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NOTICE

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INTRODUCTION

IATA commissioned this Medical Manual to provide up to date information on airline medical issues to its members, especially those which may not have the benefit of an in-house medical advisor. The practice of airline medicine has changed substantially since the last edition of the Medical Manual was written and this is reflected in the fully revised document. The Manual will be reviewed regularly to ensure it remains relevant to the needs of IATA's members.

The Medical Manual has been compiled with the expert advice of the IATA Medical Advisory Group. This comprises the medical directors of 12 airlines from all regions of the world. The knowledge and experience of the members of the Medical Advisory Group has been utilised to create a document that IATA is confident will meet the needs of airlines throughout the world.

The Medical Manual covers many of the facets of airline administration and operations from the medical perspective. It draws on the various medical specialties that are essential to the safe and smooth operations of an airline and includes public health, aviation medicine, occupational health and travel medicine.

The content has been changed to reflect current issues of interest within the airline industry. Additionally, links are provided to carefully researched websites which may be used for further information.

SECTION 1 – ROLE AND RESPONSIBILITIES OF AN AIRLINE MEDICAL DEPARTMENT

1.1 INTRODUCTION

The airline medical department has wide ranging responsibilities that affect virtually every aspect of the airline operation and those using it. The areas of responsibility fall into two main categories:

- the health of the passenger;
- the health of the employee.

1.2 PASSENGER HEALTH

The airline is responsible for carrying its passengers safely and efficiently to the destination. The airline has no real means of ensuring that all passengers are fit to begin their journey. The medical department is responsible for ensuring, as far as possible, that passenger health does not deteriorate during the journey, and that there are adequate measures in place to deal with any unforeseen in-flight medical emergency.

1.2.1 Medical Advice to Airline Passengers

Due to the marked increase of the number of airline passengers travelling abroad, the practice of Travel Medicine and proper medical advice to the passenger by the airline medical department has assumed great importance and is a major factor in successful airline operations.

1.2.2 MEDIF and FREMEC Cards (see also Section 6.3)

Passenger health and medical fitness, along with advice to passengers who need medical clearance or who have special needs is discussed in detail elsewhere in the manual. A summary is added here for completeness: (Link: www.asma.org/publications)

Many airlines provide medical clearance for passengers with recent or unstable medical conditions. Many use a special medical form based on the IATA Medical Information Form (MEDIF).

Those passengers with chronic, but stable, medical conditions, and those with additional needs, may be issued with a FREMEC card. This may be issued by the airline medical department or reservation department to travellers and a copy kept in the airline reservations system for easy reference for future travel.

1.2.3 Passenger Awareness and the Media

Many passengers have real or perceived concerns about their flight and the medical department is available to answer those queries whether they come from passengers directly, or indirectly through travel agents or the airlines' sales agents. The use of pamphlets at points of sales, and in ticket wallets, airline internet sites and in-flight magazines are all useful vehicles to provide important health information and advice for passengers and their medical advisors.

Recently passengers and the media in general have become acutely aware of medical and quasi-medical issues that might be associated with flying. Much has been made of cramped seating, obsolete regulatory requirements, cabin environment, stress of travelling etc, but the fact remains that customers wish to travel quickly, cheaply and safely to their destination. They have a responsibility to ensure that they are healthy enough to do so. The airline and its medical department have a responsibility to ensure that the flight does not have any adverse effects on those travelling.

Airline medical departments have been catapulted into the forefront of public and media interest. They need to provide a balanced scientifically based view, keeping abreast of medical research, using proven medical data which is made widely available to all. (Link: www.iata.org/inflight; www.ba.com/health; www.qantas.org; www.cathaypacific.com; www.aa.com/content/customer service; www.klm.com; www.who.int; www.cdc.gov/travel)

1.2.4 Care of the Incapacitated Passenger

The carriage of incapacitated, handicapped or disabled passengers is an important aspect of air travel.

Acceptance of the incapacitated passenger for travel requires input from the airline medical department, co-ordinating, where appropriate, with the passenger's medical advisor and the airlines' reservations, ticketing and operational departments. More details are provided in **Section 6**.

1.2.5 Global Communication

Developments in communication, the internet and e mail now mean that airline medical departments are no longer isolated. They have ready access to colleagues in other carriers to openly exchange information and views for the common benefit of all travellers. There is now a high level of inter-airline co-operation between medical departments to the benefit of all concerned.

1.3 EMPLOYEE HEALTH

The airline medical department has a responsibility for providing occupational health care for the airline employees. Some airlines go further, and provide an extended service to employees and their dependants, by offering a primary health care service. Some also provide an employee dental health service with an extension to dependants or families as well. The level of primary health care provision is influenced by the local facilities and culture.

The role and responsibility of the airline medical department must be clearly defined by the airline chief executive and a clear operating plan laid out with core objectives and responsibilities. The medical department, like any other airline department must function efficiently, providing a cost effective service.

Some airlines are prepared to subsidise their medical departments, allowing them to provide the required services at a loss, but most insist on strict budgetary controls. Some medical departments operate very effectively on a system of costing and charging other areas of their company for their services. This might seem unduly bureaucratic, but it can show most clearly to other departments within the organisation the value of the medical department and the costs relative to external providers.

1.4 POSITION IN THE CORPORATE ORGANISATION

The medical department because of its wide ranging role and responsibilities needs to have a reporting line such that medical issues that may affect either passengers or employees are brought to the attention of the most senior airline staff without delay and these are recognised and evaluated quickly so prompt action can be taken.

Depending on individual airline needs, the medical department may have a small staff of professional advisors or specialists in medical fields relevant to the airline need. Some airlines may have a Head or Director of Medical Services, who reports directly to the chief executive with a staff of occupational health, aviation medical physicians and administrative staff. Other airlines may extend the service to include staff health clinics, occupational health nurses, welfare support staff, an employee assistance programme (EAP), psychologists and dental services. The level of service will be influenced by local needs, culture and labour laws.

1.5 STRUCTURE WITHIN THE MEDICAL DEPARTMENT

Whatever the individual requirement of the airline, the medical department should have staff who have a broad knowledge in:

- Aviation Medicine;
- Preventative Medicine;
- Occupational Health;
- Travel Medicine;
- Clinical Medicine;
- Epidemiology and Research;
- Substance abuse and addiction;
- Toxicology.

1.6 THE ROLE OF THE MEDICAL DEPARTMENT

The services and functions of the airline medical department will vary and must meet the needs of the airline. There are a number of key functions that the department has to manage on a daily basis.

1.6.1 Pre-Employment Assessment

The importance of this first assessment cannot be over emphasised. A proper pre-employment medical assessment may avoid many problems including serious medico-legal issues later on. The examining health professional must be aware of the physical and mental components of specific jobs and the possible hazards of the environment in which the applicant will be required to work. The assessment should focus on the safety of the applicant and others, and on the airline's duty of care.

(a) A detailed medical history questionnaire relevant to the intended job must be completed and signed by each applicant. Any relevant past medical history needs to be carefully checked and assessed for its potential impact on future employment in the airline. The pre-employment assessment provides the base information for the employee's occupational health record.

(b) Declarations by the employee that the information supplied is correct are essential. Failure to have such at the pre-employment stage can result later in significant and serious implications for the airline if the employee alleges an illness/injury or condition is the direct result of their employment. A declaration such as follows, gives a reasonable degree of safety to both parties:

> *"I hereby declare that the answers to the above questions are correct and that I have not withheld any relevant information or made any misleading statements in relation to any medical condition experienced by me either in the past or at present.*
>
> *In order to ensure safety and for various operational reasons, we require you to complete this form in good faith and to make a full and frank disclosure of your medical history. We will rely on this information provided by you. Your employment, and continued employment, by the Company is conditional on your having provided us with complete details of your medical history and existing medical conditions. In the event that you fail to disclose any medical condition, such failure will entitle the company, at its discretion, to withdraw your offer of employment or to terminate your contract of employment, whichever is appropriate. In addition, failure to disclose medical conditions may, in certain circumstances, invalidate insurance policies such as medical insurance and life and personal accident insurance, provided to you by the Company."*

Airlines differ in the depth of the protocols for health assessment at the time of employment. This is driven by their own requirements, local labour laws and where staff is recruited from. In many airlines a simple health questionnaire plus declaration is all that is required, others, depending on the type of job, require more details, for example, flight deck crew, cabin crew, engineering staff.

Some airlines provide very specific additional protocols depending on the job applied for, which concentrate on gathering information about the individual's medical status in relation to that function. For example, for cabin crew, working in a restricted low humidity environment, questioning about allergies, ENT problems and ability to manage galley equipment is important.

Additional biometric testing may be required such as audiometry and visual acuity for those working in the noisy airside areas.

1.6.2 Periodic Health Assessment

The wide spectrum of occupational groups in the aviation industry provides a substantial challenge to the airline medical department. The relationship between the work environment and the health status of airline employees is complex and variable and requires a full risk assessment of every job and its component parts. The potential hazards include the use of solvents, paint stripper, toxic metals, isocyanates and radiation, assessment of workplace illumination, ventilation, seating and other ergonomic factors are also essential.

Period health assessments provide an opportunity for the employee to discuss health matters with someone who knows about his/her particular job. In addition, periodic assessments may provide the physician with an opportunity to make an early diagnosis of certain conditions so that corrective steps can be taken in the pre-clinical stage of the condition.

The interval and protocol of the periodic health assessment should be established in relation to age and type of work. In general the interval between health examinations is shorter after the age of 40-45 or for those involved in higher risk working environments. The protocol of the assessment should include a risk factor analysis in order to ascertain what preventative measures may be taken. Periodic drug screening may be required as directed by governmental regulation.

Groups which require specific occupational health assessments:

- Flight Deck Crew;
- Cabin Crew;
- Overseas duty travellers;
- Paint sprayers;
- Radiation workers;
- Airside drivers.

1.6.3 Care of Air Crew

The importance of the care of aircrew is paramount as health issues can readily become safety issues in airline operations. There is no other situation in which such valuable machinery and such obligation for safety of passengers and cargo is entrusted to so few highly trained operators and where the results of failure can be so catastrophic. Furthermore, the airline investment in the costs of training aircrew is enormous and outweighs that of any other category of staff.

Aircrew are highly skilled personnel and justifiably proud of their profession. It is essential that the airline doctor is viewed as a friend of the pilot group rather an as an adversary. It must be remembered that, in many instances, the medical profession is viewed by the pilot group as being the most threatening influence on their careers.

Exposure of personnel to tropical climates poses specific medical problems and an airline physician should visit these locations to experience local conditions. All aircrew, as well as other employees, should be instructed in personal health care. Films, pamphlets and posters will assist.

Some airline medical departments are designated by Government Authorities as medical centres for aircrew licensing examinations. Although this practice is not always supported by the pilot group, there are advantages in that an airline medical department knows its aircrew far better than any official government department or outside medical examiner. (Link: www.icao.int, www.faa.gov, www.cami.jccbi.gov)

1.6.4 Health Supervision of the Work Environment

The airline medical department should assist the employee safety department and the managers of areas such as the Battery shops, Electroplating shops, X-ray and Radar equipment bays, Non-destructive cleaning bays and Blasting bays in carrying out risk assessment. This will assist in the detection and appraisal of health hazards, including physical stress and psychological stresses, and must include appropriate recommendations or corrective measures. Safety hazards such as insufficient lighting, thermal problems, inadequate ventilation, noise, insufficient guards, handrails and scaffold, should be included in the survey.

1.6.5 Health and Safety Education

The training commitment varies between individual airlines but will usually include the training of cabin staff in emergency first aid. It will generally also include first aid training for other employees and should include health education and health promotion for all employees.

Cabin crew must be well trained in First Aid to enable them to assist a passenger, or fellow crew member who becomes unwell in-flight. They must be prepared for virtually any sort of medical emergency and airlines now put crew through a rigorous training programme, to incorporate all aspects of First Aid including CPR and emergency child-birth. These training programmes may be subcontracted out to specialist trainers or carried out “in house”. Either way the medical department is responsible for ensuring the content and quality are acceptable and appropriate to the airline’s operation and conform to Aviation Regulatory Authority requirements.

Some airlines now have in-flight access to ground-based specialist medical services which the crew can contact using the aircraft satellite communications system. These services are provided by physicians who are trained in remote medical care. Such systems are invaluable as they not only provide experienced medical advice relevant to air travel, but also assist the captain of the aircraft in making decisions about a potential medical diversion. Using such telemedicine systems to minimise the risk of diversion will not only save the airline cost, the passengers inconvenience, but also helps the sick passenger, who, even if unwell, does not want to be hospitalised in a foreign place with all the problems and difficulties that entails.

Crew need to be trained and updated on the use of the aircraft emergency medical equipment. Most international aircraft now carry both First Aid Kits and Doctors Emergency Medical Kits as described elsewhere in this manual. Crew must be familiar with the contents and their use, even if they do not use them themselves. Any on-board, passenger physician who comes forward to assist during an in-flight medical emergency will rely on the crew’s familiarity of the equipment to assist with the management of the sick passenger.

Many airlines now carry automatic external defibrillators to be used by crew in the event of sudden cardiac arrest. The crew must be trained in their use and limitations and be sufficiently confident and competent to use them promptly when the need arises.

All cabin crew must undergo regular re-training as part of their annual Safety Equipment checks to maintain their licence. The medical department can use this as an informal discussion forum with crew to gain feedback on their experiences and concerns. It also gives crew the opportunity to talk through situations they have been in and gain a medical explanation of the emergency.

Many airlines now insist that their flight deck crew also receive First Aid training.

Health education and promotion for all airline employees is important. This should be targeted and relevant to the needs at the time.

Employees generally appreciate this activity and respond in a positive, co-operative way. Pamphlets, posters, colour films, video-cassettes, demonstrations on manikins, audio-visual presentations, and newsletters may all be helpful.

1.6.6 Accident and Emergency Services

Airlines operate from airports, which are high security areas and access for emergency services can be an issue. The airport operator has direct responsibility to ensure emergency services are provided or have unimpeded access. The airline medical department may elect to provide basic accident and emergency services for staff and passengers particularly if remote from hospital care.

The extent of medical services provided will depend on the size of the base, the number of working employees, and the local medical facilities available in the community. At many airports around the world, there are non-airline operated clinics and these can be utilised where airline medical services are not available.

In addition to treating minor and major injuries, the clinic should also be capable of functioning as a poison control centre, maintaining a list of all possible toxic substances and their antidotes. Similarly, a roster of centres for the treatment of the severely burned patient should be readily available.

1.6.7 Aircraft Accidents

Flying is acknowledged as the safest means of travel, but accidents can and do happen albeit rarely. The airline medical department must therefore work with other airline departments to produce an appropriate response to such a crisis. The development of a Crisis Response has to be global and encompass scenarios at locations, which may be very different to the hub from which the airline operates. There are a number of international organisations that make such expertise available to airlines and these are to be recommended. Their assistance at such times to provide logistical and medical manpower is invaluable as no medical department will have the resource to do this independently.

The way the airline and the medical department respond to such a crisis can significantly influence the future of the airline. Therefore very close co-operation between local and international medical and emergency organisations is essential and regular training and exercises involving mass casualty situations are essential. All international airports undertake these regularly, as laid down by ICAO and the airline must participate fully. In most situations the medical department will not be directly involved at the accident scene, but will be expected to care for survivors after discharge from hospital, and for friends and relatives of passengers who arrive at the location in the aftermath.

It is important that accurate medical and dental records, where possible, are kept of all airline aircrew as these may be required for assistance in identification after an accident. (See also **Section 7**).

1.6.8 Immunisation

Airlines operate globally to destinations all over the world where health standards and endemic disease patterns vary greatly. It is essential that all airline staff who travel are protected against the common endemic diseases by immunisation and malaria prophylaxis as appropriate. This applies to all aircrew, and also engineers, maintenance staff, management staff, and all others who undertake duty travel.

Airline staff should carry their vaccination records and ensure that they are kept current. Health Authorities at many airports may demand to inspect these documents and difficulties can arise if crew vaccination records are found to be invalid.

Passengers may contact airline medical departments for advice about immunisation requirements and needs at destinations. Therefore, it is necessary for the airline to be able to provide up-to-date and accurate information on the varying immunisation requirements and recommendations worldwide. This is best provided through Travel Clinics or via the many excellent websites now available (Link: www.cdc.gov/travel; www.who.int; www.fitfortravel.scot.nhs.uk)

1.6.9 Advice to Management

Medical Confidentiality

It is important that all who work in a medical department should understand the rules which govern medical ethics, particularly the commitment to medical confidentiality. Although management may request a medical assessment to ascertain a person's fitness for a particular job, the ethics of the medical profession must be maintained. In general, the health professional may provide management with reports on fitness for work, appropriate limitations and likely duration. Medical information has no place in such a report and must not be included without written consent from the individual concerned.

Where an employee consults an airline health professional because of personal problems or symptoms of a clinical nature, such a consultation must conform to the normal rules of medical confidentiality.

There are circumstances which may be extremely sensitive but which may have serious implications in terms of safety of passengers or other employees. Such situations require considerable judgement on the part of the physician who must weigh the rights of the individual against the safety and rights of others. Discussion with a senior colleague is essential to ensure an appropriate outcome.

Advice to management on corporate health matters is not subject to the rules of confidentiality. It is the duty of the airline physician to be alert to all general matters of health and to communicate early trends to management. Only in this way can the health of Company personnel be properly safeguarded.

Insurance and Disability

Some airlines have comprehensive insurance schemes for their employees which provide cover for health, illness, accident, death, or loss of licence.

The airline medical department may be required to work in close conjunction with the insurers and insurance department of the airline, to provide accurate information and to ensure the claimant is both properly investigated and treated and also that the claim is justified. Informed consent to release of confidential medical information from the employee is essential.

Some airlines will "self-insure" for some of these contingencies and the onus then falls especially on the medical department to ensure that a fair and reasonable balance is struck between employee claim and investigation and the corporate response. Claims should be properly investigated and reported on by the medical department in an impartial way to ensure that the employee is fairly treated.

Occasionally, the employee or the employee's union will attempt to steer the investigation or management of such a claim by suggesting or demanding use of experts specifically designated by them. That is not in the airline's best interest, and the airline medical department should ensure that they seek, on behalf of the company the best, most independent and expert opinion available.

Medico-Legal

The airline medical department must be prepared to work closely with the legal department on claims of a medical nature against the company as well as any other legal matters requiring medical input. These claims may come from either passengers or employee, and the legal department will look to the medical department for expert medical advice and evidence.

Customer Relations

Customer enquiries and complaints may have a medical content or demand some medical explanation. This may range from complaints of "food poisoning on the flight" to allegations of injuries or illnesses caused during the flight. The types of complaint are extensive and the medical department is frequently called upon by the airline Customer Relations department to provide explanation or advice.

Factual evidence based medical information has to be provided in a concise manner. This may involve the medical department liaising with, and working with, other airline departments to collate the required information to pass back to the enquirer or complainant by Customer Relations.

Designation of Airline Physicians

The airline Medical Director must assume an active role in the selection of company designated physicians at airline out stations around the world and maintain close contact with these physicians on airline medical issues.

The airline appointed physicians will be the airline's medical representative at these destinations and are there to look after the crew and airline staff staying at that location, either on a temporary or permanent basis. They therefore need to have the same, or similar expertise as those physicians in the main airline medical department and the Medical Director should be satisfied they will have adequate facilities to care for the employee.

At these destinations, availability of hospitals and specialised facilities, including access to emergency services should be monitored.

The scope of the service and contact details must be made known to all relevant departments within the airline.

Every airline has its own method for rewarding these physicians. Many airlines also encourage a regular gathering of these physicians at the airline central hub to discuss common issues and encourage dissemination of information. It is easy for these physicians to feel isolated and unimportant to the airline, but such regular meetings enhance the spirit of belonging and of being of use to the airline.

There are now a number of specialist providers who will undertake the entire provision, supervision and management of the overseas medical services.

Liaison with External Agencies

Apart from the need to work with, and build close relationships with local medical specialist agencies, most airline medical departments develop relationships with the Civil Aviation Authorities who regulate the whole international airline operation both in their own country and internationally.

The medical department must also be prepared to participate in aviation medical committees and conferences. This allows discussion and exchange of information in a forum of peers and encourages best practice.

Bodies such as ICAO, IATA, the Airline Medial Directors Association (AMDA), Aerospace Medical Association (AsMA), the International Academy of Aviation and Space Medicine (IAASM) are all organisations where airline medical staff can meet both formally and informally to progress aviation medical matters. Other international bodies such as the World Health Organisation are now also keenly interested in aviation and travel medical matters and seek the experience and knowledge of the airline medical departments. (Link: www.asma.org; www.who.int; www.iata.org; www.icao.org; www.iaasm.org)

Research

The airline medical department will have access to an enormous amount of varied medical data which can be used for research to progress developments in the commercial aviation medical field.

As the airline industry expands and develops with long range aircraft and flights to more exotic destinations the potential for human factor research increases. Crew issues, such as radiation levels, crew fatigue, the effects of ultra-long range flights on both passengers and crew are all currently being extensively researched.

SECTION 2 – THE CABIN ENVIRONMENT

2.1 INTRODUCTION

The objective of this section is to provide the basic information about the aircraft cabin environment with further references to the extensive literature on the subject.

This section will only cover the cabin environment during normal operation. While there is also a fairly large body of literature on in-flight incidents, those incidents are considered as exceptions and should be addressed separately. This approach does not suggest that those incidents should be neglected; however, each incident is different and should be investigated appropriately. When a cause is found, the problem should be fixed immediately. When a common problem is identified in a particular type of aircraft, the same rationale applies.

It is useful to remember that three different groups share the aircraft environment: the pilots who are healthy and perform sedentary but safety sensitive work, the cabin crew who are healthy and perform fairly intensive physical activities, and the passengers who are sedentary but who can be in any state of health or ill health.

2.2 PRESSURISATION

The main difference between the aircraft cabin environment and ground transportation is the difference in pressurisation. Contrary to popular belief, the aircraft cabin is not pressurised to ground level equivalent. For mechanical and economic reasons, it is practically impossible to maintain ground equivalent pressure at high cruising altitudes. The pressurisation schedule was developed to vary between ground level pressure and a maximum equivalent cabin altitude of 2400 meters (8000 feet) depending on the aircraft altitude.

How is an aircraft pressurised and how does it maintain the pressure? Currently most aircraft are pressurised by bleeding air from its engines before the combustion chamber. However, other systems exist, such as a separate electric air compressor. Turbopropeller and jet engines function as air compressors. The pressurisation system draws air from different stages of the compressor, before it enters the combustion chamber, and redirects it to the aircraft cabin. With the assistance of an outflow valve, the pressure is raised and maintained to a predetermined desired level. **Figure 2.1 (Appendix 'A')** shows an example of a pressurisation system. The air is normally kept very clean. However, it is possible to have a mechanical malfunction which might allow contaminants into the cabin. This would constitute an incident, as described above, and the mechanical malfunction should be rectified immediately.

Returning to the pressurisation schedule, it is worth noting that this approach was accepted many decades ago when all the flights were relatively short, the aircrew were all relatively young and virtually no sick passengers travelled. In other words, the rationale was based on an average healthy young person, whether this person was a passenger or an aircrew member. Demographic and flight profiles have changed significantly over the years, and the current question is whether the original rationale is still valid. The United States National Research Council (NRC), in their extensive review of the literature on the cabin environment, recommended research on cabin pressure and oxygen partial pressure.

The selection of 2400 meters (8000 feet) was based on the oxyhemoglobin dissociation curve which shows that up to that level the hemoglobin oxygen saturation normally remains above ninety percent in the average healthy individual.

Figure 2.2 (Appendix 'B') shows how the relative decrease in atmospheric pressure influences the human physiology. The reduced oxygen partial pressure creates a mild hypoxia that is well tolerated by healthy individuals. However, passengers or crew with cardiac disease, pulmonary disease, anemia, etc. could be adversely affected. The reduced total pressure will cause gas expansion. As several body cavities contain gas, these cavities will be affected; the gas expansion will mainly affect the middle ear, the sinuses and the bowels. It also explains why a passenger with an active pneumothorax could not be accepted for air travel in a commercial aircraft. The reduced total pressure could also have an impact on evolved gas, hence the restrictions for flying after diving.

2.3 VENTILATION

It is not enough to pressurise an aircraft; it also has to be ventilated to provide comfort to the occupants and to remove contaminants.

There are two main types of ventilation system: one provides one hundred percent fresh air at all times. As the air coming out of the engine is extremely hot, it is passed through an air conditioning unit before it enters the cabin. This air then passes through the outflow valve and is replaced by fresh air coming from outside and the air conditioning unit. The other type of ventilation system provides a ratio of fresh air and recirculated air. An example of that system is seen on **Figure 2.3 (Appendix 'C')**. In this case, the air leaving the air conditioning unit is directed to a mixing unit where it meets air coming from the cabin. Before entering the mixing unit, the air from the cabin passes through a particulate filter. In modern aircraft, these filters are normally of the HEPA (High Efficiency Particulate) type. There are different levels of efficiency within the HEPA filters and there are no current regulations covering this particular aspect of ventilation. These filters only trap particulates; they have no effect on gases. After leaving the mixing unit, this mixed air is passed into the cabin. A proportion of it is exhausted through the outflow valve and the rest passes back to the mixing unit where the cycle continues. In the current commercial fleet, the ratio of fresh air to recirculated air is usually about 50:50.

While there has been and still are some questions about recirculated air, it is well accepted by ventilation experts that one hundred per cent fresh air at all times is not necessary. Indeed, nearly all commercial buildings in the last four decades have been supplied with recirculated air. In other words, if the ventilation system is adequate, recirculated air is totally acceptable. In fact, from a comfort standpoint, one clear advantage of air recirculation in aircraft is the somewhat higher degree of relative humidity.

2.4 CONTAMINANTS

The table below summarises the list of contaminants that are of concern for aircraft cabin.

CHEMICAL	Carbon Monoxide CO
	Carbon Dioxide CO_2
	Ozone O_3
	Volatile Organic Compounds (VOC)
	Semi-volatile Organic Compounds (SVOC)
	Insecticides
BIOLOGICAL	Bacteria
	Fungi
	Viruses
PHYSICAL	Particulate matters

A discussion on all those contaminants and the literature on them is beyond the scope of this manual. The reader is directed to the list of references for all the details. However, to summarise the current body of knowledge, aircraft cabin air quality during normal operation is perfectly acceptable and often better than other well accepted indoor environments. There has been very little research on Volatile Organic Compounds (VOCs) and Semi-Volatile Organic Compounds (SVOCs). The American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) has done a preliminary study on the subject paving the way for a more definitive study. NRC has also recommended research in this area.

The transmission of diseases by biological contaminants has attracted much media attention. The research to date does not report a significant risk when the ventilation system functions normally. Even in aircraft with air recirculation, the biological air quality remains perfectly acceptable. As in any other public transport or public places, the proximity to a contagious person can be a factor in transmission; however, the aircraft ventilation system has not been implicated as a factor in disease transmission. In most modern aircraft the air flow is mainly laminar, from top to bottom and not from front to back or back to front. **Figure 2.4 (Appendix 'D')** is an example of that system. Therefore, in a suspected case of disease transmission on an aircraft, the Public Health authorities do not necessarily have to contact all the passengers, as only those in the immediate vicinity may be at risk (Link: www.who.int).

2.5 TEMPERATURE

Cabin temperature is mainly a comfort issue. Technically the temperature could be easily maintained in a desired range. The problem is to find the desired range. Comfort is subjective at best. Furthermore, what is a comfortable range for a sedentary person (passenger) may be too warm for a physically active one (cabin crew). This explains why in practice there are sometimes wide variations in measured temperature: it is an attempt by the flight or cabin crew to satisfy everybody at the same time. For the cabin crew, uniform design and fabric are important so they can adjust easily to the desired temperature of the passengers by adding or removing items of clothing as necessary.

2.6 RELATIVE HUMIDITY

In an aircraft with good load factors, the relative humidity is usually between 10 and 20%. As explained under pressurisation, cabin air comes from outside the aircraft. At cruising altitude, the outside air is virtually free of moisture. Therefore, the only source of humidity is the occupant, which is not enough to maintain the relative humidity at a desirable level. Humidifying systems can and have been added in some cases; so far, operators that have used those systems have found that they cause more problems than they actually solve. Besides incurring a significant weight penalty, they also increase the risk of corrosion and contamination. Maintenance alone has been a problem. Technology may be able to overcome these problems in the future. In any case, while 10 to 20% of relative humidity is not ideal, it does not seem to have a significant impact on the occupants' health. A study on the subject was published by the Royal Air Force Institute of Aviation Medicine in England and they concluded that it was unlikely that the low level of relative humidity found in aircraft cabin had any long and short term ill effects, if overall hydration is maintained. However, it is certainly accepted that low levels of relative humidity may affect passenger and crew comfort by superficial dehydration. Dry, itchy or irritated eyes, dry stuffy nose, dry throat and skin dryness are among the most common complaints.

2.7 PASSENGER SPACE AVAILABLE

The minimum dimensions between seats are normally regulated by Airworthiness Standards. These dimensions are intended to ensure that the majority of passengers can sit upright, stand up from the seat, move to the aisle without undue difficulty and evacuate the aircraft within a specified time in the event of an emergency. So far, comfort has not been an element addressed by the regulations. Clearly, the more space available between seats, the more comfortable the occupant will be. However, the relatively small distance between the seats has been one of those accepted trade-offs to keep airline transport accessible to the general population.

In 1977, the term “Economy Class Syndrome” appeared in the literature and was widely used to refer to flight-related Deep Vein Thrombosis (DVT). In 2000, the Science and Technology committee of the UK House of Lords reviewed this issue extensively and concluded: “It (economy class syndrome) is misconceived in suggesting that the possibility of DVT need not concern business and first class air travellers, or those using other forms of long-distance transport. We recommend that health professionals and others stop using the seriously misleading term economy class syndrome. Traveller’s thrombosis would be more appropriate.” (Link: www.publications.parliament.uk)

The World Health Organisation (WHO) entered this arena in 2001 with the WRIGHT (WHO Research into Global Hazards of Travel) project. The report of Phase 1 showed the findings of the epidemiological studies, which indicate that the risk of VTE approximately doubles after a long–haul flight (>4 hours). The data also showed that this increased risk applies to other forms of travel (such as car, bus or train) where travellers are exposed to prolonged seated immobility. The risk increases with the duration of the travel and with multiple flights within a short period. The absolute risk of VTE per more than four-hour flight, in a cohort of healthy individuals, was 1 in 6000. The results of the hypobaric chamber studies with healthy volunteers predominantly without risk factors for VTE failed to demonstrate any association between hypobaric hypoxia and prothrombotic alterations in the hemostatic system. However, the travel and non-travel immobility study, which include a high proportion of individuals with risk factors suggested that some flight-specific factor may interact with pre-existing risk factors and result in increased coagulation activation in susceptible individuals over and above that related to immobility.

2.8 NOISE AND VIBRATION

An aircraft in flight, through turbine-whine, jet stream, aerodynamics, produces all kinds of vibration from the infra-sound to the ultra-sound. However, due to the acoustic treatment of the cabins of modern aircraft and the use of engine noise suppressors, the level of noise that is perceived by passengers and crew members is sharply reduced, permitting normal conversation. That has not always been the case and, there still are some older aircraft in the world fleet that generate significant noise, especially from a crew standpoint. There are some relatively modern aircraft that produce significant noise levels in the cockpit to the point that some airlines provide hearing protection for their pilots. Each airline needs to carry out a risk assessment and adapt their approach accordingly.

2.9 TURBULENCE

An aircraft moving through the air is susceptible to sudden motion called turbulence, often associated with flying in or near clouds. However, there are also times when significant turbulence may be found in clear and apparently smooth air. Forecasting this clear air turbulence is still in its developmental stages. Therefore, it is recommended that passengers keep their seat belt fastened at all times when seated.

In spite of transient turbulence and the high number of air travellers, motion sickness does not seem to be as prevalent as one would expect. It is certainly not a significant problem for airlines.

2.10 CONCLUSION

The aircraft cabin environment certainly has particularities that are very different from other modes of transportation. Some of those are trade-offs to keep this mode of transportation accessible to the general population. In spite of these, the available scientific evidence shows that the aircraft cabin environment during normal operation does not represent a risk for the healthy traveller. The ill passenger should consult his physician before travelling and, if in doubt, should advise the airline so that a proper assessment can be done. Because of their highly safety sensitive position, the aircrew should be even more cautious and should also consult their physician for any significant illness and, if in doubt, should consult the airline medical department or the airline designated physician.

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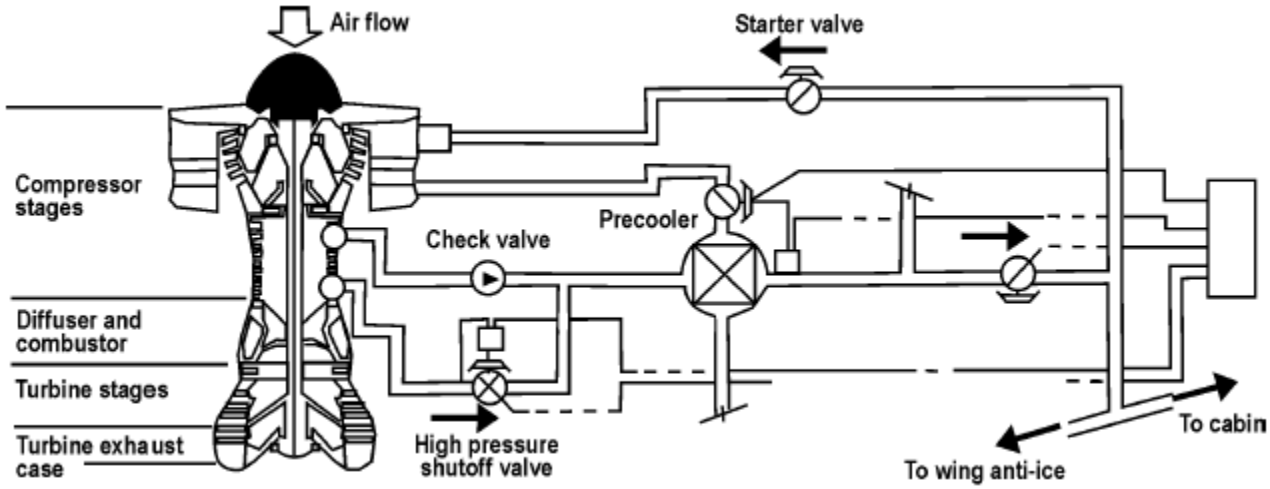
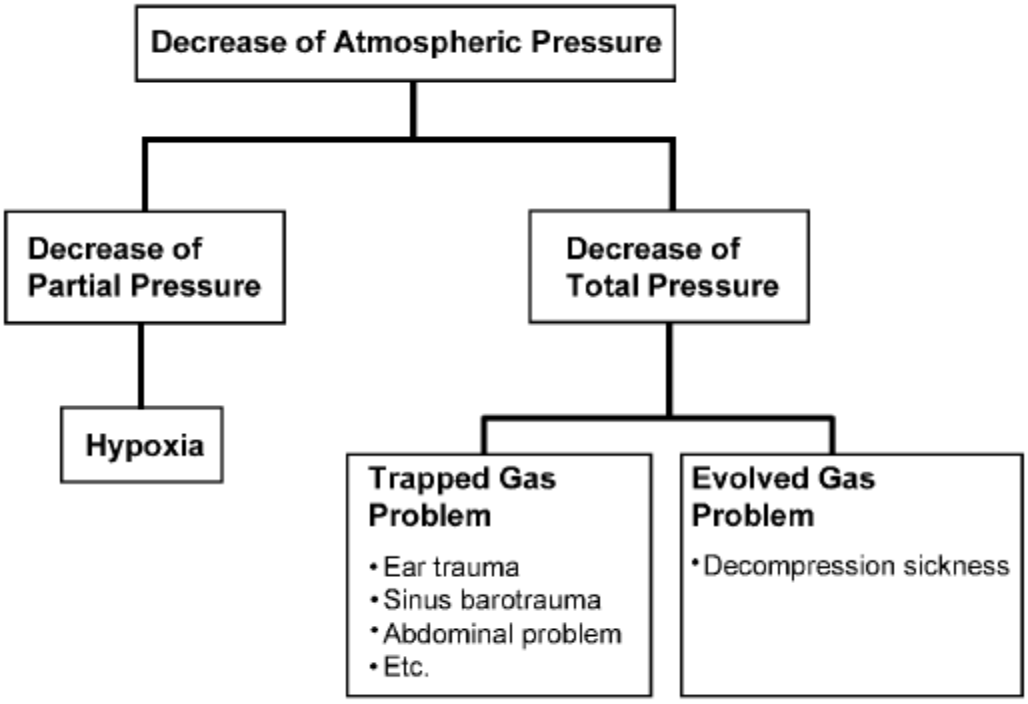
Appendix 'A'

FIGURE 2.1 – ENGINE BLEED AIR SYSTEM



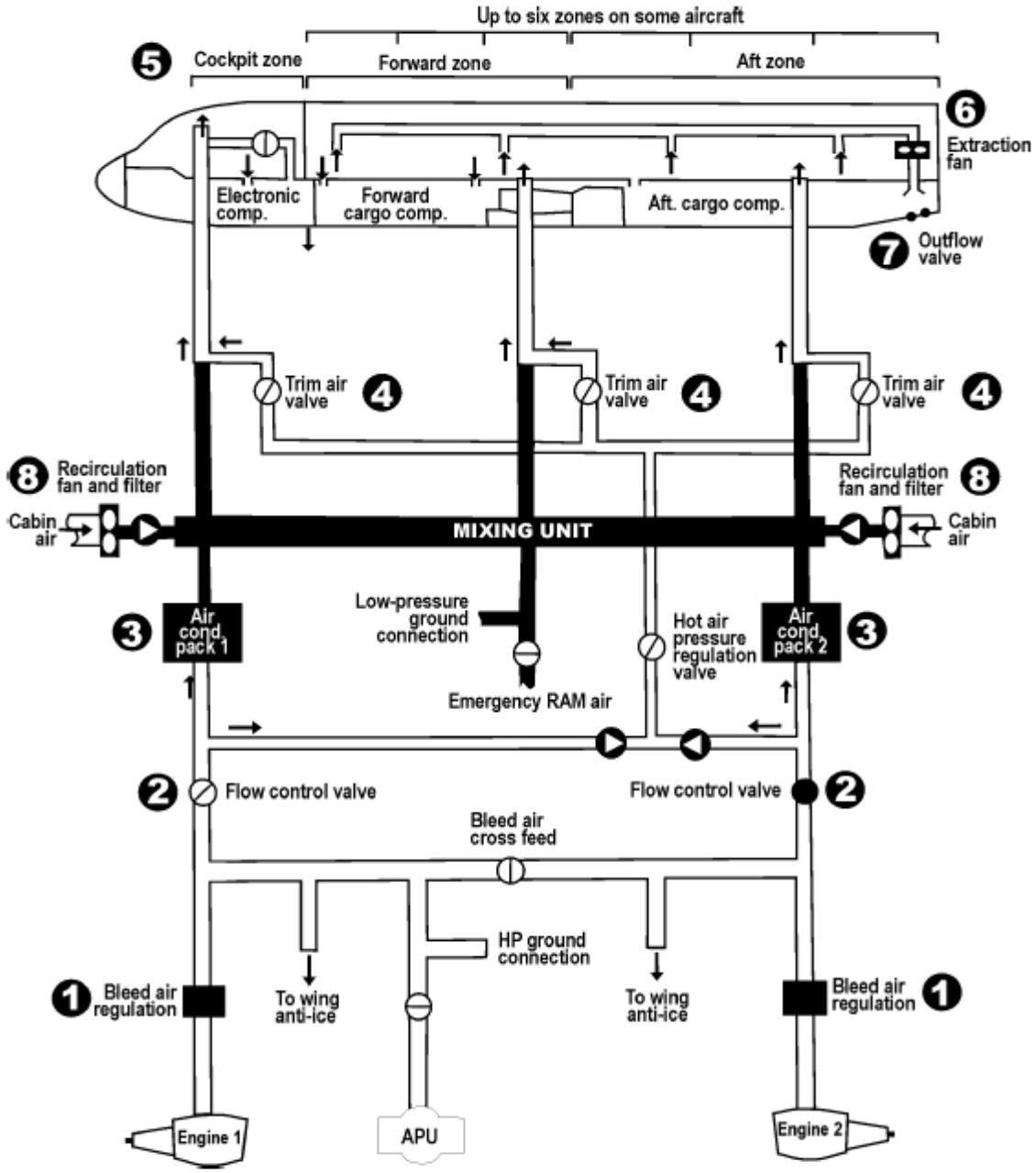
Appendix 'B'

FIGURE 2.2 – PHYSIOLOGICAL IMPACTS OF DECREASED ATMOSPHERIC PRESSURE



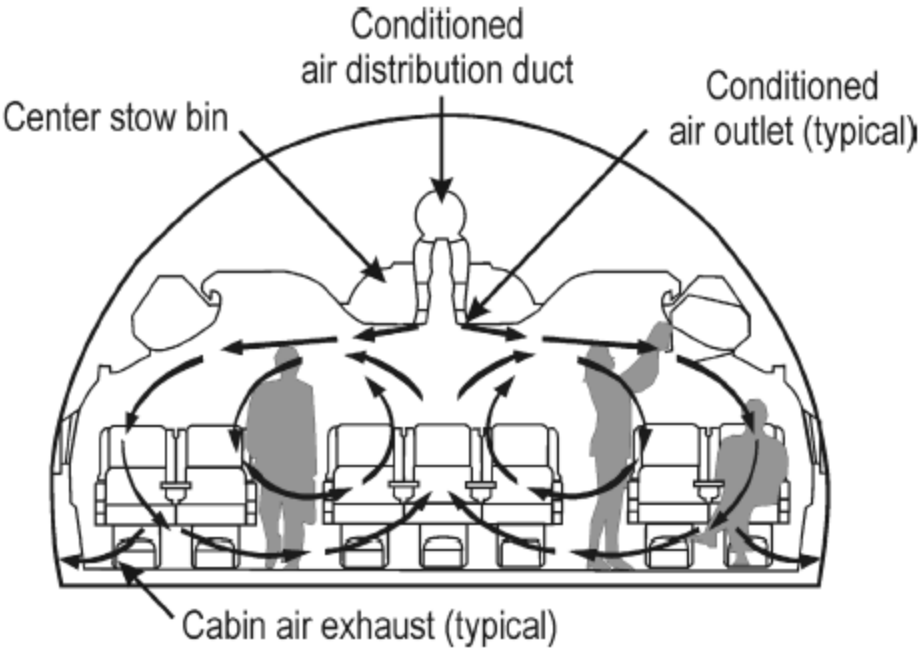
Appendix 'C'

FIGURE 2.3 – VENTILATION SYSTEM



Appendix 'D'

FIGURE 2.4 – CABIN AIR FLOW PATTERN



SECTION 3 – CREW MEDICAL STANDARDS

3.1 FLIGHT CREW MEDICAL STANDARDS

From a regulatory standpoint, the most important factor in the establishment of medical standards is flight safety. The working conditions and responsibilities of flight crew are very specific, and the various medical standards that have been developed reflect these specific environmental and occupational demands.

The internationally accepted document concerning flight crew medical standards and licensing is the *ICAO publication Personnel Licensing, Annex 1*. This document describes the minimum standards and therefore some countries have implemented stricter standards than given in the ICAO Manual. (Link: www.icao.int)

3.1.1 Rationale for Medical Standards

From an employer standpoint, flight safety is also the main objective in setting standards; however, other considerations also deserve attention. The rationale for defining and maintaining medical standards for flight crew in an airline is given by the following basic assumptions:

Flight safety. Any health problem in flight crew, which causes a performance decrement directly affects flight safety.

Occupational healthcare. The airline is responsible for the occupational health and safety of its employees and is, therefore, responsible for the prevention of exposure of its employees to the specific environmental and occupational strains of the job.

Economics. Any health problem, which interferes substantially with the performance of duties by flight crew will have a significant financial impact related to the large investment made by airlines in the selection, training and maintenance of flight crew. Regulatory authorities are only concerned for the short period of the validity of the license, while the employers think in term of 20 to 30 year career.

3.1.2 Environmental and Occupational Considerations

The various medical standards that are applied to flight crew reflect the specific environmental and occupational demands of their working conditions. These include:

- hypobaric environment, hypoxia and decreased humidity;
- turbulence, vibration and noise;
- discomfort arising from cabin layout and sustained relative immobility;
- irregular lifestyle, especially with regard to sleep-cycle, local time change, irregular shift patterns, family and social life;
- legal requirements;
- repeated changing of team, climate, culture, work and off-duty routines.

3.1.3 General and Specific Medical Considerations

Apart from specific environmental and occupational factors, there are general and specific medical considerations within the medical standards. The following general medical standards are required for safe performance of flight crew duties:

- the absence of any medical condition or any suspected medical condition that may lead to any form of acute functional incapacity;
- the absence of any existing or former medical condition – acute, intermittent or chronic – that leads or may lead to any form of functional incapacity;
- the absence of any use of medication or substances which may impair functional capacity;
- minimal requirements to the necessary functions such as vision and hearing.

3.1.4 Medical Standards

The central regulatory document for aircrew standards is the International Civil Aviation Organisation (ICAO) publication *Personal Licensing – Annex 1, Chapter 6: Medical provisions for licensing*[1]*(2) (Link: www.icao.int)*. The medical standards given in this document have been accepted by all contracting states as the minimum medical standards to be applied for flight crew licensing. The reader is referred directly to this manual since these standards change from time to time. Revision of Annex 1 is being conducted in 2004.

Some states have established stricter medical standards than those in the ICAO Manual. The airlines regulated by those states must follow their standards.

Some airlines will go further and established stricter standards yet. The extent to which they can go is governed by state laws and human rights issues. While it is beyond the scope of this manual to discuss the above and enter the debate of regulatory versus preventive medicine, any decision, whether regulatory or preventive in nature, should be based on accepted scientific evidence or the best available evidence.

3.1.5 Selection and Initial Medical Examination

The main goal of the initial medical examination is to establish medical fitness for the job, but it is also a good opportunity to evaluate health risk, provide valuable information and begin a long term professional relationship that hopefully will influence the individual health status and bring positive consequences.

No medical standard or medical examination can eliminate all possible future health risks or problems. However, the principle of **reasonably preventable** applies to clinical, occupational and aviation medicine. In the hands of expert aviation medical examiners this approach can contribute significantly to flight safety and occupational health status.

3.1.6 Responsibilities of Flight Crew

Every individual Flight Crew member has a personal responsibility for maintaining the required medical standards for safe performance of relevant tasks and responsibilities. This is formalised on several occasions in the ICAO Medical standards:

- flight crew members or air traffic controllers shall not exercise the privileges of their licence unless they hold a current medical assessment appropriate to the licence;
- applicants for licences have to furnish the medical examiner with the requested and correct information on their actual health, previous medical conditions and the results of former medical examinations regarding licensing. Holders of licences provided for in this Annex shall not exercise the privileges of their licences and related ratings at any time when they are aware of any decrease in their medical fitness which might render them unable to safely and properly exercise these privileges. Flight crew members shall not exercise the privileges of their licences and related ratings while under the influence of any psychoactive substance which might render them unable to safely and properly exercise these privileges, and shall not engage in any problematic use of substances.

These standards imply that flight crew, if in any doubt, are required to seek occupational medical advice on their fitness to exercise their duties.

[1] CAO, *International Standards and Recommended Practices, Annex 1: Personnel Licensing*, 9th edition, 2001 in basic medical terminology.

3.1.7 Responsibilities of the Airline Companies

Airlines should strictly follow the medical standards and legislation applicable.

Because of the very high costs of training pilots and flight engineers, it is essential that an airline recruits only the highest quality of staff. Having trained these individuals, it is essential that they are maintained in good health by adequate and regular medical supervision.

It is a responsibility of the airline company to make expert occupational healthcare available to all flight crew members.

Expert medical care should be provided at overseas destinations.

The medical licensing service may be provided either by the airline medical department or externally.

3.1.8 Responsibilities of Authorised Medical Examiners

In accordance with the medical standards applicable, selection and subsequent flight crew licensing may only be carried out by adequately trained aviation physicians who are licensed by the relevant Aviation Authority.

Aviation medical knowledge and experience are conditional for taking on any responsibility for the medical licensing process. "Where the examiner does not possess the requisite knowledge, any decision he makes regarding doubtful candidates may well be fraught with danger to the candidate and those who fly with him/her."[2]

Every authorised medical examiner has the individual responsibility to assess if his/her medical knowledge, abilities and experience in any given situation are sufficient for the decisions to be made.

If in any doubt further expert advice should be obtained.

3.2 CABIN CREW MEDICAL STANDARDS

Medical standards for professional and private pilots have long been clearly specified in international regulations (ICAO, Annex 1, Chapter 6); however there is generally no equivalent for Cabin Crew. A few exceptions exist; a certain number of countries require Cabin Crew to be licensed to private pilot standards. The airline determines the appropriate pre-employment health assessment required.

3.2.1 Cabin Crew Working Conditions

In the absence of official references, it is important to consider the components of the role of cabin crew and the flight environment.

Cabin Crew are subjected to the same aircraft environment as the Flight Crew. On long-haul, they are exposed to time-zone shift (jet-lag), stopovers in tropical countries and irregular working patterns.

Cabin Crew onboard duties include a significant physical component. Cabin Crew are also in charge of passengers' safety and wellbeing, physical and psychological. To assume this responsibility, they have to follow safety, rescue and first aid training with periodic refresher courses.

[2] ICAO, *International Standards and Recommended Practices, Annex 1: Personnel Licensing*, 9th edition, 2001 in basic medical terminology.

3.2.2 Aeromedical Assessment

In the absence of specific licensing authority requirements many airlines have found a clear, targeted health questionnaire is a reliable screening tool providing sufficient information to ensure that safety and the airline's duty of care are addressed.

Other airlines prefer to conduct a full medical assessment starting with a full medical history.

The majority of applicants will be assessed as medically fit and will enjoy good health throughout their entire flying career. For those who may experience disease or accident, the airline physician should remain not only an aviation medicine expert but also an adviser taking into account every aspect of individual medical problems. Each situation will be unique and will have to be addressed using the following criteria:

- Is the Cabin Crew member's medical condition likely to be aggravated by his resumption of work and continuation of his flying career?
- Is this medical condition likely to jeopardise flight safety?

SECTION 4 – OCCUPATIONAL HEALTH FOR AIR CREW

4.1 SLEEP AND CIRCADIAN RHYTHMS

The term fatigue is familiar to all but in fact covers many different physical and subjective experiences. The signs and symptoms of fatigue can be diverse and include: physical discomfort after overworking a particular group of muscles, difficulty in concentration or appreciating potentially important signals, especially following long or irregular work hours, or just simply difficulty staying awake.

In the context of flight operations, fatigue becomes important if it reduces alertness or crew performance or otherwise degrades safety or efficiency. Whilst subjective fatigue may be affected by motivation or the amount of stimulation coming from the environment, there are two physiological causes for fatigue, both of which are important in flight operations:

(i) sleep loss and disturbance, and

(ii) disruption to the body's circadian rhythms.

4.1.1 Sleep Physiology

It is widely believed that sleep is a time when the brain and body 'shut off', but it is actually a highly complex physiological process during which the brain and body alternate between periods of extreme activity and quiet but never completely 'shut off'.

Sleep is composed of two distinct states:

(i) *Non-rapid eye movement (NREM) sleep* which is divided into four stages (Stages 1, 2, 3 and 4) and during which physiological and mental activities slow. The deepest sleep occurs during Stages 3 and 4 and if awakened during this time, an individual may experience sleep inertia and, as a result, take some time to wake up and continue to feel sleepy and disorientated for 10-15 minutes.

(ii) *Rapid eye movement (REM) sleep* is associated with dreaming during which the brain is extremely active with bursts of rapid eye movements. During REM sleep the major voluntary muscles of the body are paralysed and, if awakened, individuals can often provide detailed reports of their dreams.

Over the course of a typical night, NREM and REM sleep occur in a cycle with approximately 60 minutes of NREM sleep followed by 30 minutes of REM sleep. This 90 minute cycle repeats itself through a typical sleep period, although most deep sleep occurs in the first third of the night. In general, periods of REM sleep are shorter early in the night and become longer and occur more regularly later in the sleep period.

The amount and structure of sleep changes significantly over a life span and, with increasing age, sleep becomes less deep, more disrupted and with increased awakenings, with NREM Stages 3 and 4 all but disappearing. In addition, the total amount of nocturnal sleep decreases. Therefore, rest strategies that worked when an individual was younger do not necessarily work as they get older.

Quality of sleep is just as important as quantity and disrupted sleep with multiple awakenings can have a significant effect on the total sleep period. However, to make up for sleep loss, individuals do not simply sleep longer but sleep deeper (more NREM Stages 3 and 4). Hence, during recovery sleep it is probable that, although an individual may sleep a little longer, the most notable feature will be an increase in deep sleep.

Like food and water, sleep is a physiological need, vital to human survival and critical to human existence. Sleep loss can be additive and will result in a cumulative sleep debt, together with a feeling of increased waking sleepiness. The sleep debt must be repaid, and the symptoms of sleepiness taken seriously in view of their profound effects on waking performance, mood and alertness.

4.1.2 Alcohol

Alcohol has a significant effect on the sleep cycle and, after more than two or so glasses of wine or beer, alcohol can largely eliminate all of the REM sleep in the first half of the sleep period. This can lead to subsequent alcohol withdrawal effects in the second half of the sleep period which will include sleep fragmentation. Ironically therefore, although alcohol is often used to promote relaxation and sleep, it has major disruptive effects on the subsequent rest.

4.1.3 Sleepiness

Scientific research has shown that there are two distinct components of sleepiness:

(i) Physiological sleepiness which parallels other vital physiological functions like hunger and thirst. When the body is physiologically deprived of sleep, the brain's signal is one of sleepiness and just as the only way to reduce hunger or thirst is to eat or drink, when an individual is physiologically sleepy, only sleep will reverse this need.

(ii) Subjective sleepiness is the individual's own assessment of the feeling and a self-report of that status. However, this self-reported rating can be strongly affected by other factors including environmental stimulation. The level of underlying physiological sleepiness can be concealed by an environment in which an individual is physically active, has consumed caffeine or is engaged in conversation. It is, therefore, often difficult for individuals to reliably estimate their own waking alertness, especially if they are already sleepy. Indeed, overall, there is a tendency for individuals to rate themselves as more alert than is indicated by physiological measures, in other words, they are more likely to be sleepier than they report.

There are many factors which may affect sleepiness apart from prior sleep and wakefulness and include circadian phase, the age of the individual, 'prescription only' or 'over the counter' medications and the effect of any alcohol consumed. Whilst the subject of circadian rhythms will be dealt with in more detail in the next section, it is nonetheless appropriate to consider circadian phase in the context of sleep.

Human beings are physiologically programmed to experience two periods of maximal sleepiness in a normal 24 hour cycle. The period from 0300-0500 is a circadian low point for temperature, performance and alertness and during this time the brain triggers sleep and sleepiness. The other period of increased sleepiness is between 1500-1700 and most individuals will have experienced an afternoon wave of sleepiness. These windows can be usefully employed to schedule sleep periods or naps when the brain provides a period of maximum sleepiness and an increased opportunity for sleep.

4.1.4 Circadian Rhythms

Over the course of evolution, the daily cycles in the physical environment have resulted in the establishment of an internal biological clock. Unless information related to time is received from the environment, the clock tends to run slow with the biological day set at longer than 24 hours. One of the most important environmental time cues which synchronises our internal clock to a 24 hour day is bright light.

However, it is likely that other aspects of the social environment also provide time cues although these have yet to be identified clearly and the specific mechanisms by which they affect the internal clock remain unknown.

The circadian clock cannot adapt immediately to a new environmental time and, as a result, crossing time zones will result in it being out of phase with the new time at the destination. In addition, circadian rhythms for different functions adjust more or less quickly, depending on their own innate rhythm and their interactions with other physiological functions. Thus, after a trans meridian flight, not only is the circadian clock out of step with the external environmental cues, but different internal physiological functions are out of step one with another.

There are, as one would expect, a number of factors affecting circadian adaptation and, whilst it is clear that the process takes longer the more time zones that are crossed, adaptation is known to be faster following a westward flight, or with progressively later duty times, because of the fact that the biological day is inherently longer than 24 hours. In addition, different people adapt at different rates with, in general, the ability to adapt decreasing with age. Finally, individuals who fall into the category of 'evening types' (those who are most alert in the later portion of the day) appear to adapt faster than 'morning types' (those who are most alert in the early portion of the day) and also show lower levels of daytime sleepiness following eastward flights.

4.1.5 Effect of Flight Operations

Flight operations are not always conducive to a regular sleep/wake schedule and can affect sleep and circadian factors in two ways. The first is as a result of duty periods occurring at unusual or changing times in the day/night sleep cycle and the second when there is a requirement for time zone crossings. This leads to:

(i) conflict between the environmental time (in the case of unusual or changing work schedules) or local time (in the case of changing time zones) and body times, and

(ii) circadian disruption when the body is required to adjust continuously between day and night schedules.

In addition, a further factor that can create sleep loss is a prolonged period of continuous wakefulness. It is clear that a protracted duty period can create fatigue by extending wakefulness and decreasing sleep and may also involve circadian disruption. However, in continuous operations, boredom may also be a factor and when an individual is acting as a passive monitor, particularly of relatively rare events in highly automated aircraft, there is the possibility that these elements will increase the likelihood for physiological sleepiness to emerge.

In many flight operations, the time available for sleep is constrained by a number of factors and, if an individual's physiological timing for sleep does not coincide with the scheduled sleep opportunity, then a cumulative sleep debt can result. It is clearly important for this to be considered when an individual is planning their sleep and rest schedule before, during and after a trip to ensure that there is adequate opportunity for sleep in order to avoid the inevitable effects of both sleepiness and impaired performance.

Finally, it is also important to consider the journey home after the duty period. It is estimated that sleep-related vehicle accidents account for up to 20% of all road traffic accidents and drowsy driving is as important a factor in accidents as drunk driving. If the crew member commutes by car they should be reminded that they may be driving after lengthy periods of time on duty. In addition, they may have crossed several time zones or their circadian rhythm for alertness may be at a low point.

Good practice dictates that where possible an individual should sleep when tired and crew may wish to make use of quiet areas in their crew report buildings to nap before embarking on the drive home. In general, there is some evidence that taking a caffeine containing beverage followed by a 20 minute nap will improve alertness for 1-2 hours.

4.1.6 Strategies

In broad terms, alertness management can be considered under two main headings:

(a) preventative strategies including sleep scheduling, napping and good sleep habits, and

(b) operational strategies.

and the key elements of each will be outlined. However, these are only recommendations and should be tailored to the individual crew member's needs and activities bearing in mind that the best effects are likely to come from combining strategies rather than relying on any one alone.

(a) Preventative Strategies

Preventative strategies are intended for use by crew members at home before a trip and during a layover. They focus on the underlying physiology and are aimed at reducing the adverse effects of fatigue, sleep loss and circadian disruption resulting from flight operations.

Sleep Scheduling

Crew members who are sleep deprived before the start of a duty period will experience more difficulties than those who are well rested. Indeed, if they commence a tour of duty with an existing sleep debt, then generally this will only worsen during the trip schedule.

Therefore, in addition to getting the best sleep possible before starting a trip, crew members should obtain at least as much sleep during each 24 hour period away as they would during a normal 24 hour period at home. Understanding the circadian and other factors will help them to maximise the sleep opportunities.

Finally, crew members should learn to trust themselves. If they are struggling to stay awake, then sleepiness should be taken as a clear sign to get some sleep. Conversely, if they wake spontaneously and are unable to return to sleep within 15-30 minutes, then they should get out of bed. In other words, if the brain is giving clear signals that the individual is sleepy, then sleep. However, if the individual wakes up and is alert and unable to sleep, they should get up. You can force wakefulness but you cannot force sleep.

Key Points

At Home
Get the best possible sleep before starting a trip

On a Trip
Try to get as much sleep in every 24 hours away as in a normal 24 period at home

Trust your own Physiology
If the crew member feels sleepy and circumstances permit, then they should sleep
If the crew member wakes spontaneously and cannot get back to sleep in 15-30 minutes, they should get up

Napping

Napping has been shown scientifically to improve subsequent alertness and performance. However, it is important when taking a nap just before a duty period to minimise the chances of going into the deeper phases of sleep. This will help to avoid the condition known as sleep inertia which produces a disorientated sensation which can persist for 10-15 minutes after waking from deep sleep. Limiting the duration of a nap to 45 minutes or less will minimise the chances of having significant amounts of deep sleep but will nonetheless help to decrease the period of continuous wakefulness.

If the crew member is able to nap at times other than immediately before a duty period, then the nap can be longer. In these circumstances, a nap of 2 hours or more will enable them to have at least one full cycle of deep and dreaming sleep.

Key Points

Before Duty

A nap can improve subsequent alertness and performance and will decrease the period of continuous wakefulness

If napping immediately before a duty period – limit the length of the nap to no more than **45 minutes**. At other times, naps can be longer

Remember, some sleep is better than none

Good Sleep Habits

The following recommendations are important and applicable to everyone.

It can be useful to establish a pre-sleep routine to help teach the mind and body that it is time to relax and fall asleep. As part of this, a set of cues can then be developed which will assist the individual to relax in preparation for sleep anywhere and anytime.

Paying attention to the sleep environment and trying to ensure that the room is dark (by the use of eye shades if necessary) and quiet (by turning off the telephone and using ear plugs) is also important. The bed should, of course, also be comfortable, although in a hotel this is outside the individual's control and what is comfortable for one person, may not be ideal for another.

At home before trips, the crew member should try to keep sleep time protected. At all times they should avoid going to bed hungry, as this will delay sleep, but conversely, eating a heavy meal will also disrupt sleep. Therefore, if they are hungry at bed time, the individual should eat a light snack or have something to drink, but avoid alcohol as this has a significant influence on sleep.

Caffeine is known to prevent sleep onset and disrupt subsequent sleep in susceptible people. Whilst caffeine is present in highest quantities in coffee, tea and colas, it is also present in chocolate and some individuals are so sensitive that a chocolate dessert is enough to interfere with their sleep. As a result, crew members should stop caffeine intake several hours before planned bed time.

Finally, as outlined in the section on Sleep Scheduling, if an individual cannot get to sleep within 15-30 minutes, they should get up and try doing something that they know will help them to relax and promote sleep.

Key Points

Develop and use a regular pre-sleep routine
Ensure an optimum sleep environment
Keep sleep time protected
Avoid going to bed hungry, but do not eat or drink heavily before going to bed
Avoid alcohol or caffeine before bed time
If the crew member is unable to get to sleep in 30 minutes, they should get up

(b) Operational Strategies

The most successful technique for combating sleepiness in the operational environment is physical activity. Therefore, whenever possible, crew members should engage in an activity that involves physical action, even if it is only stretching. When appropriate, they should engage in conversations with others and ensure they participate and do not just nod and listen.

Caffeine is a stimulant that may be used strategically at times to increase alertness. It is best not to consume caffeine continually before, during and after a trip. Instead, individuals should determine when caffeine may be used most effectively to combat specific periods of sleepiness such as 0300-0500 or 1500-1700. Though affected by a number of variables, caffeine will usually take 15-30 minutes to take effect and then last for up to 3-4 hours. Therefore, continually consuming caffeine throughout a flight duty period could interfere with subsequent sleep. Crew members should remember to stop caffeine far enough in advance of their planned bed time so that it will no longer be active.

Key Points

Alternate periods of activity and relaxation during the flight
The following are examples of activity:
- Conversations
- Tasks related to flight management
- Physical activities resulting from mental tasks such as navigation and systems management

The following may be considered during periods of relaxation:
- Activities not related to the flight such as reading newspapers
- Eating of snacks and meals, if possible at the start of a relaxation phase
- Controlled rest if permitted by the member airline's national regulatory authority

The phases of activity and relaxation should be alternated, but it is important that the end of each phase be expressed verbally to the other crew member.
Whenever possible, individuals should avoid taking snacks and meals at the same time as other crew members as this is likely to lead to simultaneous reductions in alertness

The following (above) information is based, in part, on material from the NASA Ames Fatigue Countermeasures Program education and training module. Rosekind, M.R., Gander, P.H., Connell, L.J., Co, E.L. (2001). **Crew Factors in Flight Operations X: Alertness Management in Flight Operations Education Module**. (NASA Technical Memorandum 2001-211385). Moffett Field, California: NASA Ames Research Center

4.2 MEDICATION

In light of the constantly changing range and nature of medications available around the world, prescribing for aircrew presents a series of challenges. The purpose of this section is to provide a framework of general principles that govern prescribing for aircrew.

4.2.1 Testing of Medication

Due to the costs involved, testing of new medication is rarely job specific. Most drugs released onto the market will not have been trialed in situations involving sleep deprived subjects regularly exposed to mild hypoxia.

Ideally, before a drug is recommended for aircrew usage, it should be subject to testing for its effect both on the sensory and motor systems. Motor testing should involve assessments of reaction time, co-ordination and manipulation skills using tracking systems or simulators. Sensory skill assessments should include elements to test perception, memory, recognition and vigilance.

4.2.2 Assessing Treatment Needs

Most common medical problems are relatively minor and although some may interfere temporarily with fitness for duty, most are self-limiting and require little or no intervention. Other more serious problems may require drug treatments but these should always be tailored to the patient as a whole and the effects on occupation must be given due consideration.

Before any physician reaches for the prescription pad, a series of points need to be considered. The answers should lead the doctor to conclude that potential benefits of treatment out-weigh the risks to the patient and additionally to flight safety.

The following questions need to be answered:

What is the problem?

It is fundamental to make a diagnosis and to understand the medical condition.

What will prescribing do to help?

Is the medication curative or simply intended to improve symptoms – The side effects need to be considered, particularly those causing drowsiness, dizziness, hypotension or visual effects.

How will it work?

An understanding of how the drug is absorbed and metabolised is required. Drug solubility in fat and water may influence choice as might considerations of elimination and whether or not the metabolites of the drug are also active.

When is it best given?

Knowledge of half-life and speed of onset of action deserve consideration and an understanding of the aircrew irregular lifestyle.

4.2.3 Principles of Prescribing

- Don't prescribe unless the indication is clear both to you and the patient.
- Use medications you know well and avoid new drugs until they have been proven to be safe and effective.
- Use the lowest dose compatible with the desired end result.
- Use only one drug, rather than several, whenever possible.
- Consider the dose frequency in relation to lifestyle. (e.g. are once or twice a day treatments easier for a long haul pilot to comply with?)
- Always explain the drug action and possible side effects to the crew member.
- Whenever possible, start treatment on the ground for at least 48 hours.
- If in doubt, research the drug and don't prescribe until you know the answer.

4.2.4 Over-the-Counter Medications

Increasingly, what were once prescription items are now, in many countries, available as over-the-counter preparations. Aircrew need to understand that knowledge of the contents, mode of action and potential side effects are essential. The advisory leaflets with the preparations must always be studied and if there are doubts, an aviation doctor should be consulted.

Some licensing authorities have produced advisory leaflets on this topic and crew should be encouraged to read them. Many airline doctors write short articles for company flight safety magazines covering areas such as this, to remind crews of their responsibilities.

4.2.5 Alternative Medicines

The words "Health Food" conjure many different images, but not all of these products are as innocuous as might be hoped for.

In some countries, a preparation that might be considered a health food is, in another, considered to be a medication. Melatonin is a good example of this confused situation.

Generally, health foods have not undergone the same degree of assessment that medications require before release onto the market. Hence, a great deal of information about mode of action and side effects is, in many cases, unknown and quality control in manufacture can never be guaranteed.

Nevertheless, such products are becoming increasingly popular and aircrew should be advised to be very cautious. A recent analysis of herbal preparations available in both eastern and western countries showed that some providers add western medicines such as steroids and amphetamines to enhance their herbal products. Aircrew should be advised that unless clear written information is provided, listing contents and possible side effects, they should not take these products.

4.3 TRAVEL MEDICINE

4.3.1 Principles of Risk Minimisation – Identification of Risk

Airlines have a general obligation to their shareholders, employees and the travelling public to identify and mitigate risks that are associated with travel. This is usually achieved by a combination of:

- elimination of unsafe practices;
- substitution of a lower risk practice;
- design changes to minimise risk;
- personal protection measures; and
- education.

4.3.2 Vaccinations and Travel[3]

(a) Routine Vaccinations Unrelated to Travel

Guidance from individual health departments should be sought, however, many countries include as a minimum the following in their routine childhood vaccination schedules:

- Tetanus, Pertussis and Diphtheria;
- BCG;
- Measles, Mumps and Rubella;
- Poliomyelitis;
- Hepatitis B;
- Haemophilus Influenzae.

(b) Vaccinations Related to Travel

While vaccinations play a definite role in disease prevention, risk elimination or substitution is usually of greater importance.

- **Hepatitis A –** This is an endemic food and water borne disease in Africa, the Sub-Continent, Asia and Greenland and of intermediate risk in the CIS: Commonwealth of Independent States. Hepatitis A, while having a low mortality rate does have a significant morbidity rate. While the careful selection of food and water will reduce the risk of contracting this disease, travellers have no control over the hygiene of the last person to handle their food before they do. It is the most vaccine preventable disease related to travel and should be offered to all travellers who are travelling from low risk to higher risk countries. The hepatitis A vaccination is highly efficacious and has a very low side-effect profile.
- **Hepatitis B** is endemic in sub-Saharan Africa, Saudi Arabia, South East Asia and the Northern Territories of Canada. Hepatitis B has a significant initial morbidity and mortality and can cause long term complications and premature death. The vaccination is indicated for anyone who is at risk of having casual sex, will be playing contact sports or will be in endemic areas for six months or more.
- **Cholera** is generally a disease of poverty and the risk to travellers is extremely small.
- **Rabies –** medical review should be sought after contact with the saliva of warm blooded animals in most countries.
- **Typhoid** risk for travellers is generally very low. Travellers should seek specific medical advice in relation to their risk of this disease.
- **Meningococcal meningitis** occurs in epidemics in sub-Saharan Africa and in northern India during winter and early spring. As there are several strains of the bacteria that cause this disease, travellers should seek specific advice as to their risks from this disease.

[3] www.cdc.gov/travel/vaccinat.htm; www.who.int/ith

(c) Compulsory Vaccinations

- Yellow fever occurs in defined countries in South America and Africa. The CDC publishes regular updates of affected countries and travel to or from these countries generally requires certification of current vaccination status. The risks associated with the use of this vaccine should be discussed with a medical practitioner prior to planned travel.
- Meningococcal meningitis vaccination is required by the Saudi Government for travellers to the Hajj.

(d) Contra-indications to vaccination

Pregnant women and those who suffer from immune deficiency syndromes, should discuss the risks and benefits of receiving live vaccinations (measles, mumps, rubella, oral polio and yellow fever).

4.3.3 Important Diseases Associated with Travel

(a) Food and Water

Depending on itinerary, style and duration of travel and degree of risk taking the following diseases may be encountered:

Amoebiasis	Hepatitis E
Bovine spongiform encephalopathy	Poliomyelitis
Cholera	Seafood poisoning/toxins
Cryptosporidiosis	Travellers' diarrhoea
Giardiasis	Typhoid fever
Hepatitis A	

Of these, travellers' diarrhoea is the most common with up to 70% of travellers being infected over a 4 week period. While education plays a part in minimisation of the risk, studies have shown that compliance with basic food safety rules decreases rapidly over time as complacency takes over. While vaccination against Hepatitis A and Poliomyelitis is efficacious, the careful selection of food and water is still the mainstay of protection from the other food and water borne diseases.

Special attention should be applied to the prevention and management of diarrhoeal diseases in children as these can lead to sudden death.

(b) Vector Spread

Lice, mites, fleas and mosquitoes spread human diseases such as:

Dengue	Malaria
Encephalitis, Japanese	Plague
Encephalitis, tick-borne	Trypanosomiasis, African
Filariasis	Trypanosomiasis, American
Haemorrhagic fevers	Typhus Fever
Leishmaniasis	Yellow fever

The clinical significance of these diseases ranges from discomfort to rapid death and shows wide variability between individuals. The risk of exposure to the vectors and the diseases varies according to country, areas within a country, living conditions and season. Thus those who plan to travel to developing countries or to rural areas in developed countries should include a risk assessment by a competent travel medical practitioner.

(c) Sexually Transmitted Diseases

A proportion of travellers travel as sex tourists; however, the freedoms of being away from home provide opportunities for sexual relations which may otherwise not occur. Whilst abstinence may be the gold standard in the prevention of sexually transmitted diseases, condoms, when used, can reduce the risk. The risks of acquiring sexually transmitted diseases are highly variable between countries and travellers who are at risk should seek advice prior to travel.

Any traveller who has been exposed to the risk of a sexually transmitted disease should seek advice and treatment from a physician who has knowledge and experience of the risks associated with a particular country.

It is important to remember that sexually transmitted diseases are:

- common;
- expensive to treat;
- sometimes asymptomatic;
- often resistant to treatment;
- associated with subsequent infertility;
- sometimes associated with premature death.

(d) Iatrogenic

In many developing countries, prescription medications are readily available over the counter. Travellers should be wary about self-diagnosis and treatment and should bear in mind that medications, which have been banned in developed countries, may still be readily available in third world pharmacies.

4.3.4 Environmental Issues

(a) Temperature

Temperature extremes on arrival leading to hypo- or hyperthermia can be significant causes of morbidity especially at the extremes of age. These effects can be exacerbated when leaving the air conditioned atmosphere of the aircraft or airport lounge and passengers and crew should be mindful of the weather conditions in both departure and arrival ports when planning travel.

(b) Atmospheric Pollution

Atmospheric pollution is sensitively related to the levels of economic development and regulatory control within a state. Sudden exposure to highly polluted air can exacerbate or unmask respiratory and cardiac conditions.

(c) Water

Swimming in contaminated water may result in ear, nose, throat and intestinal as well as parasitic infections. In tropical areas interaction with marine organisms, corals and parasites can lead to symptoms ranging from minor irritation to death.

4.3.5 Jet Lag

Jet lag is unavoidable following rapid travel over three to four time zones. It is exacerbated by:

- stress;
- over eating;
- dehydration;
- increasing age;
- travelling east;
- sleep deprivation;
- excessive alcohol consumption.

It can be minimised by:

- taking short flights;
- taking transit breaks;
- exposure to sunlight on arrival.

In general, passengers should allow a reasonable period (1 to 2 days) for adjustment prior to engaging in serious sightseeing or business.

4.3.6 Obligations of Airlines to Staff

(a) On Recruitment

All crew and staff who will be required to travel beyond their home state should be given a comprehensive briefing in relation to the health risks associated with travel. This education should be repeated on a regular basis to reinforce its importance.

Crew should be regularly reminded to tell their doctor that they have been overseas if they develop any medical problems.

(b) When Abroad

Airlines should arrange access to adequate medical, hospital and dental facilities for crew when away from home. There should be provision for contact between crew and management to ensure that the care available in slip (lay-over) ports is of no less a standard than that available in the homeport. Mechanisms should be set in place for the medical evacuation of crew if appropriate.

(c) Overseas Postings

The fact partners and children often accompany an employee on an overseas posting, places the employer under a much greater duty of care. While balancing the rights of an employee, management has to ensure that an overseas posting will not place the employee or the family at unacceptable risk to their health and safety. This will normally require that the family and the employee:

- undertake an appropriate medical assessment;
- are given education in relation to the risks associated with the posting;
- have appropriate vaccinations and prophylaxis;
- are provided with access to suitable medical and dental care.
-

Appropriate strategies need to be in place to evacuate staff and families in the event of civil unrest or medical emergency.

(d) On Return

Staff and families should have a full medical assessment, carried out by a doctor who is familiar with the medical conditions prevalent in the country of service.

4.4 COSMIC RADIATION

Ionising radiation is a natural part of the environment in which we live and the presence of cosmic radiation, which reaches the earth from the sun and outer space, has been recognised for many years. However, its significance has increased since the advent of manned space flight and high flying supersonic aircraft.

Many IATA airlines work closely with their respective scientific communities to measure radiation dose rates. Indeed, as a reflection of the changing nature of airline long haul operations, there has been considerable effort in recent years to examine the level of cosmic radiation exposure in modern subsonic aircraft flying longer distances and at higher cruising altitudes.

European Directive

Following a recommendation by the International Commission on Radiological Protection, the European Commission issued a Directive for implementation into the national law of European Union member states in May 2000. This Directive requires that flight and cabin crew to be designated as 'occupationally exposed' to natural sources of ionising radiation. The Environmental Protection Agency (EPA) has issued a similar directive in the USA.

4.4.1 Types of Radiation

Natural radiation in the form of light and heat are essential to life. Other forms of radiation generated by man, such as microwaves for cooking, radar for navigation and x-rays for medical examinations are, without doubt, of inestimable value.

The different types of radiation are most easily classified according to the effects they produce on matter. There are two categories although both of course have some biological effects when they pass through body tissues:

(a) **Non-ionising radiation –** including ultra violet light, radio waves and microwaves;

(b) **Ionising radiation –** including cosmic rays, x-rays and radiation from radioactive materials.

4.4.2 Benefits and Risks of Radiation

The benefits from natural non-ionising radiation, mainly heat and light from the sun, are enormous and considerable use is made of both ionising and non-ionising radiation. Artificial radiation has led to dramatic advances in medical diagnosis and treatment. However, whilst it is used for a wide range of procedures in industry, agriculture and research, radiation can be harmful to human beings and so people must be protected from unnecessary or excessive exposures.

(a) Non-ionising Radiation

The effects of non-ionising radiation depend on the type and intensity of the radiation. Non-ionising radiation can damage the skin and the eyes and, if it penetrates body tissues, can damage internal organs by heating them. In the long term, exposure to ultra violet radiation may cause skin cancer and cataracts.

(b) Ionising Radiation

The greatest concern about ionising radiation stems from the way in which it can cause malignant disease in people exposed to it and inherited defects in later generations.

The likelihood of such effects depend on the amount of radiation that a person receives: this is equally true whether the radiation is natural or artificial. It is therefore important to make a careful balance between the risks and benefits of radiation exposure.

4.4.3 Ionising Radiation on Earth

Where does it come from?

Ionising radiation is formed as a product of the radioactive decay of natural radioactive atoms and is part of the environment in which we live.

Terrestrial radiation is mainly emitted by radioactive atoms of uranium, thorium, radium and other atoms that are present in naturally occurring materials such as soil, rocks, bricks and tiles. There is some variation from place to place and certain types of rock, such as those found in the south-west of England, emit more radiation than others. Radium in building materials may decay and generate a radioactive gas, radon which may then be found in some homes.

Low levels of natural radioactive materials are also present in food we eat, air we breathe and water and other drinks we consume, so a proportion of the radioactive atoms in our diet is also incorporated into our body tissues.

Man in common with all animals and plants, has evolved in an environment with a background of natural radiation and with few exceptions, it is not a significant risk to health.

4.4.4 Cosmic Ionising Radiation

Where does it come from?

Cosmic radiation originates from two sources. The largest component is radiation from outer space although there is also a smaller component from the sun.

What does it consist of?

The component from outer space consists of mainly high energy protons which reach the earth at a fairly constant rate. There are also lower energy protons originating from the sun although these are much less significant except when given off in bursts during solar particle events.

What are protons?

Protons are charged particles and are affected by the earth's magnetic field with more coming into the atmosphere at the poles than at the equator. In addition, as cosmic rays penetrate the atmosphere, they initiate complex reactions to produce a cascade of secondary radiation. However, all of the rays, whatever their origin, are absorbed to some degree by the atmosphere and the dose decreases as altitude reduces.

Is the intensity of cosmic radiation constant?

Cosmic radiation intensity is generally constant although there are variations in solar activity and, as a result, both short and long term changes in the intensity and dose rate of cosmic radiation are observed.

What effect does solar activity have on cosmic radiation?

Solar activity follows a normal 11 year cycle which does affect the intensity of cosmic radiation directly. The sun emits electrons and other charged particles, the movement of which causes a solar electromagnetic field around the earth. During the solar activity maximum, the solar electromagnetic field intensity is higher than during the solar activity minimum. The stronger magnetic field around the earth provides shielding for galactic cosmic radiation which will therefore be greater during the solar maximum than during the solar minimum. The intensity of cosmic radiation at commercial aircraft altitudes is approximately 20% higher during the solar minimum than during the solar maximum. The difference is higher for polar routes than equatorial routes.

What about solar particle events?

The lower energy particles of solar radiation do not contribute significantly to levels of cosmic radiation except at times of increased activity from the sun and solar particle events when the sun contributes directly to cosmic radiation intensity in the upper atmosphere by emitting high energy protons and alpha radiation. Whilst this solar cosmic radiation may not increase the cosmic radiation intensity at sea level, the exposures of aircraft occupants can be elevated. However, the probability of such intensive solar flare events is extremely rare.

Overview of cosmic radiation

The intensity of cosmic radiation in the earth's atmosphere is not constant. Cosmic radiation is effectively absorbed by the atmosphere and as a result, higher doses are obtained at altitude than at sea level. The earth's magnetic field also decreases the cosmic radiation penetrations through the atmosphere. Because the earth's magnetic field has a higher intensity above the Equator than above the Poles, charged galactic cosmic radiation penetrates through the atmosphere more easily above the Poles than above the Equator. The intensity of cosmic radiation is therefore higher in the Polar regions than above the Equator.

The effect on the body therefore depends on the latitude and altitude at which the aircraft is flying and also the length of time of the exposure.

4.4.5 Measurement of Ionising Radiation

(a) Methods of Measurement

Estimates of the radiation dose are made more complex by the fact that the cosmic radiation field consists of many different components. A simple recording of total dose, such as may be given by a Geiger counter, will therefore give little indication of the effective dose to biological tissues.

Nevertheless, radiation can be measured directly using sophisticated equipment as was carried on board the supersonic Concorde of British Airways and Air France, or indirectly using computer software programs. The latter, when supplied with such details as the route, altitudes flown, time at each altitude, and the phase of the solar cycle, are able to calculate an estimate of the radiation dose received by crew for a particular flight.

Many studies have been undertaken comparing actual measurements with computer estimation with the two showing good agreement.

(b) Dose Estimation

Under the European Directive, the cosmic radiation dose received by flight and cabin crew is considered as occupational and all crew are therefore be subject to dose limitations. As a result, most major European carriers estimate doses for each sector flown using a computer model taking into account all the factors which have an influence on the dose received. These include the aircraft climb and descent profiles, latitude of the flight, altitude, time of year and point in the solar cycle.

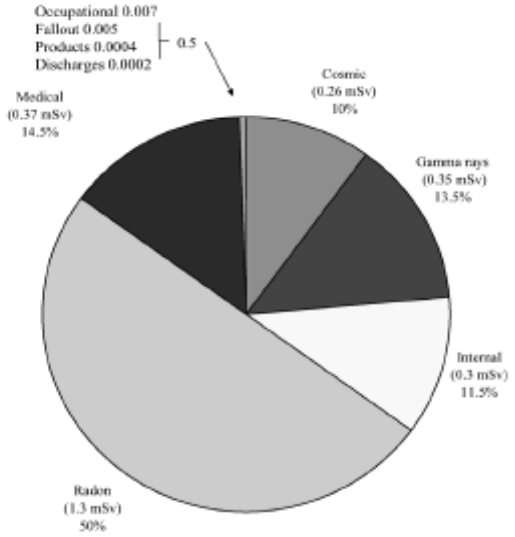
(c) Units of Measurement

The effects of ionising radiation depend not only on the dose absorbed, but also on the type and energy of the radiation and the tissues involved. These factors are taken into account in arriving at the Dose Equivalent which is measured in Sieverts (Sv). However, doses of cosmic radiation are so low that figures are usually quoted in milliSieverts (mSv), that is thousandths of a Sievert, or microSieverts (*Sv), that is millionths of a Sievert.

4.4.6 Exposure to Ionising Radiation

Background Exposure in the United Kingdom

For the general population in the United Kingdom, the total annual background ionising radiation exposure level of 2.6 mSv is made up as follows:



Source: UK National Radiological Protection Board, November 1998.

4.4.7 Radioactive Cargo

Does carrying radioactive cargo have an effect?

Radioactive cargo is transported in passenger aircraft under stringent international regulations. The quantities are small and the annual dose received by crew from radioactive cargo is negligible (less than 0.1 mSv) when compared with the dose received from any other source.

4.4.8 Occupational Exposure to Cosmic Radiation

Exposure Limits

The International Commission on Radiological Protection (ICRP) recommends a maximum exposure from occupational sources of 20 mSv per year (averaged over a period of 5 years) with an additional recommendation that the equivalent dose to the foetus in pregnant women should not exceed 1 mSv during the declared term of the pregnancy.

Occupational Exposure in Flight and Cabin Crew

Occupational exposure for flight and cabin crew will depend on the route, altitude and aircraft type. On average, dose rates received will be in the order of:

- Concorde – 12-15 µSv (microSieverts) per hour;
- Long haul aircraft – 5 µSv (microSieverts) per hour;
- Short haul aircraft – 1-3 µSv (microSieverts) per hour dependent on the altitude reached.

Can anything be done to reduce exposure?

Although cosmic radiation is a form of ionising radiation, it is impractical to consider reducing exposure by provision of shielding as one might with x-rays. Indeed, shielding may actually increase the number of secondary reaction products and thereby increase the levels of ionising radiation.

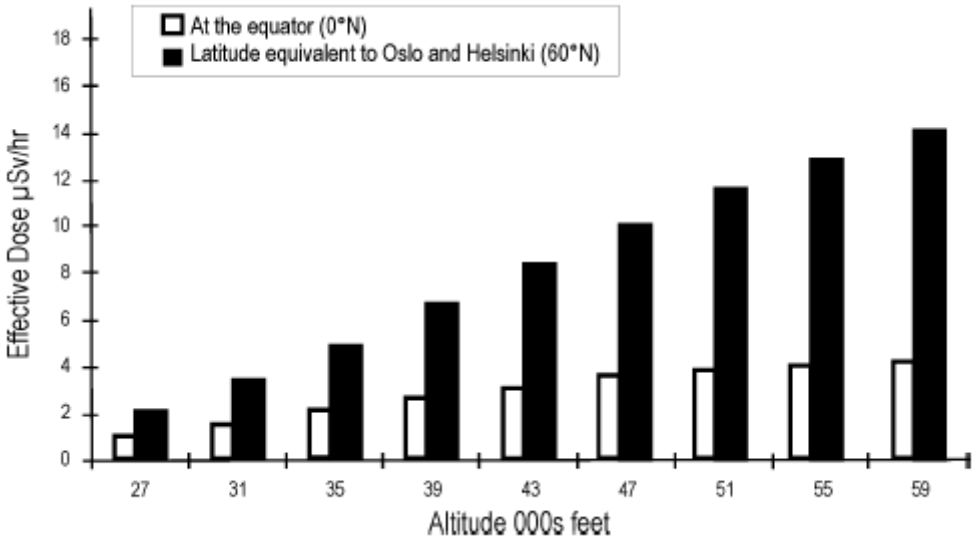
Nevertheless, as will be clear from the preceding sections, it may, in principle, be possible to try to reduce exposure by changing key variables. For instance, lowering the altitude will reduce the exposure to cosmic radiation but will lengthen the flight and therefore increase the time during which the crew member is exposed. In addition, the aircraft will also be subject to increased fuel consumption which has other negative environmental effects.

Pregnant Crew Members

With regard to pregnancy, in addition to the ICRP recommendations, the European Directive further requires airlines to reduce the dose received by the foetus to a level ‘as low as reasonably achievable’. As a result, a number of European airlines have made the decision to assign all female flight and cabin crew members to ground duties on declaration of pregnancy.

Effect of Altitude and Latitude on Cosmic Radiation Exposure

To illustrate how the cosmic radiation dose varies with altitude, the graph following shows dose rate in microSieverts per hour at altitudes between 27,000 and 59,000 feet at the Equator (0° North) and at a latitude equivalent to Oslo and Helsinki (60° North).



Computer based estimates of the effective dose received at 0°N, 0°E and 60°N, 0°E (using CARI-5E with a heliocentric potential of 735 MV[*]). The uncertainty of these estimates is approximately ±20%.

4.4.9 Risks to Health

Radiation is an emotive subject and the effects on health even more so. There has been extensive media coverage of radiation accidents such as Chernobyl and most people are aware of the effects with regard to cancer in man. There are however other risks, such as genetic effects and the effects on unborn children. Each needs to be considered separately and objectively.

Types of Effect

An exposure to non-ionising radiation, such as ultra violet light, particularly if it is excessive, may result in reddening of the skin and sunburn. This is an example of an effect for which the severity of the effect is a function of the dose received and for which there may be a threshold (known as a deterministic or non-stochastic effect, see **4.4.10 – Definitions**).

On the other hand, when ionising radiation passes through the body, and energy is transmitted to the tissues, it may affect the atoms within individual cells and result in a variety of health effects including:

- development of fatal cancer;
- genetic risk;
- risk to the health of the foetus.
-

Genetic risk is that risk which may be present because one or both parents were exposed to radiation before the child was conceived, the effects of which may be passed onto future generations.

Risk to the health of the foetus may occur as a result of exposure to radiation between conception and birth. The risk of harm depends on the stage of development at the time of exposure as well as the amount of radiation.

These are all examples of effects where there is no threshold below which exposure is completely safe and where the probability of an effect occurring, rather than its severity is a function of dose (known as a probabilistic or stochastic effect, see **4.4.10 – Definitions**).

[*] The heliocentric potential is the average for the last 11 year cycle from January 1987 to December 1997.

Development of Fatal Cancer

A cell may be altered as a result of being irradiated and subsequently become cancerous. The likelihood of this happening will depend on the dose received. For an accumulated dose of 5 mSv per year over a career span of 20 years, the likelihood of developing cancer due to the radiation will be 0.4%. This however needs to be put in perspective as 23% of the UK population will die from some type of cancer and so the overall risk will therefore increase from 23% to 23.4%.

Compared with all other risks encountered during the working life, this is very low.

Genetic Risk

A child conceived after exposure of the mother or father to ionising radiation is at risk of inheriting radiation induced genetic defects. These may take the form of anatomical or functional abnormalities apparent at birth or later in life. The risk following an accumulated dose of 5 mSv per year over a career span of 20 years will be 1 in 1,000. Again this needs to be considered against a background incidence in the UK population of approximately 1 in 50 for genetic abnormalities.

Risk to the Health of the Foetus

The possible effects of radiation to the foetus are cancer and mental retardation. There is a background rate for both of these conditions and it is estimated that exposure to cosmic radiation for 80 block hours per month for a period of 4 weeks will increase the risk by between 1 in 6,000 and 1 in 30,000 depending on the routes flown.

Epidemiological Studies in Flight and Cabin Crew

A number of IATA airlines have undertaken epidemiological studies examining the incidence of disease and life expectancy in flight crew.

In general, pilots and flight engineers have an increased life expectancy compared to the general population. Death rates from heart disease and all cancers combined are considerably less than for the general population and, although still rare, death from melanoma (which is associated with exposure to sunlight) is the principal cancer in excess.

Further larger studies are continuing and more information will be available in due course.

4.4.10 Definitions

The science of radiation physics has its own unique definitions and jargon, some of which may be unfamiliar. Below is a list of the commonly encountered terms which, whilst not exhaustive, will help to explain some of the terminology.

- Absorbed Dose
  Is the quantity of energy deposited in a unit mass of matter, such as biological tissue, when it is exposed to ionising radiation. The unit is the Gray (Gy) and is a physical quantity that does not take account of the differing effects of different types of ionising radiation.
- Alpha Particle
  A particle consisting of two protons and two neutrons which may result from a specific type of radioactive decay.
- Annual Effective Dose Equivalent
  Is the total Effective Dose Equivalent received over a 12 month period. In the case of flying staff this will be the sum of the individual Route Doses.
- As Low As Reasonably Achievable (ALARA)
  Is one of the principals of Radiological Protection requiring that all exposure should be kept As Low As Reasonably Achievable, economic and social factors being taken into account.
- Deterministic (non-stochastic) Effects
  Are those effects for which the severity is a function of the dose received and for which there may be a threshold, eg.cataract.

- Dose Equivalent
  Is a measure of the quantity of energy deposited in a unit mass of matter, such as biological tissue, taking into account the radiobiological effectiveness of the various types of ionising radiation. The unit is the Sievert (Sv).
- Effective Dose Equivalent*
  Different body tissues have different susceptibilities to the risk of damage from ionising radiation. The Effective Dose Equivalent to the whole body is obtained by multiplying the Dose Equivalent to various tissues and organs by a weighting factor appropriate to each and summing the products. The unit is the Sievert (Sv).
- Genetic Effects
  Radiation of the ovaries and testes may cause damage to the genes, the biological units of heredity arranged along the length of chromosomes.
- Ionising Radiation
  Any radiation that has sufficient energy to dislodge an orbiting electron from an atom.
- Probabilistic (stochastic) Effects
  Are those for which the probability of an effect occurring rather than its severity is a function of dose, without threshold, eg.development of cancer.
- Proton
  A particle with both mass and a positive electrical charge found in the nucleus of an atom.
- Radiological Protection
  Radiological Protection is the science and practice aimed at preventing detrimental deterministic effects and limiting the probability of stochastic effects to acceptable levels.
- Route Dose
  Is the Effective Dose Equivalent received by a crew member during one flight. The value will be dependent on flight profile, flight time and solar activity.

*Definition reproduced from the UK National Radiological Protection Board publication *Living with Radiation*, 5th Edition, 1998.

SECTION 5 – AIRCRAFT OPERATIONS

5.1 FOOD AND HYGIENE

Reference IFSA/IFCA Food Safety Guidelines www.ifcanet.com/teams/foodsafety/

5.2 DISINSECTION

The potential health hazards associated with the inadvertent transport of live vectors of insect-borne diseases on international long-haul flights have long been recognised. Recommendations on prevention of the spread of these vectors were given as early as in the 1930s.

In conjunction with the International Health Regulations (IHR) of 1969 the World Health Organisation (WHO) published recommendations for aircraft disinsection which are regularly reviewed, the latest edition being 1998. These recommendations are based on the results of field trials, surveillance programmes and scientific evidence. (Link: www.who.int)

Aircraft disinsection has been a subject of controversial public discussion. A balance has to be found between the need to avoid air traffic related spread of disease-bearing vectors and other pests and the need to avoid discomfort and health hazards to passengers and crew by disinsection procedures.

Public discussion and media attention on this subject were focused on:

- the contribution of air traffic to the risks of emerging and re-emerging diseases;
- the concern about possible adverse toxic or allergic effects caused by the chemicals used in aircraft disinsection.

The results of epidemiological surveillance through the last decade clearly have proven the necessity of preventive measures against the spread of insect vectors by means of air traffic; currently there are no effective and applicable methods in aircraft desinsection other than procedures using “chemical” insecticides.

Nevertheless aircraft disinsection procedures should regularly be reviewed in the light of new technical, biological or pharmaceutical developments.

5.2.1 Importance of Aircraft Disinsection

Major public health consequences can result from the importation of insect vectors transmitting serious human diseases. Cases of air traffic related malaria infections in people who have never stayed in malaria endemic areas have given the most direct evidence. Infected mosquitoes may transmit disease:

- to passengers and crew in flight between malaria-free areas if the aircraft had been operating in a malaria endemic area and was not properly disinsected. Well documented examples of “**airplane malaria**” have been published;
- to passengers and crew travelling between malaria-free areas during a transit stop in a malaria endemic area, “**runway malaria**”;
- to travellers, people working at or living near international airports in malaria-free areas. Between 1969 and 1999 some 89 cases of “**airport malaria**” were reported;
- to people living in malaria-free areas by chance after infected mosquitoes escape from the baggage of travellers coming from malaria endemic countries “**baggage-malaria**”.

The same mode of direct disease transmission can also apply to aircraft imported vectors of dengue-and yellow fever, Japanese-B-encephalitis, West-Nile virus, leishmaniasis, filariasis and others.

Even more serious consequences for public health will result from the establishment of imported disease vectors at the destination which can result in the transmission of diseases which are previously unknown in that country. Even the importation of uninfected insect species which are susceptible to certain diseases can contribute to the emergence of new diseases. Establishment of imported insect vectors is most likely if the climatic and environmental conditions at the destination are similar to those at the place of origin.

Cockroaches, ants and other insect pests can enter the aircraft through cargo goods, baggage or catering equipment. They are not usually regarded as direct disease transmitters but can be harmful as they may contaminate food or cause damage to the aircraft infrastructure particularly the electronic equipment. Some of these insects may find suitable conditions and breeding sites on board if regular treatment and preventive measures are not undertaken.

5.2.2 Legal Situation

All member states of the WHO are bound by the provisions of the International Health Regulations (IHR).

Article 67 and 83 of the IHR make aircraft disinsection mandatory for all aircraft leaving an airport situated in a yellow fever area and flying to an area free of this disease. The same applies to aircraft leaving areas where malaria or other mosquito-borne diseases are endemic. Article 57 contains recommendations for disinsection in case of suspected human plague aboard.

Some countries allow health authorities to order disinsection of arriving aircraft if proof of properly performed disinsection is not demonstrated.

In many countries national laws and regulations allow health authorities to order aircraft disinsection in case of vector-related disease outbreaks in humans or animals, to prevent the importation of agricultural pests or reasons other than those stated in the IHR.

5.2.3 General Principles of Aircraft Disinsection

Aircraft disinsection covers all measures aiming at the eradication of any insect on board of an aircraft.

Insects and other pests entering aircraft usually emerge from the area around the aircraft, from the airport and equipment brought into the aircraft.

Aircraft disinsection in its broad sense therefore includes preventive pest control measures in and around airports.

Aircraft disinsection methods have to take into consideration:

- that insecticides have to be applied in very close contact to passengers and crew;
- that the interior of aircraft contains a number of sensitive materials such as electronic equipment, with the attendant fire risk;
- that the active ingredients used for disinsection must be effective against a broad spectrum of insects.

Article 25 of the IHR requires that aircraft disinsection shall be carried out so as:

- not to cause undue discomfort to any person, or injury to his health;
- not to produce any deleterious effect on the structure of an aircraft;
- to avoid all risk of fire.

Active ingredients for use in aircraft disinsection currently recommended by WHO are natural pyrethrins, d-phenothrin and permethrin (cis/trans ratio 25/75).

Pyrethrins and pyrethroids have proven effectivity against a broad range of insects. Reports on the growing development of resistance among insect vectors in many regions indicate the need for continued development and evaluation of alternative insecticides.

Efficacy of disinsection methods does not depend only on the active ingredients used but also on the mode of application and the technical properties of the dispenser used for aerosol spraying. WHO recommendations on the disinsecting of aircraft also include specifications for aerosols. In general:

- **Biological performance** in terms of the insecticidal action of an aerosol produced from its dispenser shall not be inferior to the WHO recommended insecticides;
- **Dispensers:** single- or multi-use non-refillable type of max. capacity 490 cm^3:
  - formulations must be free from deposit or suspended matter at all temperatures that come into consideration,
  - requirements of the ICAO regulations on the transport of dangerous goods are to be followed,
  - the aerosol produced must be non-flammable, free from human toxicity risks and non-injurious to materials used in aircraft construction,
  - detailed WHO specifications and test procedures for aerosol dispensers in aircraft disinsection shall be considered,
  - on each container aerosol formulation, date of manufacture and the discharge rate must be indicated;
- **Discharge:** The discharge rate of the formulation from the dispenser shall be in the range of 1.0 +/- 0.2 g per second. 80% by weight of the aerosol droplets produced shall be of diameter smaller than 30 µ. Not more than 1% by weight of the aerosol shall consist of droplets of diameter greater than 50 µ;
- **Solvents:** Any solvent used in aircraft disinsection formulation should meet established criteria for non-flammability, lack of adverse effect on aircraft materials and be of low toxicity. According to these criteria each solvent should be evaluated as part of the evaluation of newly proposed formulations;
- **Propellants:** The fully or partially halogenated chlorofluorocarbons (CFCs, HCFCs) formerly widely used as propellants in aircraft disinsection aerosols are now banned in many countries due to their ozone-depleting potential. Substitutes with no ozone-depleting potential have to be evaluated regarding their pesticide dissolving properties, toxicity, non-flammability and their corrosive potential on aircraft materials. Non-flammable hydrofluorocarbons (HFC) have been evaluated as substitutes and found suitable for aircraft disinsection namely HFC 125, HFC 134a and HFC 227 ea.

5.2.4 WHO Recommended Disinsection Procedures (update 1998)

(a) "Blocks away" Disinsection

- This procedure takes place prior to take off, when disinsection is required, after passengers have boarded and the doors have been closed.
- The aircraft is treated by crew members walking through the cabins and discharging approved single shot aerosols containing quick-acting "knock-down" insecticides based on either 2% d-phenothrin or natural pyrethrins.
- Spraying is to be carried out at a rate of 35 g of formulation per 100 m^3 (10 g per 1000 ft^3).
- Prior to disinsection the procedure should be announced and the passengers should be advised to close their eyes and/or cover their faces for a few seconds whilst the procedure is carried out if they feel that it may cause them inconvenience.
- For disinsection to be effective, the aircraft air conditioning system must be turned off whilst spraying is carried out, and the crew must treat all possible insect harbourages including toilets, galleys and wardrobes unless these areas have been sprayed together with the flight-deck prior to the boarding. Foodstuffs and galley utensils should be protected from contamination.
- The flight deck is sprayed prior to boarding by the crew.
- Cargo holds, wheel wells and all other parts of the aircraft accessible from the outside only, in which insects can find shelter are to be disinsected by ground staff as near as possible to the time the aircraft leaves the apron.

- An appropriate entry on the Aircraft General Declaration should be made giving details of the disinsection procedure together with the serial numbers of the used spray cans. The empty spray cans are to be retained for inspection by the Port Health Authority on arrival.

Although not regarded as a preferred method, the **on-arrival-method** may be retained as an acceptable back-up method if an aircraft, coming from areas of threat, has not been adequately disinsected by any of the recommended methods.

On arrival, before doors are opened and disembarkation is permitted, agents of the Health Authority board the aircraft and perform disinsection of the cabin and flight deck similar to the "blocks-away" method.

(b) Pre-flight and Top-of-descent Spraying

This two-step method is similar to the "blocks-away", except that the aircraft is first sprayed on the ground with an aerosol containing a residual insecticide before passengers and crew board the aircraft.

1. Pre-flight spraying

The pre-flight spray containing 2% permethrin must be applied to the flight deck, all toilet areas, lockers, wardrobes and crew rest areas, except where approval has been granted for the residual treatment (see below) of these areas. Pre-flight spraying of the residual insecticide shall equate to a rate of 35 g of the formulation per 100 m^3 (10 g per 1000 ft^3).

2. Top-of-descent (in-flight spraying)

The second step of this method is carried out at "top-of-descent" as the aircraft starts its descent to the airport of arrival.

A quick-acting "knock-down" insecticide is sprayed into the passenger cabin by crew members walking along each aisle holding 2 ´ 100 g cans at a slow walking pace of one row per second starting at the rear of the aircraft.

An announcement shall be made before in-flight spraying is started and passengers who feel that it may cause them inconvenience should be advised to close their eyes and cover their faces while the procedure is carried out.

The active ingredient of the aerosol used for in-flight spraying must be 2% d-phenothrin. The spraying is to be applied as near as possible to the ceiling at a rate of 35 g of the formulation per 100 m^3 (10 g per 1000 ft^3).

An entry confirming the treatment should be made in the aircraft "declaration of health" and the empty spray cans of pre-flight and in-flight spraying must be retained in the aircraft and delivered to the appropriate authority on arrival.

(c) Residual Treatment

This method has been developed in New Zealand and was included in WHO recommendations on the disinsecting of aircraft in 1985.

The procedure aims at producing an even film of the residual insecticide permethrin on all interior surfaces of the aircraft to ensure that if an insect gains access to the aircraft and lands on a surface it will receive an effective dose of insecticide.

The formulation used for residual treatment is a 2% emulsion or an aerosol. Spraying of the interior surfaces shall produce an even deposit of 0.5 g Permethrin per m^2 on carpets and 0.2 g per m^2 on other interior surfaces including ceilings, walls, lockers, curtains and wall areas behind them, toilets and galleys excluding surfaces used for food preparations. Subsequent applications shall be done at the rate of 0.2 g per m^2 on carpets and 0.1 g per m^2 on other surfaces.

After spraying is completed, air conditioning packs should be run for at least one hour to clear the air of the volatile components of the spray.

Treatment must be at intervals not greater than two months to ensure efficacy of the insecticidal film.

Replacement carpets or seat covers which are exchanged within the 2 month period shall be retreated. The same applies to surfaces receiving substantial cleaning.

A “Certificate of Residual Disinsection” shall be issued by the appropriate authority and signed by the person who supervised the treatment.

A WHO consultation 1995 states that, insofar as efficacy, inconvenience to, and safety of passengers with possible predisposition to adverse health reactions is concerned, the residual disinsection method provides the most assurance. It does not require passengers and crew to be exposed to aerosol sprays and has the added benefit of lessening the workload of aircraft cabin crew.

Many airlines operating flights scheduled to destinations where disinsection is needed are using the residual treatment as the current method of first choice.

(d) Other Methods

In-flight application of insecticidal aerosols can produce a number of health complaints in passengers who have a possible predisposition or assumed hypersensitivity to chemicals. Even without adverse health effects, many airline customers find the spraying of aerosols in the cabin a nuisance.

In order to avoid this inconvenience other methods have been developed and evaluated of which the following two seem to be most promising:

Pre-embarkation method

This method has been developed in Australia and New Zealand and has been introduced in the WHO Report of the Consultation on aircraft disinsection 1995.

The method is not yet included in the list of WHO-recommended methods.

This disinsection procedure consists of spraying all interior spaces of the aircraft with an aerosol containing a mixture of a fast-acting (2% phenothrin) and a residual (2% permethrin) insecticide before embarkation.

Trials have proven the efficacy of this method killing all flying insects and others which gained access to the aircraft.

The strong repellant effect of this aerosol also prevents a substantial number of insects from entering the aircraft.

Spraying of the aerosol mixture is carried out after cleaning and catering is finished, and no longer than one hour before boarding begins.

All interior spaces shall be sprayed including flight deck, crew rest, lockers, wardrobes, and toilets. Spraying aims at an equal dispersal of 35 g of the formulation per 100 m^3 (10 g per 1000 ft^3). Air-conditioning packs have to be turned off during treatment.

The obvious advantages of this method:

- no inconvenience to passengers and crew; no departure delays;
- application possible by trained airline staff;
- use of relatively safe WHO-recommended insecticides;
- simple and inexpensive method easy to audit by authorities.

Two-step-method

More recently this method has been developed in Germany and has been approved by the appropriate national authority. A series of trials in laboratories and in wide-body aircrafts under realistic conditions have proven its efficacy and safety.

The objectives in the development of this method were:

to achieve reliable insecticidal activity against a broad spectrum of flying and non-flying vectors; to avoid the application of insecticides in the presence of passengers and crew;

to avoid the cumulative contamination of all the interior surfaces of the aircraft with a residual insecticide taking the long-lasting effects of absorption and release of permethrin on the aircraft interior materials into account.

First step:

A film of residual pyrethroid is applied in regular intervals to the floor and side walls of the aircraft cabin and other interior spaces as a “spot” or “barrier” treatment to control and eliminate non-flying vectors such as lice, ticks, mites and fleas as well as other insect pests such as cockroaches and ants. Cargo holds are treated with a residual film according to the “residual treatment” method.

The treatment can easily be done together with routine maintenance by trained staff. In addition regular pest monitoring with diagnostic measures should be established. Depending on the results of monitoring further treatment with suitable baits may be necessary.

Second step:

At destinations where disinsection is needed the interior of the aircraft is sprayed with an aerosol containing 2% d-phenothrin not more than one hour before crew and passengers board the aircraft.

After cleaning and catering are finished, trained members of the ground staff walk along each aisle twice at a slow walking pace of one row per second and discharge the fast-acting aerosol above the seats on the first turn and under the seats on the second. The spraying should be done at a rate of 35 g of the formulation per 100 m^3 (10 g per 1000 ft^3) with spray cans of 100-250 g size and a specified discharge rate.

The doors of the aircraft must be closed, all overhead and sidewall lockers, cupboards and toilets have to be opened and the air condition must be turned off during treatment and for at least another 10-15 minutes.

Besides the fast-acting “kill-effect” d-phenothrin has a relatively short “residual-effect” which ensures that flying insects entering the aircraft during passenger boarding will receive an effective dose of insecticide when they land on cabin surfaces during the flight.

The “repellant-effect” of d-phenothrin additionally reduces the number of flying vectors entering the aircraft during boarding.

5.2.5 Considerations

While there is no serious objection to the importance of vector control in air traffic and other means of transport the methods of aircraft disinsection remain controversial both in terms of safety and to a lesser extent of efficacy.

Methods where aerosol sprays are discharged in the presence of passengers and crew will always be perceived as a nuisance and, to some passengers and crew-members as unacceptable.

Disinsection of aircraft in many cases is required when a threat to public health, agriculture or environment by air traffic does not exist or is questionable. Such cases will further reduce acceptance of and compliance with disinsection procedures.

Both the monitoring of insect vectors in and around international airports and for the presence of vectors on aircraft as well as the surveillance of vector resistance have to be improved by national and international institutions.

The data from such studies should be used to review the disinsection methods currently in use and to develop alternative methods.

5.2.6 Communication to Passengers and Crew

Airlines should ensure that their ground staff and air crew are regularly informed about the procedures, safety of insecticides and the World Health Organisation (WHO) recommendations on cabin disinsection.

When establishing a policy, airlines should try to obtain the most reliable information, for example, from national control authorities, regarding the risks involved and any imposed disinsection requirements. They should ensure that passengers are informed as early as possible, preferably prior to boarding, that disinsection will be carried out.

5.3 Cargo

Aircraft carry cargo in addition to passengers. Some flights carry no passengers but still have crew members on board. The people who handle cargo, the operating crew as well as those on board the aircraft need to be protected from dangerous cargo.

5.3.1 Dangerous Goods

Hazardous materials uplifted by air as cargo are referred to as dangerous goods. According to the WHO/IATA classification, they are broken down into 9 classes. Full details of these dangerous goods are shown in the *IATA Dangerous Goods Regulations* which are issued annually www.iata.org.

The 9 classes listed are:

- Class 1 – explosives;
- Class 2 – gases;
- Class 3 – flammable liquid;
- Class 4 – flammable solids;
- Class 5 – oxidising substances and organic peroxides;
- Class 6 – toxic and infectious substances;
- Class 7 – radioactive substances;
- Class 8 – corrosives;
- Class 9 – miscellaneous dangerous goods.

The IATA Dangerous Goods Regulations cover in the classification, identification, packing, marking and labelling, documentation and handling of these classes of goods. It also states the limitations of these processes. It is not possible to verify or physically check each package or box for their contents. Instead, “in good faith” as long as the supplier/ shipper declares as truthfully as possible the contents of the package, the airline cargo handling agents accept what is documented as the true contents. In these days of heightened terrorism it may be possible that the documentation/declaration process of goods to be airlifted may be false.

When such goods are uplifted, they must be packed, marked and labelled according to the *IATA Dangerous Goods Regulations*. They are accepted only if the shipments pass an acceptance checklist.

These shipments are accepted by the cargo staff and loaded onto pallets and containers which are then loaded onto the aircraft.

Usually none of these items poses any health hazard unless damage occurs when fumes, gases, liquids and solids (radioactive) may leak out and pose a health hazard to handling staff and those in the vicinity.

5.3.2 Emergency Treatment Following Exposure to Dangerous Goods Item

First aid:

Emergency treatment of acute poisoning is facilitated if a sample of the chemical/poison is available together with the name and formula of the poison. Poison/chemicals can be absorbed through breathing (inhalation), swallowing and/or through the skin.

Inhalation:

(a) Remove victim from contaminated area.

(b) Keep warm and quiet, do not panic.

(c) If breathing has stopped, start cardio pulmonary resuscitation (CPR – Basic life support).

(d) Administer oxygen if available.

(e) Summon medical help.

Ingestion:

(a) If victim is vomiting, allow this to happen to empty stomach.

(b) If victim is lying down, turn victim to one side to prevent aspiration of vomit into the lungs.

(c) Summon medical help.

Skin contact:

(a) Dilute the contaminating substance with large amounts of water either with a shower, hose or bucket.

(b) Remove contaminated clothing. Those assisting the victim should wear gloves if possible.

(c) Chemical burns of the eye should be treated with large amounts of water.

(d) Consider medical help.

Radioisotope spill:

(a) Prompt decontamination is necessary to minimise exposure.

(b) Medical consultation is necessary to detect body contamination.

(c) If a person is contaminated, the clothing should be removed and the body washed thoroughly with water.

5.3.3 Storage and Handling of Toxic and Corrosive Materials

Damaged drums may leak and leaking fluid in an enclosed space may cause dangerous concentrations of vapours or caustic burns. If a leaking container is discovered, turn the container so that the leak point is at the top to stop further loss. Ventilate the area thoroughly.

Do not open a container or handle toxic or corrosive material without using protective clothing including goggles, an effective respirator, a clean cap and clean rubber gloves.

Key Points

If something is spilled or leaks:
Mop it off
Wash it down
Find out what it is
Get medical advice

If something spills on you:
Wash it off with lots of water
Find out what it is
Get medical advice

5.3.4 Transport of Dangerous Goods by Air

The *IATA Dangerous Goods Regulations* contain complete instructions for the packaging, labelling and handling of goods with potentially dangerous properties. When these Regulations are complied with, these packages offer no more danger than packages of general cargo.

If a package of dangerous goods is damaged or leaking, follow the instructions in Subsection 9.4 of the *Dangerous Goods Regulations (Appendix 1)*. If contact has been made with the contents, follow the emergency procedures in paragraph 10 to 17 above.

SECTION 6 – PASSENGER CARE

6.1 Fitness to Fly

The average healthy passenger tolerates air travel very well, however the cabin environment may present significant challenges to those with medical problems. More people are travelling including the elderly and those with medical problems because of the changes in demography and attitude toward air travel.

Every airline should have a medical clearance procedure; however, local laws vary and procedures must be adapted accordingly. The American Disability Act is a good example of a law that constrains medical clearance. This in turn may create difficulties for reciprocity between airlines and makes it virtually impossible to harmonise the individual airline rules and forms. IATA considers that medical guidelines should be reasonably consistent and based on accepted physiological principles for the benefit and protection of the passenger and the safety of the flight. These medical guidelines will be discussed later. (Link: www.asma.org/publications)

6.1.1 Responsibility for Medical Clearance

For many years, the physicians of passengers with medical problems were asked to provide a "Medical Certificate" authorising air travel and specifying travel conditions.

Practical experience has demonstrated that a physician who does not specialise in air transportation may not be fully familiar with all of the particular medical challenges involved. Also, very few non-airline physicians can reasonably be expected to know what kind of special assistance the airlines might be able or willing to give for each specific trip.

It is recommended that airlines consider the former medical certificates solely as advice given by the passenger's physician. This advice is taken into account by each carrying airline's own medical department before deciding whether or not – and under what conditions – the passenger is acceptable for carriage, and which type of special assistance could be offered by the airline.

6.1.2 General Guidelines for Medical Clearance

Medical clearance is required by the airline's medical department if the passenger:

(a) suffers from any disease which is believed to be actively contagious and communicable;

(b) is likely to be a hazard or cause discomfort to other passengers because of the physical or behavioural condition,

(c) is considered to be a potential hazard to the safety or punctuality of the flight including the possibility of diversion of the flight or an unscheduled landing;

(d) is incapable of caring for himself and requires special assistance;

(e) has a medical condition which may be adversely affected by the flight environment.

Passengers not falling into the above categories normally do not need medical clearance, however, if in doubt, medical advice should be obtained.

6.1.3 Passenger Categories

The general guidelines apply to those with an acute or unstable medical condition:

Those passengers with a chronic and stable medical condition may be issued with a FREMEC card. This avoids the necessity to obtain medical clearance for each journey, and describes the passenger's medical needs and special handling requirements. Details of the MEDIF and FREMEC cards are set out in **Section 6.3**.

6.1.4 Logistics of Medical Clearance

This relies on full and clear communication between the passenger and the treating physician, the airline reservations department and the airline medical advisor. Robust procedures must be in place to ensure that special facilities such as oxygen, stretcher, and wheelchair are reliably provided. See example of a Medical Clearance Procedure in **Appendix 'A'**.

Arrangements for hospital admission, medical escorts and ambulance transfer should be made by the passenger or his agent and are not the responsibility of the airline.

6.1.5 Special Services

Special services may be provided by the airlines if given sufficient advance notice. Some may be available free of charge, while for others there will be a charge. The special services available include:

(a) special meals (diabetic, low salt, low cholesterol, etc);

(b) wheelchairs (airport buildings, carry-on);

(c) special seating (bulkhead, near toilet);

(d) oxygen;

(e) stretcher;

(f) lifting services.

Important

The onboard emergency medical equipment is intended for unplanned emergencies only.

6.1.6 Specific Medical Guidelines

The following tables are provided as a guide to the timeframe that should elapse between a medical event and the intended flight. The timeframes may be changed following considered medical assessment of a specific case. Keep in mind that there is a very limited amount of research data on this material and most of the guidelines are based on practical experience. The quality of care at the departing station is also a factor in the decision making process.

Count the day of operation and the day of travel in calculating the number of days post incident.

Diagnosis	Assessment by a doctor with aviation medicine experience	Accept	Comments
Cardiovascular and other Circulatory Disorders			
Angina	Unstable angina or angina with minimal exertion	Controlled with medication. No angina at rest.	
Myocardial infarction	Within last 10 days or high risk (EF<40%, heart failure, pending further investigation, revascularisation or device therapy)	≥10 days if uncomplicated	
Cardiac failure	Acute heart failure or uncontrolled chronic heart failure	If cardiac failure is controlled and condition is stable	Adequate control is someone that can walk 50 meters or go up a flight of stairs on room air at a normal pace without breathlessness. Otherwise, in-flight oxygen needs to be considered
Pulmonary oedema	Unresolved	Resolved pulmonary Oedema + any precipitating condition	May need also to comply with myocardial infarction rules
Cyanotic congenital heart disease	All cases		In-flight oxygen needs to be considered in all cases
Cardiac surgery	9 days or less for CABG and valve surgery. Recent transpositions, ASD, VSD, transplants etc.	≥10 days	ASD = atrial septal defect VSD = ventricular septal defect CABG = coronary artery bypass graph
Angiography (Heart – Coronary artery X rays)	24 hours or less	≥24 hours if original condition is stable	
Angioplasty with or without stent (Widening of arteries)	2 days or less	≥3 days if asymptomatic	
Pacemaker or defibrillator implantation		≥2 days if no pneumothorax and rhythm is stable	
Ablation therapy		≥2 days	Patient flying within a week of the procedure is considered at high risk of DVT
Deep venous Thrombosis of legs	If active	Once asymptomatic	Stable on oral anticoagulants
Pulmonary embolism	Onset 4 days or less	≥5 days if anticoagulation stable and PAO_2 normal on room air	The new direct factor Xa inhibitor may be acceptable
Blood disorders			
Anemia	Hb less than 9.5 g/dl (5.9 mmol/L) unless due to chronic disease	≥Hb 9.5 g/dl (5.9 mmol/L)	If acutely anemic, Hb level should be assessed more than 24 hrs. after last blood loss, which must have ceased
Sickle cell disease	Sickling crisis in previous 9 days	≥10 days	Always need supplement of oxygen
Respiratory Disorders			
Pneumothorax (air in the cavity around the lung due to a puncture wound or spontaneous)	6 days or less after full inflation. If general condition is adequate, early transportation with “Heimlich type” drain and a doctor or nurse escort is acceptable	7 after full inflation 14 days after inflation for traumatic pneumothorax	
Chest surgery	10 days or less	≥11 with uncomplicated recovery	e.g. lobectomy, pleurectomy, open lung biopsy
Pneumonia	With symptoms	Fully resolved or, if X-ray signs persist, must be symptom free	
Tuberculosis	Untreated or in the first two weeks of treatment	After at least two weeks of appropriated treatment and asymptomatic	

Diagnosis	Assessment by a doctor with aviation medicine experience	Accept	Comments
COPD, emphysema, pulmonary fibrosis, pleural effusion (fluid in the lung cavity) and hemothorax (Blood in the cavity around the lung) etc.	Supplementary oxygen needed at ground level. PO_2 < 50mmHg Unresolved recent exacerbation	Exercise tolerance (walk) > 50 metres without dyspnea and general condition is adequate. Full recovery if recent exacerbation. No current infection.	
Cystic Fibrosis	FEV1 < 50% at ground level	No current infection	
Asthma		Currently asymptomatic and no infection	
Cancer	Under active treatment (radio or chemo) Pleural effusion Dyspneic at ground level	Asymptomatic	Major hemoptysis is a contraindication
Bronchiectasis	Hypoxemic at ground level	No current infection	
Neuromuscular disease	Severe extra pulmonary restriction Need home ventilation		
Pulmonary arteriovenous malformations	If severe hypoxemic (SpO2 < 80% at ground level		
CNS disorders (Central Nervous System)			
TIA	2 days or less	After 2 days and proper investigation	
CVA (Stroke)	4 days or less	5-14 days if stable or improving, with a nurse escort. Passenger travelling in the first 2 weeks post stroke should receive supplementary oxygen	If an uncomplicated recovery has been made, a nurse escort is not required.
Grand mal fit	24 hrs or less	≥24 hours if generally well controlled	
Cranial surgery	9 days or less	≥10 days, cranium free of air and adequate general condition	
Gastro-intestinal			
GIT Bleed	24 hours or less following a bleed	≥10 days	1-9 days can travel if endoscopic or other clear evidence (i.e. Hb has continued to rise to indicate bleeding has ceased) of healing
Major abdominal surgery	9 days or less	≥10 days if uncomplicated recovery	e.g. bowel resection, “open” hysterectomy, renal surgery etc.
Appendectomy	4 days or less	≥5 days if uncom-plicated recovery	
Laparoscopic surgery (Keyhole)	4 days or less	≥5 days if uncom-plicated recovery	e.g. cholecystecomy (gall bladder removal), tubal surgery
Investigative laparoscopy	24 hours or less	≥24 hours if gas absorbed	
ENT disorders (Ear, Nose and Throat)			
Otitis media and sinusitis	Acute illness or with loss of Eustachian function	If able to clear ears	
Middle ear surgery	9 days or less	≥10 days with medical certificate from treating ENT	Ex: Stapedectomy

Diagnosis	Assessment by a doctor with aviation medicine experience	Accept	Comments
Tonsillectomy	10 days or less		Although it may be ok to fly between day 3 and 6, there is a significant risk of bleeding between day 1 and 2 and between day 7 and 10
Wired jaw	Without escort	Escorted (+ cutters) or self quick release wiring	
Psychiatric illness			
Acute psychosis	Episode within 30 days (e.g. mania, schizophrenia, drug induced)		This is for safety reason
Chronic psychiatric disorders	If significant risk of deterioration in flight	If properly controlled by medication and stable (i.e. living out in the community taking care of all own needs including medication)	
Eyes disorders			
Penetrating eye injury	6 days or less	≥7 days	Any gas in globe must be resorbed
Intra-ocular surgery	6 days or less	≥7 days	Any gas injected in the globe must be resorbed; for injection of SF6, a minimum of 2 weeks is required and for C3F8, a minimum of 6 weeks is required; written specialist fitness to fly commercially is required.
Cataract surgery	24 hours or less	≥24 hours	
Corneal laser surgery	24 hours or less	≥24 hours	
Pregnancy			
Single, uncomplicated	Beyond end of 36th week (Calculated using the Estimated Date of Delivery – EDD)	Clearance not required before end of 36 weeks	
Multiple, uncomplicated	Beyond end of 32nd week (Calculated using the Estimated Date of Delivery – EDD)	Clearance not required before end of 32	
Complicated pregnancies	On individual basis		
Miscarriage (threatened or complete)	With active bleeding	Once stable, no bleeding and no pain for at least 24 hours	
Neonates			
New born	Less than 48 hours old Incubator +/- ventilator cases	Fit and healthy babies can travel at 48 hrs. but preferably at 7 days	
Trauma			
Full plaster cast (flight more than 2 hrs.)	Less than 48 hours after injury if the cast is not bivalved	≥48hrs	Comply also with anemia rules for # femur/pelvis i.e. HB 9.5 gm/dl (5.9 mmol/L)
Burns	If still shocked or with widespread infection	If medically stable and well in other respects	
Ventilators	Seriously ill cases should only be accepted after detailed discussion with airline medical advisor	Long term stable cases requiring only ventilation with air	

Diagnosis	Assessment by a doctor with aviation medicine experience	Accept	Comments
Miscellaneous			
Communicable diseases	During contagious stage of illness		
Spinal surgery	Within 7 days of surgery	after 7 days of surgery	Passengers must be able to sit upright for take off and landing. Should be able to tolerate unexpected severe turbulence and vibration associated with flight. Support braces such as a Halo brace may prevent wearing of the lifejacket in the unlikely event of an emergency.
Terminal illness (if prognosis for the flight is poor)	Individual assessment of cases		
Decompression	Untreated and/or symptomatic cases	3 days after treatment for bends only or 7 days after treatment for neurological symptoms	

References:

Fitness to fly for passengers with cardiovascular disease, The report of the working group of the British Cardiovascular Society, Heart 2010;ii1-ii16. doi:10.1136/hrt.2010.203091

Managing passengers with stable respiratory disease planning air travel: British Thoracic Society recommendations. Thorax, Sept. 2011, Vol 66, Supplement 1

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INCUBATION AND INFECTIVITY

INCUBATION PERIODS OF IMPORTANT INFECTIONS

INFECTION	INCUBATION PERIOD	
	Maximum Range	Usual Range
Short incubation periods (less than 7 days)		
Anthrax	2-5 days	
Bacillary dysentery	1-7 days	
Cholera	Hours-5 days	2-3 hours
Diphtheria	2-5 days	
Gonorrhoea	2-5 days	
Meningococcacaemia	2-10 days	3-4 days
Scarlet fever	1-3 days	
Intermediate incubation periods (7-21 days)		
Amoebiasis	14-28 days	21 days
Brucellosis	7-21 days	
Chickenpox	14-21 days	
Lassa fever	7-14 days	
Malaria	10-14 days	
Measles	7-14 days	10 days
Mumps	12-21 days	18 days
Whooping cough	7-10 days	7 days
Poliomyelitis	3-21 days	7-10 days
Psittacosis	4-14 days	10 days
Rubella	14-21 days	18 days
Smallpox	7-17 days	11 days
Trypanosoma rhodesiense infection	14-21 days	
Typhoid fever	7-21 days	
Typhus fever	7-14 days	12 days
Long incubation periods (more than 21 days)		
Filariasis	3 months +	
Hepatitis A	2-6 weeks	4 weeks
Hepatitis B	6 weeks - 16 months	12 weeks
Cutaneous leishmaniasis	1 week - months	
Visceral leishmaniasis	2 weeks - 12 years	2-4 months
Leprosy	Months - years	
Rabies	Variable	2-8 weeks
Trypanosoma gamiense infection	Weeks - years	

PERIODS OF INFECTIVITY IN CHILDHOOD INFECTIOUS DISEASE

Chickenpox
5 days before rash - 6 days after last crop

Diptheria
2-3 weeks
(shorter with antibiotic therapy)

Measles
From onset of prodromal symptoms until 4 days after onset of rash

Mumps
3 days before salivary swelling - 7 days after

Rubella
7 days before onset of rash - 4 days after

Scarlet fever
10-21 days after onset of rash
(shortened to 1 day by penicillin)

Whooping cough
7 days after exposure - 3 weeks after onset of symptoms
(shortened to 7 days by antibiotics)

MEDICINE International Cross Reference
Fever in the International Traveller
MEDICINE International 2

6.2 AIRLINE INITIAL EMERGENCY MEDICAL RESPONSE PROGRAMMES

Airlines prepare for on-board medical emergencies by providing a system to assist a passenger or crew member in medical need. Services may include:

- first aid and medical response kits;
- trained cabin personnel;
- air to ground communication between the cockpit and ground physicians;
- automatic External Defibrillation;
- telemedicine.

It is important to note that beyond this emergency response, airlines do not serve as medical advisors to passengers, and there is no doctor-patient relationship between an airline and a passenger. Medical issues of concern to the air traveller are best discussed between the passenger and their own physician in advance of travel.

6.2.1 First Aid and Medical Response Kits

This need for first aid and medical response kits was well recognised shortly after the inauguration of regular scheduled flights by the airline industry, and is now regulated by the licensing authorities.

Airline first aid and medical kits vary in scope and complexity. Several factors must be taken into consideration in deciding what items and the number of each item should be included in an aircraft medical first response kit. The need should be based on audit of the inflight incidents. Although injuries, abrasions, contusions, burns, syncope, asthma, neurologic seizures, and cardiac events are high prevalence medical events based on several studies, the first step in any airline's medical kit design is to first survey and determine what medical events are occurring on board in that unique air carrier. Also, the airline medical expert should determine the frequency that medical providers travel on the airline, to determine whether or not the kit should be first aid based, more based on advanced medical expertise, or some combination of both. Also, the air carrier must consider whether ground-based physician expertise is available to provide direction to cabin attendants, or on-board travelling medical personnel.

The weight and size of the first aid kit has to be taken into consideration. The kit should be able to withstand temperature extremes, frequent jostling, and repetitive ascents and descents. The avionics department should test any electrical medical equipment in a medical kit to ensure that interference with aircraft navigational equipment does not occur.

It is the opinion of many airlines that narcotics should not be included, however some airlines believe they should. Likewise, the inclusion of surgical instruments is also controversial.

Many airlines also have first aid kits for ground personnel, tropical first aid kits, and travel first aid kits.

The air carrier should conduct a careful study of state, country and international laws governing first aid kits, and/or the practice of medicine within certain locations, before designing an airline Emergency Response medical program. As an example, the kit recommended by the Aerospace Medical Association is shown in **Appendix 'B'**.

6.2.2 Cabin Crew Training

All cabin crew should be given initial and recurrent training in first aid and basic travel health so they can intelligently use the first aid kit, and/or assist an on-board provider in using the kit. Some airline courses are based on the International Red Cross first aid course, adjusted to fit the needs of the airline industry, and the remote environment of the aircraft cabin. Some airlines have created their own cabin crew first aid course based on international standards, adjusted to fit the needs of the airline industry, and the remote environment of the aircraft cabin. An example is found at **Appendix 'C'**.

General In-Flight First Aid Measures

In the event of the occurrence of a serious injury or illness in flight, it is suggested that the following general procedures be taken:

(a) call ground provider if you have one available;

(b) solicit the aid of a physician or trained nurse if one is aboard;

(c) if one is not on board, follow the first aid procedures in the first aid kit. A first aid manual should be included in the aircraft first aid kit;

(d) make the passenger as comfortable as possible;

(e) give oxygen if condition warrants and if advised in the first aid manual, or by a ground physician;

(f) obtain and record the following information, and report to the Captain, and/or the ground medical physician:

- name of passenger,
- general nature of the condition or major symptoms,
- whether a stretcher or wheelchair is needed,
- medications or treatments given.

It is essential as well to determine whether or not any contagious disease is present, and the captain so advised.

6.2.3 Air to Ground Communication

It is clear that a physician will not be travelling on every aircraft. Further, cabin attendants can be trained to a certain level of medical expertise, but they are not health care professionals. Some air carriers have expert physicians readily available on the ground, 24 hours a day, and 7 days a week; to provide the Captain and on-board crew with expert medical advice when medical emergencies occur. This may be provided by airline physicians or by a specialist provider.

Typically, the Captain is looking for a quick assessment as to whether or not the plane should divert for the medical situation. The ultimate diversion decision remains with the Captain, who also must account for fuel, weather, safety of landing site, and other operational factors beside the emergency.

6.2.4 Automatic External Defibrillation

Airlines that elect to carry Automatic External Defibrillators (AED) on board their aircraft should ensure that they have established clear policies with respect to liability, maintenance, quality assurance and training standards – particularly the requirement for CPR (cardio-pulmonary resuscitation) training. The USA have mandated AED for airlines as of April 2004.

6.2.5 Telemedicine

Finally, there are evolving steps in the area of telemedicine. Twelve (12) lead ECG strips, along with vital signs, images of the patient, two-way voice communication and other means using seat back phones are already on the market.

Phone data transmission is slow, and is often unreliable especially in transpolar travel for reliable use of telemedicine equipment and seat back phones. Medical systems should be able to capitalise on the evolution of Internet services on board planes, leading to more effective transmission of vital medical information to ground physicians in the event of emergencies. With a full medical telemetry system, a definitive analysis and guidance as to whether a diversion is appropriate can be provided for the airline, and provide for a return on investment for these expensive systems.

6.2.6 Reporting of Medical Incidents

In developing their medical care policy, airlines need to determine what information needs to be documented, such as:

- a clear and standard form to ensure that incidents are well documented;
- a central point of responsibility needs to be identified and will include an incident reporting system as well as an incident management process;
- the number and types of incidents occurring over a set period of time;
- determine the circumstances when actions should be taken;
- define and communicate what actions should be taken;
- implement a process to ensure that medical supplies, equipment and training programmes are appropriate to the type of incidents occurring.

A sample Medical Incident form to be used by cabin crew to report incidents is attached as **Appendix 'D'**.

6.2.7 Handling of Deaths on Board

In the event of a death on board, Cabin Crew have the primary role in responding to the situation. Airlines should thus provide flight and cabin crews with clear instructions as to what action should be taken when a death occurs on board and ensure that they receive the appropriate training.

Only a medical doctor can formally pronounce a person dead. If an airline has predetermined areas for stowing a passenger's body, and the body has to be moved to another part of the aircraft, it is essential that Cabin Crew move the body discreetly. For example, an aircraft wheelchair may be used, so as not to draw the attention of other passengers. The Pilot in command must be informed of the death as he is responsible for decision making regarding the next step and because some countries require specific notification.

Close co-operation needs to be established with national governments and airport authorities to ensure that procedures are properly communicated to ground staff. When a serious medical emergency has occurred on board resulting in the death of a passenger, crew need to be trained in dealing with accompanying passengers. There can also be lasting effects on the crew involved. It is recommended that airlines develop procedures to ensure that crew are properly supported after such incidents.

6.3 MEDIF FORMS AND FREMEC CARDS

An ever-increasing number of passengers with reduced mobility are using air transport for business, vacation, or when seeking specialised medical treatment.

They often seek advice from a physician as to whether they are fit to fly. Airlines try their best to aid these passengers.

6.3.1 IDENTIFYING PASSENGERS WITH REDUCED MOBILITY?

The definition of a passenger with reduced mobility is understood to be the following: a person whose mobility is reduced due to physical deficiency (locomotory or sensory), intellectual deficiency, age, illness or any other cause of disability and who needs some degree of special accommodation or assistance over and above that provided to other passengers. This requirement will become apparent from special requests made by the passengers and/or their family or by a medical authority, or reported by airline personnel or industry-associated persons (travel agents, etc.). The level of assistance required by the airport and/or the carrying member can vary depending on the different needs that the passenger with reduced mobility has when travelling by air.

6.3.2 MEDIF

The MEDIF is the name given to the forms used by airlines to manage passengers with reduced mobility. It has two attachments: Attachment A (**Information Sheet for Passengers Requiring Special Assistance)** and Attachment B (**Information Sheet for Passengers requiring medical clearance)** (see Appendix 'E').

What are the contents of the MEDIF?

Attachment A contains details of the air itinerary of the passenger and describes the special arrangements or assistance required by the passenger. The responses given to the questions in Attachment A will determine if a medical clearance is required by the airline. A medical clearance is required by the airline for passengers with recent and/or unstable medical conditions.

Attachment B provides the airline with the specific medical data on the passenger and the special arrangements recommended by the physician.

Who completes the MEDIF?

Attachment A of the MEDIF must be completed, as early as possible, by the travel agent/booking office.

Attachment B must be completed by the attending physician. It is of utmost importance that the attending physician gives precise and factual information and not merely a diagnosis together with a statement that, in his opinion, the patient is fit to travel by air.

For example, with a diagnosis of lung cancer, details about loss of pulmonary function, whether patient has metastases causing neurological or other symptoms that hamper normal functioning should be given. Every detail, even those not caused by the underlying diagnosis, can be important.

It is also vital for the airline medical department/advisor to know exactly what nursing care is required during a flight.

All medical information in this form is strictly confidential.

6.3.3 FREMEC

If a passenger with reduced mobility is a frequent airline traveller and has a stable medical condition established by the initial medical clearance, then a frequent travellers medical card (FREMEC) may be issued by the airline. (See FREMEC IN **Appendix 'E'**). It avoids the necessity to obtain medical clearance for each journey and determines the passenger's special handling requirements. Such cards are usually honoured by other airlines.

Appendix 'A'

MEDICAL CLEARANCE PROCEDURES EXAMPLE

Each airline can design its procedure according to its needs and the regulations it has to respect. In order to help airlines that do not have a procedure in place yet, the following is given as an example that could be adjusted to their needs.

(a) A passenger or his travel agent contacts the airline Reservation Office (RO) to make a booking and notifies the RO that the passenger has a medical problem.

(b) The RO agent transfers the call to a specialized desk (Meda).

(c) Meda takes the regular booking data and ask the passenger or travel agent to advise the treating physician that the airline RO will be in touch with him/her to get the medical details.

(d) Medafax the clearance form (MEDIF or Company Clearance Form) to the treating physician who would fill the form and fax it back to the Meda. If the airline considers that any charge is the responsibility of the passenger, it should be specified on the fax.

(e) Once the Meda receives the form back, it can approve the clearance if it is straightforward and meets pre-established criteria, or it sends it to the medical department for approval.

(f) The medical department approves the clearance, denies it or contact the treating physician if more information are required to make the decision.

(g) Once the Meda has received the decision of the medical department, it advises the passenger or its travel agent of the decision and finalizes the reservation process. A note on the passenger's file specifies that a medical clearance has taken place and also specifies the special requirements if any.

(h) If special services (wheelchair, oxygen, stretcher, etc.) are required, the Meda will make the arrangements with the airline department(s) that is (are) responsible for these services.

(i) The affected stations of each carrying airline are notified by the initial airline RO.

(j) Complete details of special handling arrangements made at affected stations are included in the passenger name record (PNR).

Important

Arrangements for hospitals, ambulances, etc. should be made by the passenger or his physician and only after all air travel arrangements have been finalized.

Passengers asking for a Frequent Traveller Card would go through that complete procedure only once their condition is stable.

Appendix 'B'

AEROSPACE MEDICAL ASSOCIATION RECOMMENDED

EMERGENCY MEDICAL KIT, FIRST AID KIT, UNIVERSAL PRECAUTION KIT

EMERGENCY MEDICAL KIT

The medication contents of an aircraft medical kit would typically include:

Epinephrine 1:1000
Antihistamine injectable (inj.)
Dextrose 50% inj. 50 ml (single dose ampule or equivalent)
Nitroglycerin tablets or spray
Major analgesic inj. or oral
Sedative anticonvulsants inj.
Antiemetic inj., or Ondansetron oral dissolvable
Bronchial dilator inhaler with disposable collapsible spacer
Atropine inj.
Adrenocortical steroid inj. or similar oral absorption equivalent
Diuretic inj.
Medication for postpartum bleeding (Misoprostol, i.e. Cytotec)
Sodium Chloride 0.9% (1000 ml recommended)
Acetyl salicylic acid (aspirin) for oral use
Oral beta blocker

Note: if a cardiac monitor is available, (with or without an AED), the following would normally be added to the above list:
Epinephrine 1:10,000 (can be a dilution of epinephrine 1:1,000)

Note: when available and cost effective, auto-injectors are easier to use and can be used by cabin crew under order from ground medical advisor if there are no health professional on board.

EMERGENCY MEDICAL KIT

The equipment contents of an aircraft medical kit would typically include:

List of contents
Sphygmomanometer (electronic preferred)
Stethoscope
Airways, oropharyngeal (appropriate range of sizes)
Syringes (appropriate range of sizes)
Needles (appropriate range of sizes)
Intravenous catheters (appropriate range of sizes)
System for delivering intravenous fluids
Antiseptic wipes
Venous tourniquet
Sharp disposal box
Gloves (disposable)
Urinary catheter (with sterile lubrication gel)
Sponge gauze
Tape adhesive
Surgical mask
Emergency tracheal catheter (or large gauge intravenous cannula)
Umbilical cord clamp
Thermometer (non-mercury)
Torch (flashlight) and batteries (operator may choose to have one per aircraft in an easily accessible location)
Bag-valve mask
Basic life support cards

Note: the carriage of AEDs would be determined by an operator on the basis of a risk assessment, taking account the particular nature of the operation

FIRST AID KIT

The contents of an aircraft first aid kit would typically include:

List of contents
Antiseptic swabs (10/packs)
Bandage adhesive strips
Bandage, gauze 7.5 cm x 4.5 cm
Bandage triangular 100 cm folded and safety pins
Dressing, Burn 10 cm x 10 cm
Dressing, compress, sterile 7.5 cm x 12 cm approximately
Dressing, gauze, sterile 10.4 cm x 10.4 cm approximately
Adhesive tape, 2.5 cm standard roll
Skin closure strips
Hand cleanser or cleaning towelettes
Pad with shield or tape for eye
Scissors, 10 cm (if permitted by applicable regulations)
Adhesive tape, surgical 1.2 cm x 4.6 m
Tweezers, splinter
Disposable gloves (several pairs)
Thermometer (non-mercury)
Resuscitation mask with one-way valve
First-aid manual (an operator may decide to have one manual per aircraft in an easily accessible location
Incident record form

Note: first aid kit should not include ammonia inhalants

Note: since some countries do not allow any medication in the first aid kit, some airlines will carry an extra kit containing over the counter medication to be used passively, i.e. only given to passenger on specific request by the passenger. This kit will typically include items such as:

Mild to moderate analgesic for adults and children
Antiemetic
Nasal decongestant
Antacid
Antihistaminic
Antidiarrheal

UNIVERSAL PRECAUTION KIT

The contents of an aircraft universal protection kit would typically include:

Dry powder that can convert small liquid spill into a granulated gel
Germicidal disinfectant for surface cleaning
Skin wipes
Face/eye mask (separate or combined)
Gloves (disposable)
Impermeable full length long sleeved gown that fastens at the back
Large absorbent towel
Pick-up scoop with scraper
Bio-hazard disposal waste bag
Instructions.

Appendix 'C'

FIRST AID TRAINING

Training typically provides knowledge and skill in subject areas appropriate for cabin crew. Suggested subject areas are as follow:

Altitude Physiology (working at altitude)

- changes in atmospheric pressure;
- relative hypoxia;
- trapped gas;
- decompression sickness;
- cabin depressurisation;
- hyperventilation;
- cabin air quality.

Travel Health

- immunisation;
- protection against infectious diseases;
- circadian rhythm and jet lag;
- fatigue management;
- cosmic radiations
- personal safety (e.g. use of alcohol, other drugs, traffic safety).

Regulations

- first aid training and equipment (ICAO and National Aviation Authority's regulations);
- reporting of communicable diseases (ICAO and IHR);
- aircraft disinfection and disinsection (application of insecticide);
- biohazard waste disposal.

Procedures and resources

- crew coordination and teamwork;
- seeking medical advice (ground and/or in-flight);
- medical equipment (e.g. first aid kit, medical kit, oxygen);
- death on board;
- documentation to be completed;
- reasons for, and importance of, completion of forms following medical incidents;
- form contents and explanation of terms;
- the importance of the completion of the relevant sections of the form by an assisting onboard health professional;
- use of the tear-off slip to accompany a casualty when disembarking the aircraft as a personal record of:
  - the incident;
  - any treatment that may have been given;
  - death on board;
- PIC notification and communication.

First aid (problem recognition and management)

Assessing a Casualty

- *Surveying a casualty: Primary survey; Secondary survey;*
- *History of an incident;*
- *Looking for external clues; Measuring body functions; Examining a casualty;*

- *Identifying specific recognition features;*
- *Mechanics of lifting: Moving a casualty; passengers with disability.*

Life-saving Procedures

- *Principles of resuscitation;*
- *Primary actions for adult, child and infant;*
- *Opening the airway; Clearing the airway;*
- *Checking breathing; Rescue breathing;*
- *Checking for circulation;*
- *Cardiopulmonary resuscitation; Automated external defibrillator (adult only) if carried;*
- *Choking;*
- *Recovery position.*

Medical Problems

- the unconscious (underlying causes);
- suspected communicable diseases;
- respiratory disorders (asthma, hyperventilation, chronic lung diseases, persistent coughing);
- cardiovascular disorders (angina, heart attack, shock, DVT);
- abdominal problems (vomiting, diarrhoea, pain, heartburn, bleeding);
- nervous system disorders (headache, seizure, stroke);
- ear, nose and throat problems such as barotrauma (body damage caused by pressurisation difference) and/or epistaxis (nose bleed)
- behavioural/psychological disorders (panic attack, alcohol intoxication, irrational behavior);
- other problems (diabetes, allergic reaction, pregnancy related).

- *Trauma*
  - *wounds and bleeding (practical training);*
  - *burns;*
  - *head and neck injury;*
  - *eye injury (Foreign object in the eye; Chemical splash to eye; Direct injury);*
  - *musculo-skeletal injury (fractures, sprains,etc);*
  - *chest and abdominal injury.*
  - *dealing with sharps injuries*

Initial training would typically address all the subject areas listed above.
Unless there were changes to the altitude physiology, travel health and regulations components, it would not be necessary to review these areas each year. However, in the event of changes, cabin crewmembers would typically be promptly advised, and such changes would then be addressed during the next recurrent training.
The procedures, resources and first aid subject areas would be addressed in recurrent training, to include testing and evaluation. Selected elements included in these subject areas would be addressed each year in recurrent training such that all elements are addressed during every 36-month period.
It is recommended that elements chosen to be reviewed each year be built into practical scenarios. Scenario-based training is advantageous because:

- it requires the crew to function as a team;
- scenarios might be designed to cover multiple aspects of first aid, as well as subjects from other areas, such as altitude physiology and regulations;
- it stimulates participation and improves retention.

Other training methods would also be acceptable as long as it can be reasonably established that cabin crewmembers have the knowledge and skills to apply first aid and life-saving procedures at any given time.

Appendix 'D'
SAMPLE OF MEDICAL INCIDENT REPORT FORM

NAME OF AIRLINE
Completed form to be returned to: ……………………………………

Sample Medical Incident Report *(To be completed for all incidents)*			
1. Name of person completing form		2. Staff ID:	

SECTION 1:

3. Date	/ /	4. Flight No:		5. From:		6. To:	

PATIENT DETAILS *(Complete as applicable)*

7. Name							
8. Sex	M / F	9. Date of Birth:	/ /	10. Seat No:		11. Frequent flyer member:	
12. Home Address:						Tel.:	

DETAILS OF ILLNESS / ACCIDENT

13. Time/Date of Onset (GMT):	: hrs. / /	14. Location:	
15. Describe events leading up to incident:			

SYMPTOMS & SIGNS *(tick, circle or complete all appropriate boxes):*

Pain:	16. Site(s):		17. Severity:	Mild / Moderate / Severe
	18. Character:	Sharp / Cramping / Aching / Throbbing:	19. Pattern:	Constant / Variable
Bleeding	20. Site(s):		21. Severity:	Mild / Moderate / Severe

22. Nausea		23. Vomiting		24. Diarrhoea		25. Cough		26. Breathless or wheezy	
27. Faint		28. Pale		29. Blue		30. Flushed		31. Clammy / Sweating	
32. Hot / feverish		33. Cold		34. Dizzy		35. Weakness		36. Fit / Convulsion	
37. Anxious		38. Confused		39. Aggressive		40. Intoxicated			
41. Rash / spots	42. Where:								
45. Other (specify)									

INJURY *(tick appropriate box / boxes):*

46. Abrasion		47. Amputation		48. Fracture		49. Bruising		50. Burn	
51. Concussion		52. Cut		53. Dislocation		54. Sprain		55. Foreign Body	

Body Part

56. Head / neck		57. Eye		58. Ear		59. Torso		60. Back	
61. Arm		62. Hand		63. Finger		64. Leg		65. Foot / toe	

OBSERVATIONS:	65. Pulse: / minute	67. Blood Pressure: mm/Hg
	68. Temperature:	69. Respiration: / minute
	70. Other observations:	

PATIENT'S MEDICAL HISTORY

		DETAIL 5
70. Had this problem before?	YES / NO	
71. Taking any medication?	YES / NO	
72. Any allergies	YES / NO	
73. Any recent illnesses or operations?	YES / NO	
74. Currently pregnant?	YES / NO	If yes how many months?

CABIN CREW ACTION *(circle or complete as indicated)*

75. Oxygen given?	YES / NO	75. If yes, did patient's condition improve?		YES / NO
76. Medication given? (specify)				
77. Was own medication or from other passenger used? (specify)				
78. Defibrillator used?	YES / NO	78. If yes, were any shocks administered?		YES / NO
79. Other onboard medical equipment used (specify)				
80. Was Cardiopulmonary Resuscitation (CPR) performed?	YES / NO	Pulse restored? YES / NO	Respiration restored? YES / NO	Consciousness regained? YES / NO
81. Use of ground medical control	YES / NO	Successful / unsuccessful	Comms used: SATCOM / HF / ACARS	
82. Assistance of on-board Dr. or Health Professional	YES / NO	Successful / unsuccessful		
83. Attempt to contact company doctor:	YES / NO	Successful / unsuccessful		
84. Port Health Authority advised:	YES / NO			
85. Further information / comments:				

OUTCOME *(tick)*

Diversion		Patient recovered before landing		Patient walked off aided / unaided	
Patient left aircraft by wheelchair		Patient left aircraft by stretcher		Patient died on aircraft	

Treatment:	None		First Aid		Ground medical		GP / Appointed Dr		Hospital	

Crew:	Fit to operate		Fit to fly as passenger		Remained in hotel / hospital	

---------- **Cut-off portion** ----------

Transfer of Care to Ground Medical Services			
Name of Casualty:		Date and time of onset:	
Brief Details of Incident:			
Oxygen given?	YES / NO	If yes, did patient's condition improve?	YES / NO
Was casualty unconscious at any time?	YES / NO		
Defibrillator applied?	YES / NO	If yes, were any shocks given?	YES / NO
Medication Administered: Drug:	Dose:	Time (GMT):	
Any other treatment given:			
Crew Member name (CAPITALS):	Staff Number:	Signature:	

Appendix 'E'

MEDIF

RESOLUTION 700 ATTACHMENT A

Information Sheet for Passengers Requiring Special Assistance

1. Last name / First name / Title .....
2. Passenger name record (PNR) .....
3. Proposed itinerary .....
   Airline(s), flight number(s) .....
   Class(es), date(s), segment(s) .....
4. Nature of disability .....
5. Stretcher needed onboard? ____ Yes ____ No
6. Intended escorts ____ Yes ____ No
   Name ..... Title ..... Age .....
   PNR if different .....
   Medical qualification _____ Yes _____ No Language spoken .....
7. Wheelchair needed ____ Yes ____ No
   Wheelchair categories ____ WCHR ____ WCHS ____ WCHC Own wheelchair ____ Yes ____ No
   Collapsible WCOB ____ Yes ____ No Wheelchair type ___ WCBD ___ WCBW ___ WCMP
8. Ambulance needed (to be arranged by the Airline) ____ Yes ____ No
   If yes, specify destination address .....
   If no, specify ambulance company contact .....
9. Meet and assist ____ Yes ____ No
   If designated person, specify contact .....
10. Other ground arrangements needed ____ Yes ____ No
    If yes, specify .....
    Departure airport .....
    Transit airport .....
    Arrival airport .....
11. Special inflight arrangements needed ____ Yes ____ No
    If yes, specify type of arrangements (special meal, extra seat, leg rest, special seating) .....
    Specify equipment (respirator, incubator, oxygen, etc) .....
    Specify arranging company and at whose expense .....
12. Frequent traveller medical card (FREMEC) ____ Yes ____ No
    If yes, specify FREMEC number, issued by, expiry date .....

RESOLUTION 700 ATTACHMENT B PART ONE

Information Sheet for Passengers Requiring Medical Clearance (to be completed or obtained from the attending physician)

1. Patient's name.....

   Date of Birth .....Sex..... Height .....Weight .....

2. Attending physician .....

   E-mail ....

   Telephone (mobile preferred), indicate country and area code ..... Fax .....

3. Diagnosis (including date of onset of current illness, episode or accident and treatment, specify if contagious) .....

   .....

   .....

Nature and date of any recent and/or relevant surgery ....

4. Current symptoms and severity .....

   .....

   .....

5. Will a 25% to 30% reduction in the ambient partial pressure of oxygen (relative hypoxia) affect the passenger's medical condition? (Cabin pressure to be the equivalent of a fast trip to a mountain elevation of 2400 metres (8000 feet) above sea level) ____ Yes ____ No ____ Not sure

6. Additional clinical information

a.	Anemia	____ Yes	____ No	If yes, give recent result in grams of hemoglobin .....
b.	Psychiatric and seizure disorder	____ Yes	____ No	If yes, see Part 2
c.	Cardiac condition	____ Yes	____ No	If yes, see Part 2
d.	Normal bladder control	____ Yes	____ No	If no, give mode of control.....
e.	Normal bowel control	____ Yes	____ No	
f.	Respiratory condition	____ Yes	____ No	If yes, see Part 2
g.	Does the patient use oxygen at home?	____ Yes	____ No	If yes, specify how much.....
h.	Oxygen needed in flight?	____ Yes	____ No	If yes, specify ____ 2 LPM ____ 4 LPM ____ Other

7. Escort

a.	Is the patient fit to travel unaccompanied?		____ Yes	____ No
b.	If no, would a meet-and-assist (provided by the airline to embark and disembark) be sufficient?		____ Yes	____ No
c.	If no, will the patient have a private escort to take care of his/her needs onboard?		____ Yes	____ No
d.	If yes, who should escort the passenger?	____ Doctor	____ Nurse	____ Other
e.	If other, is the escort fully capable to attend to all the above needs?		____ Yes	____ No

8. Mobility

   a. Able to walk without assistance ____ Yes____ No b. Wheelchair required for boarding ____ to aircraft ____ to seat

9. Medication list .....

10. Other medical information .....

RESOLUTION 700 ATTACHMENT B PART TWO

Information Sheet for Passengers Requiring Medical Clearance (to be completed or obtained from the attending physician)

1. Cardiac condition
   a. Angina ____ Yes ____ No When was last episode? .....
      • Is the condition stable? ____ Yes ____ No
      • Functional class of the patient?
      ____ No symptoms ____ Angina with important efforts ____ Angina with light efforts ____ Angina at rest
      • Can the patient walk 100 metres at a normal pace or climb 10 -12 stairs without symptoms? ____ Yes ____ No
   b. Myocardial infarction ____ Yes ____ No Date .....
      • Complications? ____ Yes ____ No If yes, give details .....
      • Stress EKG done? ____ Yes ____ No If yes, what was the result? ..... Metz
      • If angioplasty or coronary bypass,
      can the patient walk 100 metres at normal pace or climb 10–12 stairs without symptoms? ____ Yes ____ No
   c. Cardiac failure ____ Yes ____ No When was last episode? .....
      • Is the patient controlled with medication?____ Yes____ No
      • Functional class of the patient?
      __ No symptoms __ Shortness of breath with important efforts __ Shortness of breath with light efforts __ Shortness of breath at rest
   d. Syncope ____ Yes ____ No Last episode .....
      Investigations? ____ Yes ____ No If yes, state results .....

2. Chronic pulmonary condition ____ Yes ____ No
   a. Has the patient had recent arterial gases? ____ Yes____ No
   b. Blood gases were taken on: ____ Room air ____ Oxygen .....LPM
      If yes, what were the results ..... pCO_2 ..... pO_2
      Saturation ..... Date of exam.....
   c. Does the patient retain CO_2? ____ Yes ____ No
   d. Has his/her condition deteriorated recently? ____ Yes____ No
   e. Can the patient walk 100 metres at a normal pace or climb 10-12 stairs without symptoms? ____ Yes ____ No
   f. Has the patient ever taken a commercial aircraft in these same conditions? ____ Yes ____ No
      • If yes when? .....
      • Did the patient have any problems? .....

3. Psychiatric Conditions ____ Yes ____ No
   a. Is there a possibility that the patient will become agitated during flight ____ Yes ____ No
   b. Has he/she taken a commercial aircraft before ____ Yes ____ No
      • If yes, date of travel? ..... Did the patient travel ____ alone ____ escorted?

4. Seizure ____ Yes ____ No
   a. What type of seizures?.....
   b. Frequency of the seizures.....
   c. When was the last seizure? .....
   d. Are the seizures controlled by medication? ____ Yes ____ No

5. Prognosis for the trip ____ Yes ____ No

Physician Signature ..... Date .....

Note: Cabin attendants are not authorised to give special assistance (e.g. lifting) to particular passengers, to the detriment of their service to other passengers. Additionally, they are trained only in **first aid** and are not permitted to administer any injection, or to give medication.

Important: Fees, if any, relevant to the provision of the above information and for carrier-provided special equipment are to be paid by the passenger concerned.

Notes regarding the MEDIF forms

Airlines using the suggested MEDIF forms must ensure that confidentiality is respected once the forms are completed.

Airlines must also ensure that usage of the forms is compatible with local laws.

FREMEC

FREQUENT TRAVELLER'S MEDICAL CLEARANCE (FREMEC)

Honouring instructions: The data contained in the shaded fields MUST always be transmitted with any reservation request. Journeys requested but not authorized by this Card require completion of the Information Sheet for Passengers Requiring Special Assistance.

FREMEC Number: / Issued by: Valid until:

(Airline Code Number) (Serial Number) (Airline's Reservations Dept's Telex Code) (day/month/year)

The holder of this Card:

(Surname) (Initial) (Title) (Sex) (Age)

(Permanent Address) (Phone)

Has the following permanent/chronic incapacitation

The holder is authorised by the airline issuing this Card, to travel by air within the validity of this Card, subject to: (a) the Conditions stated on the reverse, (b) no worsening of the Holder's present health conditions, and (c) full observance of all carrier rules, regulations and instructions, and with the following LIMIATIONS:

(Code, if any. Example: WCHC, etc.)

(Insert limitations, including any permanent dietary requirements)

(2)

CONDITIONS OF ISSUE

1. Cardholders are required to REPORT ALL CHANGES in their present handicap or incapacitation, and/or the deterioration in their physical or medical condition, to the airline representative or agent with whom they are in contact.
2. Subject to all terms and conditions stated on this Card, the authorisation for air travel is valid only up to the date stated on the front.
3. This Card is not transferable and must be produced, together with proof of the cardholder's identity, on every occasion wherever airline reservations are made for the cardholder, at time of ticket issuance, and when so requested by the airlines or their agents or representatives.
4. Cardholders are reminded that arrangements for travel should be made as much in advance as possible. They should also allow sufficient time for check-in formalities.

Date and Place of Issue

Passenger's Signature

(Legal guardian or Passenger's witness may sign if passenger is physically unable to do so).

SECTION 7 – MEDICAL INVOLVEMENT FOLLOWING AIRCRAFT INCIDENTS

7.1 CRISIS RESPONSE

The tragic events of September 11th, 2001 brought to the fore the painful truth that airplanes, for whatever reason, do on very rare occasions crash. Such tragedies occur regardless of the precautions that are taken in an industry where safety is always at the forefront of every action.

Corporate medical accident response takes many forms, and is highly dependent on the nature and location of the accident. Again, the internal medical department takes a pivotal role in such painful, but necessary business needs in an airline operation. In a remote foreign location, typically within a few hours of the event, a plane is dispatched to the location with the Initial Response Team. A medical response group is part of the Initial Response Team comprising occupational health nurses, and typically a company physician. The team provides first aid medical support to the company response team in the remote location.

A secondary function of the initial medical response team is to provide emotional and counselling support for the responding team. Employee Assistance Program [EAP] counsellors are vitally needed to attend to the critical incident response needs of the on-site crews, the crew member bases and other support functions. A crash is deeply felt by a broad segment of members of the company, if not all.

Another tier of support is in the area of providing emotional and other support to family members of crash victims. Some major airlines have teams of hundreds of trained employees whose role is specifically to serve the bereaved families, or who have an injured family member in hospital. The team member will stay with the family for anything up to several weeks, to arrange transportation, facilitate hospital care of the injured family member, and attend to any need which requires an interface with the airline.

Finally, medical team members may support the post-accident investigation, typically using expertise in the areas of egress, survival and human factors. The involvement varies dependent upon the country in which the crash took place. Local laws take precedence, and the government of the country will dictate the degree of involvement permitted.

The emotional welfare of the crew member families and the rest of the company is also of critical importance. Special emphasis should be given to flight crews, some of whom may be legitimately frightened to get back on an aircraft. A proactive, sympathetic approach permitting crew members to miss a certain number of trips, but then to be proactively called by trained EAP counsellors will be helpful. Most personnel return after these compassionate interventions.

The appendix contains sample material that can serve as a model to distribute to employees during crash events.

Appendix 'A'

TAKE CARE OF YOURSELF – A BROCHURE TO HELP YOURSELF IN THE EVENT OF AN AIRLINE TRAGEDY

September 11, 2001 – where were you? What were you doing? As the tragic events unfolded, what were your initial reactions? These are only a few questions that when answered may provide insight into how you are coping with the tragedy.

As members of the airline industry, we were directly affected and are now left with facing not only the psychological aftermath, but also the economic repercussions. Just as we were trying to cope with the loss of friends, colleagues, and even family members, we are faced with the new challenges of war, layoffs, and the fear of future terrorist acts. Attempting to recover from this tragic event may seem to be a monumental task, however, recognising that your emotional and psychological reactions are not uncommon and that there ways to help you achieve resolution will help you to get through the difficult period.

Your response to a critical incident may manifest as physical, emotional, intellectual or behavioural symptoms. Although your initial reaction may have been shock and disbelief, now that time has passed you may be experiencing different symptoms now. The following is a list of some of the common symptoms that one may experience after a critical incident.

Physical

- *Sweating*
- *Appetite changes*
- *Fatigue*
- *Headaches*

Intellectual

- *Poor concentration*
- *Poor job performance*
- *Difficulty with decision-making*

Emotional

- *Anxiety*
- *Guilt*
- *Anger*
- *Depression*
- *Grief*

Behavioural

- *Withdrawal*
- *Irritability*
- *Loss of interest in activities*
- *Lashing out at others*

Recovery may take from weeks to months. The length of time will differ for each individual and even though you may not have experienced any symptoms initially, you may have a delayed response. Nevertheless, how you deal with these symptoms will depend greatly on your ability to identify the symptoms before they become unmanageable or disruptive to your life. Realising that everyone responds to a traumatic event differently, you must determine your approach.

What You Can Do for Yourself

When you've experienced a trauma, it can be a shock to your whole system. The following are some ideas to help you cope with any physical or emotional symptoms you may be experiencing:

- Be at work. *Your colleagues know what you are going through. Do not succumb to* staying *at home. Your co-workers are your best support.*
- Eat well-balanced and regular meals*, even if you don't feel like it. Good nutrition is* very *important when you are feeling stressed*
- *Get plenty of rest.*
- *Exercise regularly.* It can help work off some physical stress symptoms, leaving you feeling calmer and better able to relax. If you're feeling lethargic if can help energise you and clear your mind.
- *Avoid caffeine, especially if you are having trouble sleeping.*
- *Avoid the use of drugs or alcohol*, including prescription and over the counter drugs to numb the pain. It will only complicate or delay your recovery.
- *Structure your time and set priorities.* Maintain your basic normal routine, but give yourself permission to skip the extras for a while.
- *Don't make any major life changes or decisions.*
- *Do make as many small daily decisions as possible to reassert your sense of control.*
- *Give yourself permission to feel rotten and to share your feelings with others.* Do things that you enjoy. Fake mini-breaks: go out to dinner, take 10 minutes alone, watch a movie.
- *Talk with people you trust: your family, friends, and co-workers.* Don't be afraid to reach out. People do care.
- *Don't be afraid to set limits with others when you don't feel like talking.* You don't have to discuss the incident or your feelings when you don't want to.
- *Don't label yourself as crazy.* Remind yourself you're having normal reactions.
- *Write down your thoughts and feelings.* This can be especially helpful if you're having trouble sleeping or when you wake from a troubling dream.
- *Ask for help if you need it,* if you are having trouble coping on your own. Help is available from many sources:
    - Professional assistance from a counsellor may sometimes be necessary. This does not imply weakness or craziness. It simply indicates that the particular event was just too powerful to handle by yourself.
    - In the workplace you may be able to get assistance from your co-workers, the human resource department, or company EAP.
    - Church, friends, family, and other community resources can be valuable sources of support.
- *Realise that what you are experiencing is normal.* You may feel fear, shock, anger, confusion, or depression. These feelings are normal, and will usually ease with time.
- *Avoid comparing yourself with others* – everyone is different and reacts differently to a traumatic event.
- *Don't try to fight reoccurring thoughts, dreams, or flashbacks.* They are normal and they will decrease overtime and become less painful. Dreaming of the incident is common. There may be times when you think or feel that the incident is recurring, sometimes like a "miniflashback".
- *Maintain as normal a schedule as possible.* Staying with normal routines will help you recover from a critical incident.
- *Use company resources to help you through this difficult time.* Ask your supervisor or human resources representative about company resources for people coping with a critical incident.

- *Take care of yourself.* You may be more vulnerable to illness or fatigue when coping with a traumatic event. Eat nutritious food and drink plenty of water, even when you don't feel like it.
- *Use a relaxation that works for you.* You might find help from yoga, meditation, or some other relaxation technique.
- *Be alert for signs that you may need help coping,* such as becoming teary all the time.

Finding support

- *Contact the employee assistance program (EAP).* EAP can offer confidential support to help you cope with your feelings and reactions to the critical incident. Your EAP can also provide helpful materials, referrals to local resources, counselling, and long-term counselling, if necessary.
- *Talk about your feelings with co-workers, your manager, family, or friends.* Don't try to hide or ignore your emotions.
- *Consider seeing a counsellor:* If your feelings become prolonged or if you are having trouble coping or handling your feelings.

What You Can Do for Others

Take care of yourself first. Then you can help others.

Listening

- Listen carefully.
- Acknowledge feelings as normal.
- Be sensitive to individual circumstances, and different points of view.
- Don't respond with "you're lucky it wasn't worse". Instead, say that you are sorry such an event has occurred and you want to understand and help.
- Don't take emotional responses like anger personally.
- Respect an individual's need for privacy. If someone doesn't want to talk about the incident or their feelings, don't insist.

Reaching Out At Work

- Organise support groups at work to help one another.
- Offer a "listening ear" to someone who hasn't asked for help but may need it.
- Give encouragement, support and understanding with on-the-job issues.
- Identify resources for additional help (EAP, mental health benefit, human resources department).

Helping Family and Friends

- Offer to spend time with the traumatised person. Reassure them that they are safe now.
- Offer help with everyday tasks like cleaning, cooking, caring for the family.
- Respect their need for privacy and time alone,
- Suggest available help (EAP, community resources, church groups, etc.).
- Keep communication open – be available and accessible,

The most important point is: do not be afraid to ask for help. There are a number of resources available for professional assistance, which includes your minister, physician, or EAP representative. And above all, take care of yourself!

www.iata.org/medical-manual

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