In-Flight Emergencies

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Epidemiology

- Prevalence: 1 in 604 flights

- Types of in-flight emergencies:
  - Syncope/near syncope (32-37%)
  - GI including nausea/vomiting (9-15%)
  - Cardiovascular (7%) including cardiac arrest (0.2%)
  - Other (Psych/intox, allergy, ob/gyn, unknown)

- Physicians provide assistance in 48% of in-flight medical emergencies

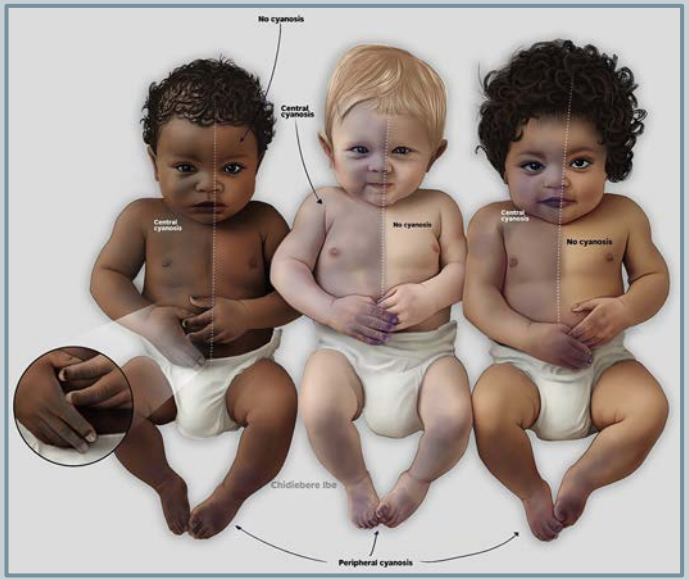
- 4-7% of IME required diversion

Pathophysiology: Low Cabin Pressure

- Cruising altitude is 30,000 to 40,000 ft, and passenger cabins are pressurized to an equivalent to **being at an altitude of 5000 to 8000 ft**.
- This lower pressure leads to expansion of closed gas-containing spaces in the body (eg, **sinuses, GI tract and middle ear**) and non-physiological gas collections (eg, pneumothorax)
- At 8000 ft of altitude, the volume of gas in an enclosed space **increases by approximately 30%**
- Altitude changes trigger discomfort in patients with existing URIs, including sinusitis or otitis media

Pathophysiology: Reduced Oxygen Partial Pressure

- Cabin has a lower partial pressure of oxygen at altitude, with resultant mild hypoxia in healthy passengers (**decreasing mean arterial oxygen saturation from 97% to 93%**)
- This effect can be more pronounced or symptomatic in passengers with **existing pulmonary conditions**.
- Passengers with hypoxia or respiratory insufficiency at baseline may benefit from **supplemental oxygen at cruising altitude**



Pathophysiology: VTE

- Prolonged sitting and hypoxia may trigger **decreased venous flow, systemic inflammation, and platelet activation**
- Symptoms of DVT or PE most commonly present **hours to days** after completing air travel but can occur on flights of long duration or during multiple flights in succession
- Risk for high-risk passengers may be up to 5% per flight
- **Symptomless VTE may occur in up to 10%** of passengers on long flights (>4 hours)

Pathophysiology: Environment

- Cabin air, drawn from an outside dry environment at altitude and pressurized and dehumidified by cycling through the engine compartment, **may contribute to dehydration among passengers**
- Recycling of air may also expose passengers to potential allergens, **even when the source of allergens is several rows away from a passenger (rare)**
- Although the enclosed and limited-space environment of aircraft raises concern for transmission of communicable diseases, **pre-existing exposure MAY be a more common infectious source** depending on the illness.

Good Samaritan Law

- protects passengers who provide medical assistance from liability **except in cases of gross negligence or willful misconduct**
- seeking compensation in return for providing aid may jeopardize your standing under existing immunity laws, although **no one has been sued as a result of it on a plane**
- United States, Canada, England, and Singapore, there is no legal duty to help
- Australia and much of Europe **requires physicians to render assistance**
- As of 2002, only 1 case has occurred in the US involving a physician being sued for assisting in an IME, and that case was **dismissed without hearing**
- **“What if I’ve been drinking or took an Ambien?”**

Good Samaritan Law

- **Bottom line:** There are **zero confirmed cases** of a physician being successfully sued for providing volunteer medical assistance during an in-flight emergency. While lawsuits can occasionally be filed, they've been dismissed.

- While you have theoretical legal exposure, the data shows that you are **infinitely** more likely to die in a plane crash than be sued for rendering aid.

- Combined with the legal duty to act in other countries and the moral obligation to do so, there are more ethico-legal reasons **to** provide care than to **not.**

Flight Kit Contents

Table 3. Contents of Emergency Medical Kits

	FAA-Mandated Emergency Medical Kit[a]	Additional Contents[b]
Equipment	Airways, oropharyngeal Adhesive tape, 1-in Alcohol sponges Cardiopulmonary resuscitation mask Intravenous administration set Needles Protective gloves Sphygmomanometer Stethoscope Syringes Tape scissors Tourniquet (for intravenous catheter placement) Manual resuscitation device, 3 masks Instructions on kit use	Burn dressings Cord clamps Disposable scalpel Endotracheal tubes Emergency tracheal catheter Glucometer Insulin syringe Laryngoscope blade Pulse oximeter Skin closure strips Thermometer Tourniquet (for hemorrhage control) Umbilical cord clamp Urinary catheter
Medications	Analgesic, nonnarcotic Antihistamine, 50 mg, injectable Antihistamine tablets, 25 mg Aspirin tablets, 325 mg Atropine, 0.5 mg, 5 mL Bronchodilator, inhaled Dextrose, 50%/50 mL, injectable Epinephrine, 1:1000, 1 mL, injectable Epinephrine, 1:10 000, 2 mL, injectable Lidocaine, 5 mL, 20 mg/mL, injectable Nitroglycerin tablets Saline solution, 500 mL	Antacid tablets (eg, calcium carbonate) Calcium chloride Chlorphenamine Cinnarizine Decongestant spray Dexamethasone Diazepam Diclofenac sodium, injectable Diclofenac sodium tablets Digoxin Dimenhydrinate Epinephrine autoinjector Fexofenadine Furosemide Glucose gel Glucagon Haloperidol Hydrocortisone Hyoscine Ibuprofen Ketorolac injectable Lorazepam Meclizine Methylprednisolone Metoprolol Morphine Nalbuphine Naloxone Ondansetron Oxytocin Promethazine

Approach

- **Captain is in Charge**

- In-flight emergencies rely on one large decision point: can the flight continue to its intended destination or does the situation require alternative landing plans, aka “diversion”?

- Pilot establishes radio or satellite telephone communications with the ground-based medical support

Approach

1. Identify yourself and report your training and current clinical practice.
2. Determine the type and duration of symptoms, presence of high-risk symptoms (eg, chest pain, shortness of breath, or focal weakness)
3. Vital signs (pulse, blood pressure, and respirations)
4. Mental status
5. Pertinent physical findings
6. The flight attendant should obtain the emergency medical kit, and oxygen should be administered to the person with the IME if needed
7. After gathering patient information, the flight attendant should establish contact with any ground-based medical support personnel available and relay this information, including any recommendations for therapeutic interventions or diversion concerns.
8. Airlines commonly have standardized forms to document care; health care professionals involved in IMEs should request and use these forms.

SYNCOPE / NEAR-SYNCOPE

30% of all in-flight emergencies

Initial assessment-suspect

- ☐ **Vasovagal:** Pale, diaphoretic, improves with simple measures in 15-30 min.
- ☐ **Cardiac cause (eg, myocardial infarction):** Chest pain, dyspnea, arm or jaw pain, persistent bradycardia.
- ☐ **Pulmonary:** Dyspnea, pleuritic chest pain.
- ☐ **Stroke:** Slurred speech, facial droop, or arm weakness.
- ☐ **Hypoglycemia:** Diaphoretic, cool skin; assess with glucometer if available.

Management and expected course

- ☐ **If unconscious ▶** Lie flat, elevate legs, apply oxygen. If no pulse or signs of life, follow cardiac arrest card.
- ☐ **If transient syncope ▶** Supine position, elevate legs. Oral fluids with head raised if nausea absent. If improves in 15-30 min, slowly sit up and return to seat if tolerated.
- ☐ **If hypoglycemia ▶** Oral glucose or 25 g of dextrose 50% intravenously.
- ☐ **If other conditions suspected ▶** Refer to relevant card.
- ☐ **If no improvement or not progressing as expected ▶** Contact ground-based medical support for additional recommendations.

CARDIOVASCULAR SYMPTOMS

7% of all in-flight emergencies

Initial assessment

- ☐ Identify if any prior myocardial infarction or other cardiovascular history.
- ☐ In some settings, a 12-lead electrocardiogram may be obtained and transmitted for ground review (and/or volunteer review if qualified to read).
- ☐ **Suspected acute coronary syndrome:** Chest pain, dyspnea, arm or jaw pain.
- ☐ **Suspected arrhythmia:** Persistent bradycardia, tachycardia, or irregular heartbeat.
- ☐ **Suspected dyspepsia:** Isolated epigastric burning with no associated symptoms. This is a consideration of exclusion, supported by history of similar symptoms.

Management and expected course

- ☐ **If suspected acute coronary syndrome ▸** Aspirin, 325 mg orally; nitroglycerin, 0.4 mg sublingually every 5-10 min (if systolic blood pressure is ≥ 100 mm Hg).
- ☐ **If any dyspnea or respiratory distress ▸** Give oxygen, unless saturations are known to be near or at normal levels.
- ☐ **If dyspepsia suspected ▸** Antacids or other analgesics can be given after appropriate risk stratification. Alternative causes should first be considered.
- ☐ **If persistent or additional symptoms ▸** Contact ground-based medical support for additional recommendations.

GASTROINTESTINAL ILLNESS

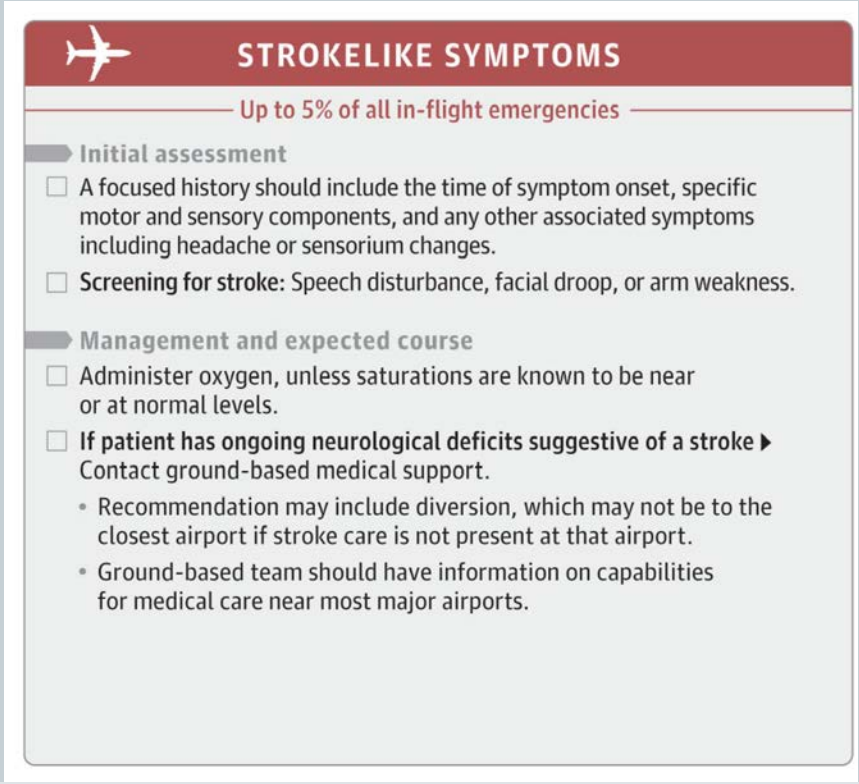
15% of all in-flight emergencies

Initial assessment

- ☐ Identify extent and timing of symptoms, including nausea, vomiting, diarrhea, bleeding, and specifics of any abdominal pain (location, quality, and severity).

Management and expected course

- ☐ **If nausea/emesis ▸** Use an oral antiemetic if available; if not tolerated, consider a parenteral antiemetic.
  - Provide oral hydration if tolerated.
  - Use sugar-containing liquids if symptoms of hypoglycemia.
  - If oral intake not tolerated, consider intravenous fluids.
- ☐ **If dyspepsia ▸** Use an antacid if available in the emergency medical kit.
- ☐ **If diarrhea ▸** Use an antidiarrheal if available in the emergency medical kit.
  - If patient has fever and persistent diarrhea (>14 d), contact ground-based medical support, as local public health authorities may need to be contacted at the destination.
- ☐ **If severe abdominal pain, tenderness on examination, rigid abdomen, or blood in bodily fluid ▸** Contact ground-based medical support for additional recommendations.


STROKELIKE SYMPTOMS
Up to 5% of all in-flight emergencies
Initial assessment
A focused history should include the time of symptom onset, specific motor and sensory components, and any other associated symptoms including headache or sensorium changes.
Screening for stroke: Speech disturbance, facial droop, or arm weakness.
Management and expected course
Administer oxygen, unless saturations are known to be near or at normal levels.
If patient has ongoing neurological deficits suggestive of a stroke ▸ Contact ground-based medical support.
Recommendation may include diversion, which may not be to the closest airport if stroke care is not present at that airport.
Ground-based team should have information on capabilities for medical care near most major airports.

RESPIRATORY DISTRESS

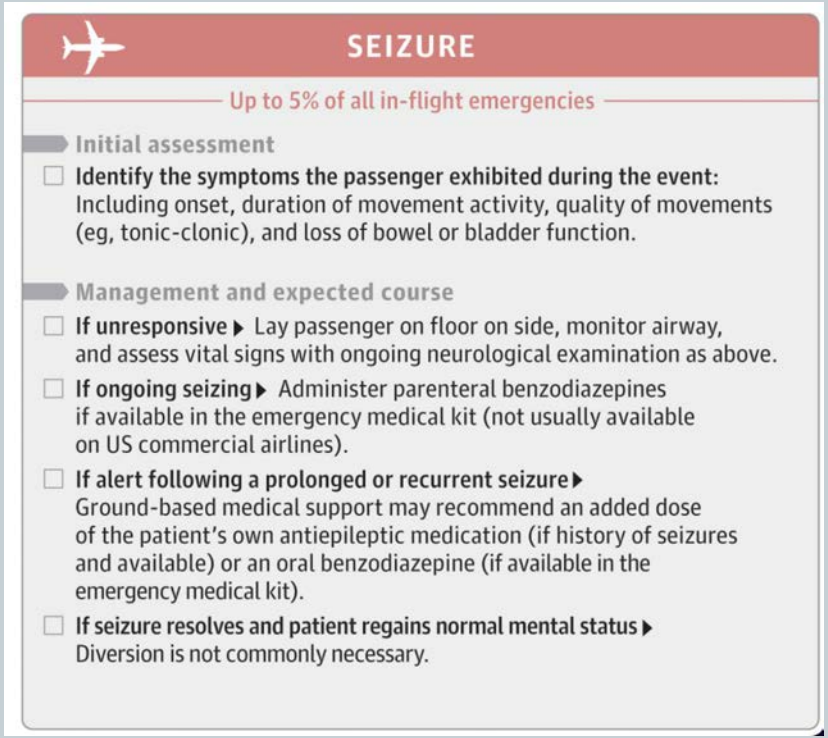
10% of all in-flight emergencies

Initial assessment

- ☐ Identify history of respiratory disease, scuba diving, extremity swelling, or infectious symptoms.
- ☐ If available, check pulse oximetry.

Management and expected course

- ☐ **If ongoing dyspnea or known oxygen saturation is <95%** ▸ Administer oxygen.
  - If passenger's portable oxygen concentrator fails or is not used for a patient with preexisting lung disease, consider trial of oxygen therapy.
  - If passenger uses ≥4 L/min on the ground, the onboard oxygen supply may not be enough to reverse hypoxia.
  - Monitor flow rate of oxygen administered; canister consumption is variable and aircraft may not have sufficient oxygen for continuous use for the duration of the flight.
- ☐ **If bronchospasm** ▸ Administer albuterol, 2.5 mg inhaled.
- ☐ **If allergic reaction** ▸ Refer to allergic reaction card.
- ☐ **If passenger does not improve** ▸ Contact ground-based medical support for additional recommendations.


SEIZURE
Up to 5% of all in-flight emergencies
Initial assessment
Identify the symptoms the passenger exhibited during the event:
Including onset, duration of movement activity, quality of movements (eg, tonic-clonic), and loss of bowel or bladder function.
Management and expected course
If unresponsive ▸ Lay passenger on floor on side, monitor airway, and assess vital signs with ongoing neurological examination as above.
If ongoing seizing ▸ Administer parenteral benzodiazepines if available in the emergency medical kit (not usually available on US commercial airlines).
If alert following a prolonged or recurrent seizure ▸
Ground-based medical support may recommend an added dose of the patient's own antiepileptic medication (if history of seizures and available) or an oral benzodiazepine (if available in the emergency medical kit).
If seizure resolves and patient regains normal mental status ▸
Diversion is not commonly necessary.

TRAUMA

5% of all in-flight emergencies

Initial assessment

- [ ] Assess all injuries for any open wounds, tenderness, deformity, or active bleeding.
- [ ] Assess patients with injury to the head, neck, or back for any neurological symptoms.

Management and expected course

- [ ] **Injuries from falling luggage** ▸ Typically minor and may be assessed further at the destination.
- [ ] **Active bleeding** ▸ Control bleeding with direct pressure using a gloved hand.
- [ ] **Ongoing heavy extremity bleeding** ▸ Consider applying a tourniquet.
- [ ] **Suspected long bone or joint injuries** ▸ Splinting material is not commonly found in the emergency medical kit, but may be improvised from available equipment (eg, a U-shaped half-rolled magazine secured with tape will make a good forearm or wrist splint).

ALLERGIC REACTION

2% of all in-flight emergencies

Initial assessment

- ☐ Identify any known or likely allergen exposure; duration and severity of symptoms; and any airway swelling, respiratory involvement, or signs of systemic reaction such as generalized hives.
- ☐ **Suspected local allergic reaction:** Localized pruritic rash or isolated hives.
- ☐ **Suspected anaphylaxis:** Airway swelling, respiratory distress, generalized hives, hypotension, nausea/vomiting.

Management and expected course

- ☐ **If local allergic reaction ▸** Diphenhydramine, 25-50 mg in adults or 1 mg/kg in children orally.
  - If unable to tolerate oral ingestion, diphenhydramine intravenously/intramuscularly at above dose.
  - Try a different histamine blocker if available in the emergency medical kit.
- ☐ **If anaphylaxis ▸** Epinephrine, 1 mg/mL (0.3 mL in adults, or 0.15 mL in children intramuscularly), diphenhydramine, and steroids if available in the emergency medical kit. Epinephrine may be available as an autoinjector or in an ampoule to be drawn up via syringe.
- ☐ **If there is no improvment ▸** Contact ground-based medical support for additional recommendations.

PSYCHIATRIC SYMPTOMS

Up to 3% of all in-flight emergencies

Initial assessment

- ☐ Aim to create a rapport with the passenger to deescalate the situation.
- ☐ Elicit information and consider the passenger's use of mood-altering substances.
- ☐ Identify if patient takes specific psychiatric medications, dosing, last dose taken, and if available on aircraft.

Management and expected course

- ☐ **If verbal deescalation ineffective** ▶ Consider a benzodiazepine if available from an extended emergency medical kit.
  - Benzodiazepines are not commonly available in the emergency medical kit and are infrequently necessary even when available.
- ☐ **If combative** ▶ Refer to flight crew for individual airline security protocols, which take precedence over attempts at medical management.
  - Airline security protocols vary by airline and may include restraining the passenger or diverting the aircraft for the safety of other passengers and crew.

OBSTETRIC EMERGENCIES

1% of all in-flight emergencies

Initial assessment

- ☐ Identify onset and detailed description of symptoms, along with information about the pregnancy (eg, parity, gestational age, and any preceding complications).
- ☐ **Vaginal bleeding:** Assess duration and severity (ie, equivalent of pads per h).
- ☐ **Labor suspected:** Regular contraction, gush of vaginal fluid.

Management and expected course

- ☐ **If vaginal bleeding <1 pad per h ▸** Expectant management is common.
- ☐ **If preterm labor in third trimester ▸** Place the passenger on left side and consider fluid intravenously if any concerns exist for blood loss or distress.
- ☐ **Active labor, ongoing/severe vaginal bleeding, or increasing/severe abdominal pain ▸** Contact ground-based medical support for additional recommendations.

SUBSTANCE ABUSE AND WITHDRAWAL

Up to 3% of all in-flight emergencies

Initial assessment

- ☐ Identify type, amount, and timing of substances used.
- ☐ Identify symptoms and mental status, along with vital signs.
- ☐ **Suspected opioid ingestion:** Altered mentation, constricted pupils, respiratory depression.
- ☐ **Suspected alcohol ingestion:** Altered mentation, slurred speech, behavior changes.
- ☐ **Suspected stimulant ingestion:** Altered mentation, tachycardia, dilated pupils, agitation.

Management and expected course

- ☐ **If normal vital signs and no respiratory compromise** ▶ Observation only.
- ☐ **If suspected opioid ingestion with respiratory depression** ▶ Naloxone, 0.4-0.8 mg intravenously or 2 mg intramuscularly/intranasally.
- ☐ **If suspected alcohol overdose** ▶ Observe and provide antiemetic therapy.
- ☐ **If suspected stimulant ingestion** ▶ Observe and hydrate (for tachycardia). Consider benzodiazepine if available from the emergency medical kit.
- ☐ **If ongoing respiratory distress or combativeness** ▶ Contact ground-based medical support for additional recommendations. Refer to airline crew for individual airline security protocols.

CARDIAC ARREST

0.2% of all in-flight emergencies

Initial assessment

- [ ] Check breathing and pulse; limit pulse checks to <10 seconds.

Management and expected course

- [ ] **If no pulse or signs of life ▶**
  - Start chest compression-only cardiopulmonary resuscitation, with addition of bag-valve-mask ventilation (30 compressions to 2 ventilations) when the emergency medical kit is available and someone skilled is present.
  - Obtain and apply automated external defibrillator as soon as possible and follow instructions for defibrillation.
  - If no shock is advised, or AFTER a shock is delivered, resume cardiopulmonary resuscitation if there is no pulse.
  - If no response to cardiopulmonary resuscitation and automated external defibrillator, initiate an intravenous line. Administer epinephrine (0.1 mg/mL) 1 mg intravenously, along with consideration of causal reversible conditions such as hypovolemia and tension pneumothorax.
- [ ] Instruct flight crew to notify the ground team and pilot if not already done. If no shock is delivered, the decision to divert will be influenced by how long ongoing cardiopulmonary resuscitation exists without return of circulation.

Differential Diagnoses ("Worst First")

- Syncope or near syncope
  - Worst: ACS, PE, arrhythmia, hypoxia, hypoglycemia, toxic exposure
  - Common: Vasovagal, dehydration, medication reaction
- Chest pain
  - Worst: ACS, PE, pneumothorax, bronchospasm, aortic dissection
  - Common: GERD, MSK, anxiety
- Shortness of breath
  - Worst: COPD, asthma, pneumonia, PE, toxic exposure, allergic reaction
  - Common: panic attack, asthma, COPD
- Stroke-like symptoms
  - Worst: CVA, TIA, hypoglycemia, seizure, intracranial mass
  - Common: syncope, medication reaction, complex migraine
- GI symptoms
  - Worst:pancreatitis, medication/substance withdrawal, toxicity, DKA
  - Common: Motion sickness, foodborne illness, gastritis, enteritis, GERD

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References

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