tracing efforts in the event of a confirmed case of an infectious disease.

Environmental Hygiene:

Implementing enhanced cleaning and disinfection protocols for aircraft cabins, airport facilities, and high-touch surfaces to minimize the risk of disease transmission.

Implementation of Public Health Measures at Points of Entry

Capacity Building:

Training aviation personnel, healthcare workers, and border control staff in infection control measures, outbreak response protocols, and public health emergency management.

Surveillance and Monitoring:

Establishing surveillance systems to monitor health trends, detect outbreaks, and assess the effectiveness of public health interventions at POEs.

International Collaboration:

Engaging in international collaboration and information sharing to exchange best practices, lessons learned, and scientific expertise in aviation public health.

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