

Guidance Document

(Produced by: Aerospace Medical Association Air Transport Medicine Committee)

Medical Emergencies: Managing In-flight Medical Events

(Guidance material for health professionals)

Publications concerning in-flight medical events that result in in-flight treatment and diversions have appeared in the lay and scientific literature. Several have been based on one event, or on data from one or two airlines, and consequently may draw conclusions that are not necessarily applicable throughout the industry. This guidance document has been developed primarily for medical practitioners who volunteer to provide assistance on board and for those who wish to understand the background to airline provision of on-board first aid and medical care. This document considers: what are "in-flight medical events" and how often they occur; on-board medical supplies; cabin crew training; automated external defibrillators, and legal aspects. A checklist is provided for medical professionals called to provide assistance during an in-flight event.

Introduction

Publications concerning in-flight medical events that result in treatment, diversions, etc. have appeared in the lay and scientific literature. Until recently all reports were based on a single event (1,2), or on data from one or two airlines (3,4,5,6), and consequently might have drawn conclusions that are not necessarily applicable throughout the industry, as passenger demographics might vary from airline to airline and country to country. In 2013, Peterson (15) reported on outcomes of medical emergencies on commercial airlines flights based on five domestic and international airlines. With its restrictions this study may be a little more representative of the overall situation on in-flight medical events.

In this document, six members of the Aerospace Medical Association (AsMA), medical practitioners with experience in airline medical departments and/or regulatory aviation authorities, provide information concerning aspects such as on-board medical supplies, legal and regulatory constraints, training of cabin crew and their role in assisting medical volunteers, liability issues and advice for medical volunteers.

In-flight medical events

The term "In-flight medical event" includes a wide spectrum of illnesses, ranging from the trivial, such as a mild headache, to the very serious, including death. The great majority of events that come to the attention of cabin crew are successfully managed by first aid measures such as reassurance or simple 'over the counter' medications e.g. mild analgesic. A medical emergency can be regarded as one which requires medical supplies other than those intended for first aid, a doctor's advice from ground medical support (specialized medical companies that provide advice

from the ground directly to the aircraft), the help of an on board volunteer health professional, or results in a diversion or in death.

It is not known with certainty how many in flight medical events occur each year since there is no internationally agreed recording and classification system. A number of authors have suggested the adoption of an international standardized recording system for in-flight medical events, but this would be a costly and logistically difficult task, and may not result in practical benefit (7,8).

If there is a need to address the subject in one particular State (country), a more practical and cost effective approach may be for that individual State regulatory aviation authority to consider the topic with the airlines they regulate, identify in detail the area under consideration (e.g. support to medical volunteers, cabin crew training, medical kit contents, education of medical volunteers during medical training, etc.) and agree on a way forward.

Despite the limited information available, collective experience of airline medical departments has shown that minor medical events may be relatively common, whereas major events are rare, considering the large and increasing numbers of airline passengers. For example, a survey of 20 international airlines over a 7-year period revealed an average of 0.33 medical diversions per billion revenue passenger kilometers. (personal communication) This was also corroborated from the published and unpublished experience from major ground based medical support services (Peterson et al. / personal communication). From their experience a medical event where a diversion was recommended varied from 2 to 8%.

On board medical supplies

The International Civil Aviation Organization (ICAO), a specialised agency of the United Nations, is responsible for setting the rules that regulate international flight safety. It does this by establishing global Standards and Recommended Practices (SARPs), which are then applied by national regulatory bodies, which also take legal responsibility for their implementation: some of the SARPs deal with passenger health. An ICAO Standard (an ICAO Standard is mandatory) for on board medical supplies establishes the requirement that 'adequate' medical supplies are carried, but the detailed number and type of first aid and medical kits to be carried, and their contents, are contained in non-mandatory Recommended Practices and guidance material. Requirements for individual airlines are therefore determined by the national aviation regulatory authority, in collaboration with the airlines they regulate.

Whilst the number and types of kit (an ICAO Recommended Practice) are similar between airlines, their contents (contained in guidance material) may vary significantly, depending on the views of the national regulatory authority where the airline is based. However, for international travel, the International Air Transport Association (IATA, the trade association for the airlines) and AsMA (the largest association of aviation medicine professionals) recommend the same contents for medical supplies. The contents have also been reviewed by the American College of Emergency Physicians (ACEP), which supports the recommendations.

FIRST-AID KITS

The first-aid kit contents that follow are recommended by the Aerospace Medical Association. *(The recommendation has been coordinated and approved by the International Air Transport Association (IATA), International Academy of Aviation and Space Medicine (IAASM), American Osteopathic Association (AOA), American College of Emergency Physicians (ACEP), in collaboration with the American Medical Association (AMA). It has also been coordinated with and agreed to by the Chief, ICAO Aviation Medicine Section, subject to approval of the Council in due course.)*

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

List of kit contents

- Antiseptic swabs (10/packs)
- Bandage adhesive strips
- Bandage, gauze 7.5 cm x 4.5 cm
- Bandage Triangular 100cm 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

EMERGENCY MEDICAL KIT

The emergency medical kit contents that follow are recommended by the Aerospace Medical Association.

(The recommendation has been coordinated and approved by the International Air Transport Association (IATA), International Academy of Aviation and Space Medicine (IAASM), American

Osteopathic Association (AOA), American College of Emergency Physicians (ACEP), in collaboration with the American Medical Association (AMA). It has also been coordinated with and agreed to by the Chief, ICAO Aviation Medicine Section, subject to approval of the Council in due course.)

The equipment contents of an aircraft emergency 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 lubricating 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.

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

- Epinephrine 1:1000
- Epinephrine 1:10000 (can be a dilution of epinephrine 1:1000)
- Antihistamine injectable
- Anti-psychotic drug (e.g., haloperidol)
- Dextrose, 50% injectable, 50 ml (single dose ampule or equivalent)
- Nitroglycerin tablets or spray
- Major analgesic inj. or oral

- Sedative anticonvulsant inj.
- Antiemetic inj. or oral dissolvable (e.g. ondansetron)
- Bronchial dilator inhaler with disposable collapsible spacer
- Atropine inj.
- Adrenocortical steroid inj. or similar oral absorption equivalent
- Diuretic inj.
- Sodium Chloride 0.9% (1000 ml recommended)
- Acetyl salicylic acid (aspirin) for oral use
- Oral beta blocker

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

Note: Where possible, legally and economically, and where technically available and effective, alternative methods of administration (i.e.: nasal spray, sub-lingual spray, oral-dissolving, etc) may replace injections in order to facilitate treatment by any assisting volunteer, including personnel who are not trained to use this method e.g. cabin crew, under direction from ground based medical services or airline's standing orders as necessary.

- Example: Sedative anticonvulsant injectable or intra-nasal

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 typically includes items such as:

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

UNIVERSAL PRECAUTION KITS

The universal precaution kit contents that follow are recommended by the Aerospace Medical Association.

(The recommendation has been coordinated and approved by the International Air Transport Association (IATA), International Academy of Aviation and Space Medicine (IAASM), American Osteopathic Association (AOA), American College of Emergency Physicians (ACEP), in collaboration with the American Medical Association (AMA). It has also been coordinated with and agreed to by the Chief, ICAO Aviation Medicine Section, subject to approval of the Council in due course.)

The contents of an aircraft universal precaution 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

The same approach applies to on board medical equipment. For instance, ICAO does not mandate, as a Standard, automated external defibrillators (AED) to be carried since the latest study that considered AED availability for public health purposes does not prioritise aircraft (9). The carriage of AEDs is usually determined by operators on the basis of a risk assessment taking into account the particular needs of the operation (as recommended by ICAO). Having said that, many major international airlines have them on all of their aircraft, but only two regulatory authorities are known to mandate them.

Ground-based medical support systems are widely used by airlines, especially by long haul aircraft, to provide advice to crew who are dealing with a medical emergency. The ground-based medical officer can provide invaluable advice to crew and to an on-board volunteer doctor (should one be available) since the ground-based medical officer is trained in the provision of aircraft related medical advice, knows exactly what is contained in a particular operator's on-board medical supplies and is aware of the medical facilities in the vicinity of the aircraft, should a diversion need to be considered.

A few airlines carry telemetry instruments, enabling medical data to be transmitted from the aircraft to a ground based station where analysis by specialists can be undertaken and advice provided. Although this technology may become more widely used in aviation in the future, it is still in its infancy and there are little data available to date on its use.

Principles concerning the provision of first aid and medical care on board aircraft.

- The emergency medical kit and other medical equipment is provided in order to respond to an unplanned medical emergency (not for medical needs that can be anticipated pre-flight, i.e. passengers with known medical conditions should bring their own medical supplies in their carry-on luggage and not rely on aircraft emergency equipment)

- It is the responsibility of the passenger to notify the airline in a timely manner, before flight, if he/she has a serious medical condition
- Relatively few major medical events occur in-flight, bearing in mind the large number of passengers carried
- It is not feasible to provide on a commercial airliner the equivalent of a ground-based medical care facility
- Cabin crew are trained in first aid and understand the aviation environment. They have sufficient knowledge of emergency equipment to support a volunteer medical professional
- Medical equipment carried on board must be justified in terms of cost/benefit, in the same way a health authority must decide what equipment or drugs it can afford.
- With adequate pre-flight preparation even those with serious medical conditions can fly safely
- Increased use of a medical “clearance to fly” (12) process by the treating physician would probably prevent many in-flight medical events that currently occur

Note: Many airlines provide detailed advice on their website for potential travelers with a medical problem and can provide advice to a treating physician if there is any doubt concerning fitness to fly.

Cabin Crew Training

The ICAO Standard that addresses cabin crew training states “An [aircraft] operator shall establish and maintain a training programme, approved by the State of the Operator, to be completed by all persons before being assigned as a cabin crew member. Cabin crew members shall complete a recurrent training programme annually.”

As is the case for the contents of on board medical supplies, the national regulatory aviation authority provides detailed requirements of the cabin crew training program. However, it should require cabin crew to be competent in the use of all emergency and lifesaving equipment that may be carried on board, such as first aid kits, medical kits, universal precaution kits (for use in the case of communicable disease) and AEDs. IATA provides a sample first aid and travel health syllabus for cabin crew training; this information can be found in the IATA Medical Manual (12). It strongly recommends scenario-based training for cabin crew that integrate the volunteer medical professional into the team. These recommendations are based on well-established training principles in the aviation sector and on guidelines developed through consensus.

Legal aspects ‘What is my liability if I provide assistance?’

There are a number of legal issues regarding in-flight medical events.

One that may be of most concern for assisting professionals is ‘what is my liability if I assist an ill traveler?’ There is no relevant international law and individual States have adopted different

approaches. To our knowledge, no individual physician has to date been sued for assisting an ill traveler, although a few airlines have been sued as a result of an in-flight medical event. If an airline requests in-flight medical assistance, it will normally accept the liability associated with this request. In fact, some airlines have a form that is made available to a treating physician that stipulates this specifically. However, an individual volunteer doctor is more likely to be uncertain of the legal situation when he offers to provide medical assistance and so the next topic 'checklist for assisting medical professionals' will cover this issue.

Another frequent question relates to death on board, which presents two different aspects. If resuscitation has been initiated, when should it be stopped? IATA has consulted medical and legal experts to produce guidelines for cabin crew that can also apply to assisting medical professionals. (13) These guidelines include the concept of 'presumed dead' when considering when to cease resuscitation. In order to stop resuscitation, an ill traveler has to be at least presumed dead and a medical professional can provide advice to this effect. Since the legal implications for declaring the death of a passenger varies from country to country, airlines have different policies. If a death has occurred, the assisting medical professional should limit his involvement to advising the cabin crew as to the event, deferring to the pilot in command the communication that will be made to ground based authorities and what further action need be taken on board.

Another question related to death on board concerns living wills or DNR (Do Not Resuscitate) instructions. Again there is no international law or case law that covers this issue. If it comes to the attention of a cabin crew that a passenger is not well but the attending family member presents a DNR order, most airlines, if not all, will refuse to recognize this order and may request medical assistance to provide resuscitation. The medical professional that comes forward has to decide if he/she wants to proceed with resuscitation according to his/her ethical values and legal knowledge about the situation (which is likely to be very limited). If the first medical professional decides against resuscitation, the cabin crew may ask for another medical professional depending on the particular airline's policy.

Guidance on management of in-flight medical events

Two hypothetical cases are described from the point of view of a volunteer physician. The chosen scenarios may also apply to other similar situations.

Unconsciousness

When a passenger loses consciousness, what should be done?

First, ask the cabin crew to stay with you for any assistance that you might require. Then proceed to assess the patient as you would normally do elsewhere. As the great majority of these incidents are benign, the result of vaso-vagal syncope, by the time you have confirmed that the passenger has a good pulse and is breathing normally, the passenger will likely have regained consciousness. A few

more minutes in a supine position and the passenger will be ready to return to his seat without further problem.

If the passenger does not regain consciousness quickly, ask the cabin crew to bring the emergency medical kit and the defibrillator if one is available; also ask if the airline has access to a medical ground provider. If so, ask him/her to initiate contact with that provider. Such providers can be an invaluable resource; they are usually qualified in emergency medicine, fully knowledgeable about the on board medical supplies and can assist with decisions concerning a diversion, if required.

If the medical kit has arrived and the passenger is still unconscious and medical ground support is not available, consult the list of contents of the medical kit to see if the medication you would like to use is in it. If it is, the cabin crew should be able to assist you to find it. For instance, if hypoglycemia is suspected, most kits will have intravenous glucose available.

If the passenger does not recover, and you suspect a major cardiac event, you have to assess to the best of your ability if the passenger will continue to deteriorate or not, and start considering a diversion. The captain has to be quickly informed to evaluate if a diversion is possible and if suitable medical facilities are available at the diversion point.

If the passenger's pulse ceases and there is no AED, begin CPR and ask the cabin crew to assist. You can expect that all cabin crew have been trained in CPR.

If an AED is available, at least one cabin crew member will be trained in its use and the airline protocol normally calls for them to manage the equipment. The volunteer physician is therefore not expected to take over the AED, but to provide other professional assistance such as setting up an intravenous line.

Assuming there is no close diversion point, the next question will be when to stop resuscitation. IATA in consultation with subject matter experts has developed guidance material for that situation. (13) You may consider familiarizing yourself with this information before you fly in case you find yourself in such a situation.

Suspected Communicable Disease

The same details about cabin crew support, medical equipment and ground support mentioned above also apply here.

If a passenger is coughing persistently ask the ill passenger to use a face mask that should be available in the medical kit and/or the first aid kit. Use of a face mask by the ill passenger is recommended by the World Health Organization (WHO) and most public health authorities.

If you suspect a significant communicable disease (not a common cold), advise the cabin crew immediately as they have to advise the pilot in command who in turn needs to advise the destination airport.

If several rows (at least 3) can be cleared of other passengers at the front or rear of a section of the aircraft, you may consider moving the ill passenger to this area in order to increase the distance between the affected individual and other passengers.

The cabin crew may have a procedure for managing such a case, but if they are uncertain, ask the ill passenger to remain in his seat except to go to the washroom and ask the cabin crew if they can designate a washroom for the use of the ill passenger only. Depending on the aircraft and the passenger load, that may or may not be possible.

If the ill passenger has frequent vomiting and/or diarrhea, the same principles (except face mask) apply.

IATA has guidelines for cabin crew on suspected communicable diseases that cover all the important steps. You may want to familiarize yourself with those before travelling. (14)

Below is a checklist developed by airline medical officers on a consensus basis for volunteer medical professionals. It provides advice that addresses questions that are most commonly raised by volunteers in the context of on board medical treatment.

Summary Checklist for volunteer medical professionals

This checklist is provided to assist volunteer medical professionals that consider responding to a request for medical assistance.

- Before flight, consider the possibility that you may be asked to provide on board medical assistance. If appropriate, consult your medico-legal insurance provider as to what cover is provided should you be involved in treating an individual during a flight. Consider carrying a copy of your medical license to practice.
- Decide if you are in a proper condition to respond to a medical emergency (e.g. if you have consumed a significant amount of alcohol, it may be inappropriate to respond to an emergency).
- Ask to see information provided by the airline to volunteer medical professionals (if available) e.g. information on liability
- Identify yourself and offer proof of credentials if you have them.
- If the situation appears to be serious, inquire if the airline has a contract with a medical ground support company. If so, ask that they be contacted to bring them into the loop as early as possible. Even if you are an emergency qualified physician the support of the ground company may become very helpful - in case of diversion for instance - since they are familiar with the availability of ground based medical facilities.

- Request the emergency medical kit if one is available (small aircraft or those flying short-haul routes may not have an emergency medical kit). Inquire if telemedicine equipment is available (although most aircraft do not have such facilities). If the ill traveler has arrested, the cabin crew will normally provide an AED when one is available. If not provided, ask if one is available.
- Request that at least one cabin crew member remain available to answer your questions, to help with procedures, to communicate with the pilots, etc.
- If necessary, ask for an interpreter.
- When possible and if appropriate, treat the traveler whilst seated. If he needs to be horizontal, request that he be transported to where the intervention will interfere the least with mobility of the other cabin crew and the passengers.
- If resuscitation is required and you are presented with a “Do Not Resuscitate” order by the accompanying family member or friend, first decide if that is acceptable to you; note that if it is, the cabin crew may decide to continue resuscitation on their own if it is their company policy and/or ask for another volunteer medical professional.
- Document your findings and treatment, preferably on the airline form if one is available. Keep your own personal copy.
- Do not attempt to practice beyond your level of expertise, but remember that whatever your level of expertise is, it is better than any non-health professional and your help may be very valuable.

Conclusion

While in-flight medical events may be relatively common, major medical emergencies are rare. Cabin crew are trained in first aid and will manage most medical events on their own. When a medical professional volunteers to help with a medical emergency, he should secure the assistance of at least one cabin crew member, request the medical kit and the AED if appropriate (and if one is available).

Good data on which to base objective decisions concerning international requirements for cabin crew training, on board medical supplies and procedures are currently lacking but experience of specialists working in the field indicates that most in-flight medical events are handled appropriately. Increased pre-flight use of existing guidelines by treating physicians, in collaboration with airline medical advisors, would prevent some in-flight medical emergencies. Passengers should be aware before travelling by air that there are some inherent risks involved and that they have the responsibility to plan for any known medical conditions. If adjustments to regulations are required, these are likely to appear first at a national level, before international action through ICAO is proposed. If agreed by a majority of States, changes to international requirements can be made.

References

1. Mattison MLP, Zeidel M. Navigating the challenges of in-flight emergencies. JAMA 2011; Published online May 6, 2011
2. Shaner DM, Up in the air-suspending ethical medical practice. N Engl J Med. 2010;363(21):1988-1989
3. Valani R, Cornacchia M, Kube D. Flight diversions due to onboard medical emergencies on an international commercial airline. Aviat Space Environ Med 2010;81(11):1037-1040
4. Sand M, Bachara FG, Sand D, Mann B. Surgical and medical emergencies on board European aircraft; a retrospective study of 10189 cases. Crit Care 2009;13:R3
5. Delaune EF, Lucas RH, Illig P. In-flight medical events and aircraft diversions: one airline's experience. Aviat Space Environ Med 2003;74: 62-68
6. Sirven JL, Claypool DW, Sahs KL, Wingerchuk DM, Bortz JJ, Drazkowski J, Caselli R, Zanick D. Is there a neurologist on this flight? Neurology 2002; 58: 1739-1744
7. Ruskin KJ. In-flight medical emergencies: time for a registry. Crit Care 2009;13(1):121
8. Mahony PH, Myers JA, Larsen PD, Powell DMC, Griffiths RF. Symptom-based categorization of in-flight passenger medical incidents. Aviat Space Environ Med 2011;82(12):1131-1137
9. De Maio VJ, Coyle D, Stiell IG, O'Grady Kathryn, Vaillancourt C, Nesbitt L, Well GA. Location-specific cost-effectiveness of public access defibrillation. SAEM annual meeting, 2006:Abstract 142
10. International Civil Aviation Organization, Montreal, Canada: Annex 6 – Operation of Aircraft 2010: Attachment B.
11. International Civil Aviation Organization, Annual Report to the Council 2010, Appendix 1. <http://www.icao.int/publications/Pages/annual-reports.aspx>, accessed November 2012
12. International Air Transport Association (IATA) Medical Manual, http://www.iata.org/whatwedo/safety_security/safety/health/Pages/index.aspx, accessed November 2012
13. IATA Guidelines for Death On Board http://www.iata.org/whatwedo/safety_security/safety/health/Pages/index.aspx accessed Nov. 2012
14. IATA Guidelines for Suspected Communicable Diseases <http://www.iata.org/whatwedo/safety/health/Pages/diseases.aspx>
15. Peterson DC, Martin-Gill C, Guyette FX, Tobias AZ, McCarthy CE, Harrington ST, Delbridge TR, Yealy DM. Outcomes of Medical Emergencies on Commercial Airline Flights. NEJM, 2013;368;22, 2075-2083