

In-flight Cardiorespiratory Emergencies: Respiratory Care above 30,000 Feet

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Alberto Santos Dumont (1873-1932)



Paris, France, Oct 19th, 1901



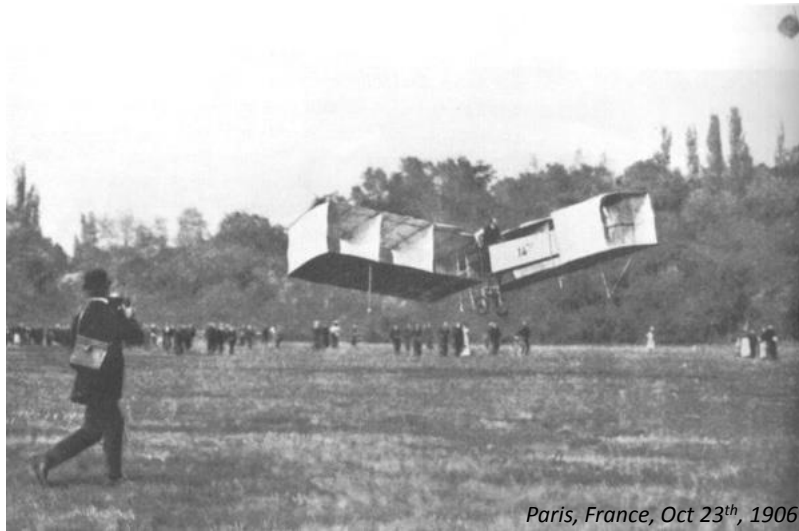
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Paris, France, Oct 23th, 1906



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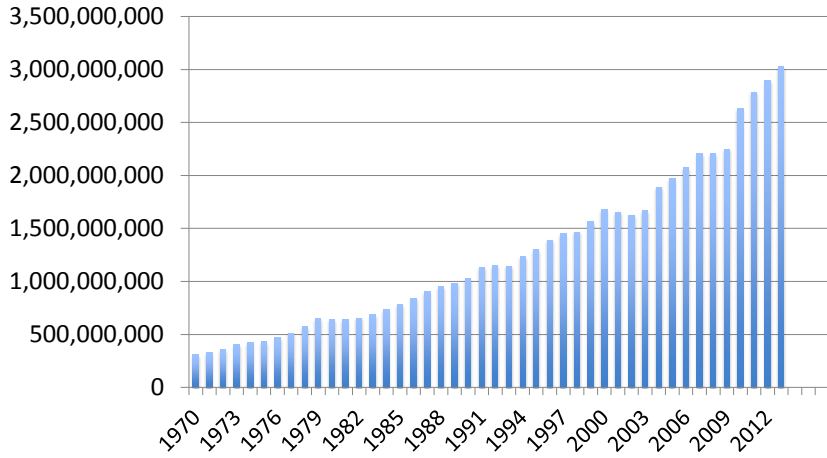


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Air Transport (Passengers Carried Worldwide)



Data Source: The World Bank



Commercial Air Travel



- Bigger planes
- More people
- Longer routes
- More time in the air
- Something is bound to happen



Commercial Air Travel

- Lower air humidity
- Dehydration
- Changes in cabin pressure
- Hypoxia, hypoxemia
- Hyperventilation
- Altitude sickness
- Confined environment
- Crowded conditions
- Decreased mobility
- White noise
- Dimmed lights
- Limited resources
- Delayed access to definitive care



At Cruising Altitude



- Cruising altitude
 - 32,000 to 43,000 ft
- Cabin altitude
 - 6,000 to 8,000 ft
- PAO₂ at sea level
 - ~100 mmHg
- PAO₂ at cruising altitude
 - 72 to 64 mmHg



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 PEDIATRIC EMERGENCY CARE
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Commercial airline travel decreases oxygen saturation in children

ANDY P. LEE, MD, LOREN G. YAMAMOTO, MD, MPH, MBA, NATALIE L. RELLES, MD

BMJ 1998;316:887-94

Effect of exposure to 15% oxygen on breathing patterns and oxygen saturation in infants: interventional study

K J Parkins, C F Poets, L M O'Brien, V A Stebbens, D P Southall



In-Flight Respiratory Issues

- Bronchospasm (asthma)
- COPD
- Croup
- Cough
- Pneumonia
- Aspiration
- Anaphylaxis
- Sinus decompression
- Respiratory distress
- Pulmonary embolism
- Hypoxemia
- Pulmonary hypertension
- Pneumothorax
- Respiratory arrest



The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Outcomes of Medical Emergencies on Commercial Airline Flights

Drew C. Peterson, M.D., Christian Martin-Gill, M.D., M.P.H.,
Francis X. Guyette, M.D., M.P.H., Adam Z. Tobias, M.D., M.P.H.,
Catherine E. McCarthy, B.S., Scott T. Harrington, M.D.,
Theodore R. Delbridge, M.D., M.P.H., and Donald M. Yealy, M.D.

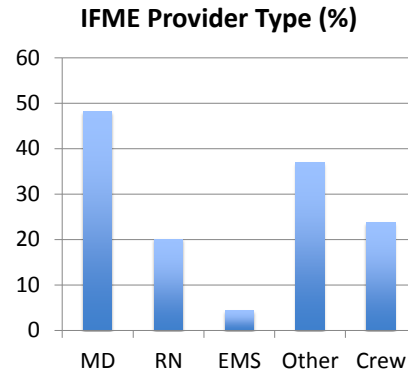
N Engl J Med 2013;368:2075-83.

DOI: 10.1056/NEJMoa1212052



IFME Characteristics

- 11,920 IFME
- 16 IFME / 1 million pax
- 1 IFME / 604 flights
- Mean age 48 ± 21 yrs
- Age range (14d to 100 yrs)
- Aircraft Diversion: 7.3%



N Engl J Med 2013;368:2075-83



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Table 1. In-Flight Medical Emergencies According to Medical-Problem Category and Outcome.

Category	All Emergencies	Aircraft Diversion	Transport to a Hospital ^a	Hospital Admission [†]	Death
All categories	11,920/11,920 (100)	875/11,920 (7.3)	2804/10,877 (25.8)	901/10,482 (8.6)	36
Syncope or presyncope	4463/11,920 (37.4)	221/4463 (5.0)	938/4252 (22.1)	267/4123 (6.5)	4
Respiratory symptoms	1447/11,920 (12.1)	81/1447 (5.6)	311/1371 (22.7)	141/1336 (10.6)	1
Nausea or vomiting	1137/11,920 (9.5)	56/1137 (4.9)	243/1025 (23.7)	61/994 (6.1)	0
Cardiac symptoms	920/11,920 (7.7)	169/920 (18.4)	370/813 (45.5)	162/770 (21.0)	0
Seizures	689/11,920 (5.8)	83/689 (12.0)	224/626 (35.8)	75/602 (12.5)	0
Abdominal pain	488/11,920 (4.1)	50/488 (10.2)	164/412 (39.8)	41/391 (10.5)	0
Infectious disease	330/11,920 (2.8)	6/330 (1.8)	45/239 (18.8)	8/232 (3.4)	0
Agitation or psychiatric symptoms	287/11,920 (2.4)	16/287 (5.6)	38/249 (15.3)	17/244 (7.0)	0
Allergic reaction	265/11,920 (2.2)	12/265 (4.5)	40/233 (17.2)	8/229 (3.5)	0
Possible stroke	238/11,920 (2.0)	39/238 (16.4)	92/214 (43.0)	46/196 (23.5)	0
Trauma, not otherwise specified	216/11,920 (1.8)	14/216 (6.5)	34/185 (18.4)	5/180 (2.8)	0
Diabetic complication	193/11,920 (1.6)	15/193 (7.8)	45/181 (24.9)	13/172 (7.6)	0
Headache	123/11,920 (1.0)	10/123 (8.1)	23/108 (21.3)	4/107 (3.7)	0
Arm or leg pain or injury	114/11,920 (1.0)	6/114 (5.3)	27/100 (27.0)	4/98 (4.1)	0
Obstetrical or gynecologic symptoms	61/11,920 (0.5)	11/61 (18.0)	29/53 (54.7)	11/47 (23.4)	0
Ear pain	49/11,920 (0.4)	1/49 (2.0)	2/43 (4.7)	1/43 (2.3)	0
Cardiac arrest	38/11,920 (0.3)	22/38 (57.9)	14/34 (41.2)	1/6 (16.7)	31
Laceration	33/11,920 (0.3)	1/33 (3.0)	3/26 (11.5)	0/25	0
Other	821/11,920 (6.9)	62/821 (7.6)	162/705 (23.0)	36/679 (5.3)	0
Unknown	8/11,920 (0.1)	0/8	0/8	0/8	0

Contents of Emergency Medical Kits

Airways, oropharyngeal	Analgesic, non-narcotic
Adhesive tape, 1-inch	Antihistamine, 50 mg, injectable
Alcohol sponges	Antihistamine tablets, 25 mg
CPR mask	Aspirin tablets, 325 mg
IV administration set	Atropine, 0.5 mg, 5 cc
Needles	Bronchodilator, inhaled
Protective gloves	Dextrose, 50% / 50 cc, injectable
Sphygmomanometer	Epinephrine 1:1000, 1 cc, injectable
Stethoscope	Epinephrine 1:10,000, 2 ml, injectable
Syringes	Lidocaine, 5 ml, 20 mg/ml, injectable
Tape scissors	Nitroglycerine tablets
Tourniquet	Saline solution, 500 cc
Manual resuscitation device with 3 masks	
Basic instructions on use of the kit	

Enhanced Medical Kit

Burn dressings	Calcium chloride	Morphine
Cord clamps	Diazepam	Nalbuphine
Disposable scalpel	Digoxin	Naloxone
Endotracheal tubes	Glucose gel	Promethazine
Emergency tracheal catheter	Furosemide	Sodium bicarbonate
Glucometer	Lorazepam	
Laryngoscope blade	Haloperidol	
Steri-strips	Hydrocortisone	
Thermometer	Meclizine	
Tourniquet	Methylprednisolone	
Urinary catheter	Metoprolol	

Lightening Rod Effect

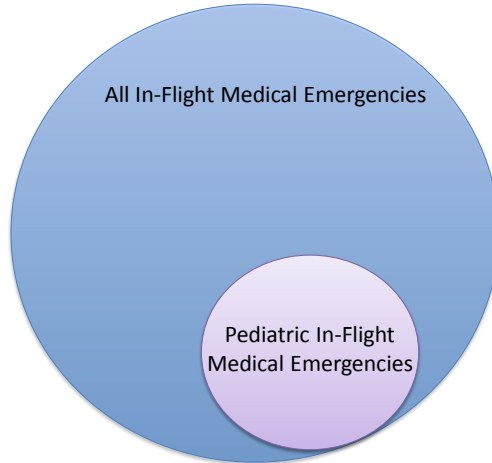
1. The febrile, irritable, mottled infant
2. The child dancer with leg pain
3. The intoxicated anesthesiologist
4. The suicidal Englishman
4. The ectopic vs ruptured ovarian cyst
5. The diaphoretic overweight man with chest pain
6. The bald, unconscious man with a midline scar
7. The apneic lady



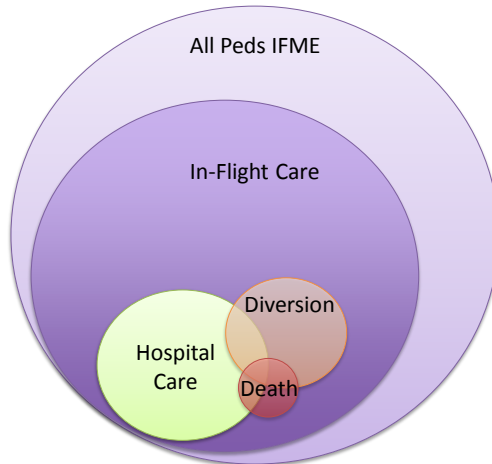
Pediatric In-Flight Emergencies

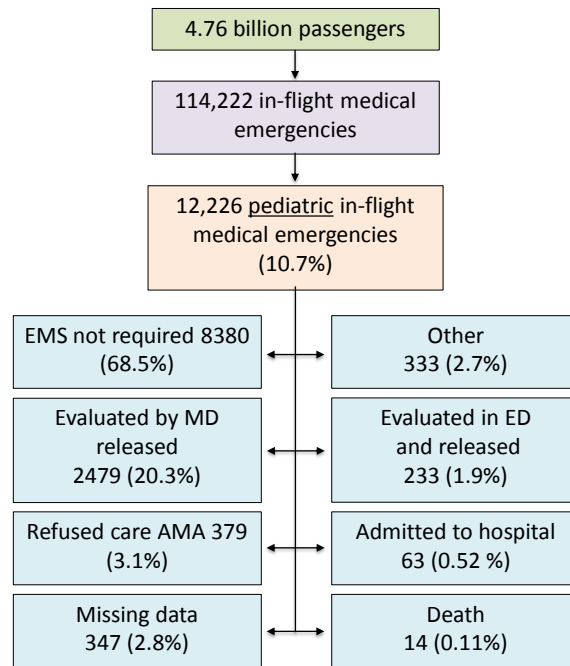


Pediatric In-Flight Emergencies



Pediatric In-Flight Emergencies

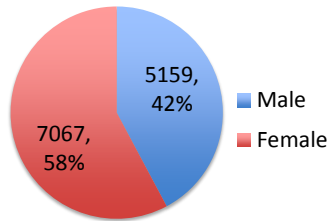




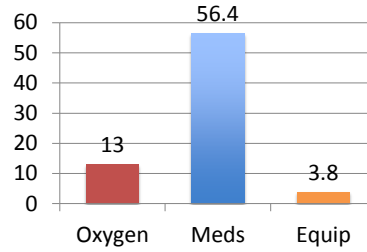
Diagnostic Category	N (%)
Gastrointestinal	4311 (35.3%)
Infection/fever	2469 (20.2%)
Neurologic	1486 (12.2%)
Allergic	1052 (8.6%)
Respiratory	770 (6.3%)
ENT	598 (4.9%)
Trauma	241 (2%)
Dermatologic	216 (1.8%)
Psychiatric	189 (1.5%)
Burns	156 (1.3%)
Orthopedic/musculoskeletal	135 (1.1%)
Cardiac	104 (0.8%)
Dental	71 (0.6%)
Endocrine	52 (0.4%)
Other	376 (3.1%)

Pediatric In-Flight Emergencies

Gender

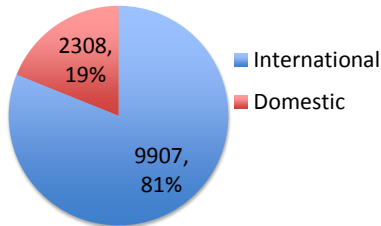


Medical Kit Use (%)

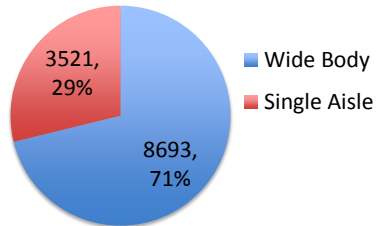


Pediatric In-Flight Emergencies

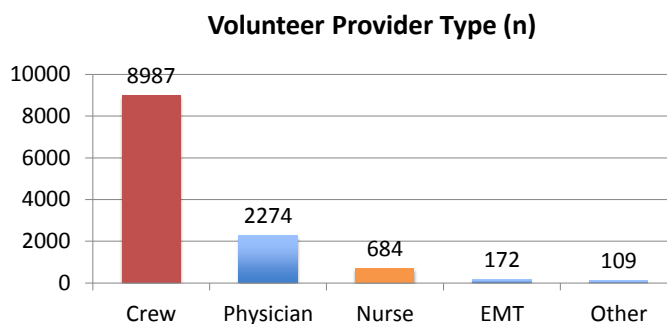
Route



Aircraft Type



Pediatric In-Flight Emergencies



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Pediatric In-Flight Emergencies

Need for Aircraft Diversion (n=115, 0.94%)	Odds Ratio (95% CI)
Emergencies Involving Infants	3.65 (2.25-5.93)
Assisted by Physician Volunteer	8.47 (5.21-13.75)
Total Flight Duration	0.997 (0.995-0.998)
Flight Time Remaining	1.004 (1.003-1.005)



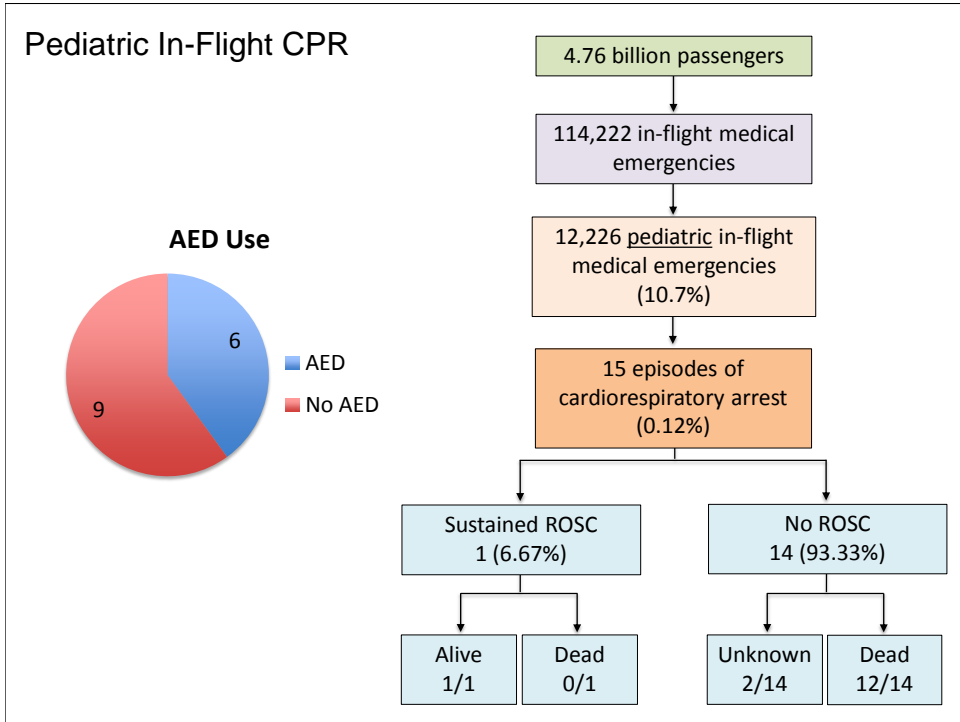
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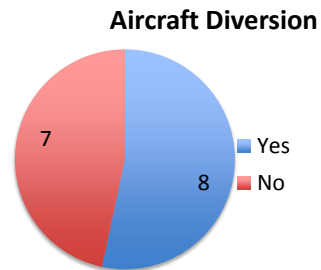
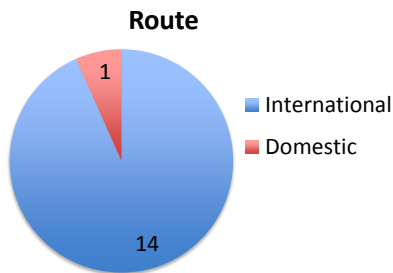
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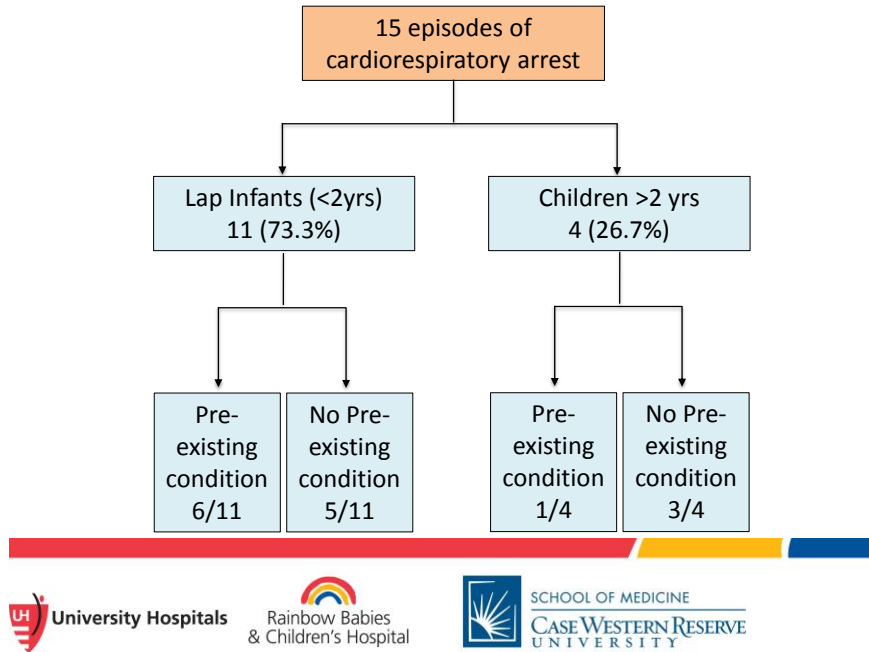
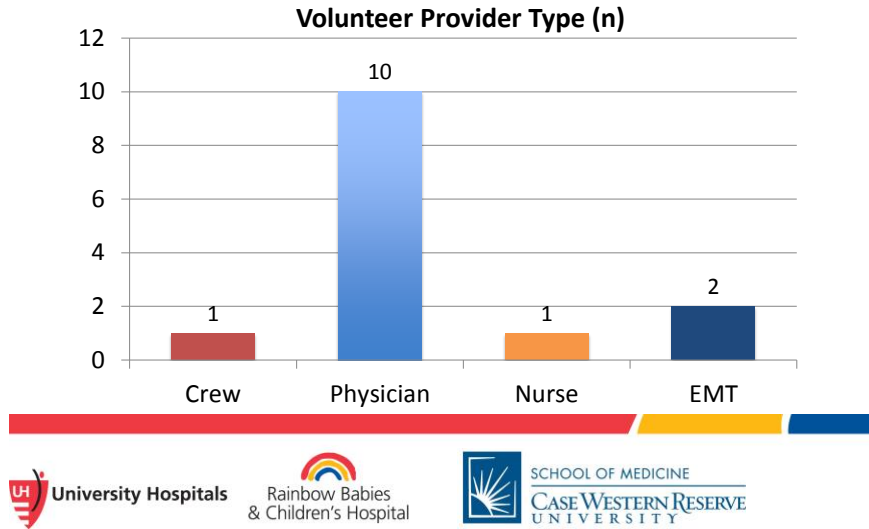
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Pediatric In-Flight CPR



Pediatric In-Flight CPR





Online Brief Report

Fatalities Above 30,000 Feet: Characterizing Pediatric Deaths on Commercial Airline Flights Worldwide*

Alexandre T. Rotta, MD, FCCM^{1,2}; Paulo M. Alves, MD, MSc³; Katherine E. Mason, MD^{1,2};
Neil Nerwich, MD⁴; Richard H. Speicher, MD^{1,2}; Veerasathpurush Allareddy, BDS, MBA, PhD, MMSc⁵;
Veerajalandhar Allareddy, MD, MBA^{1,2}

Pediatr Critical Care Med 2014; 15:e360-e363



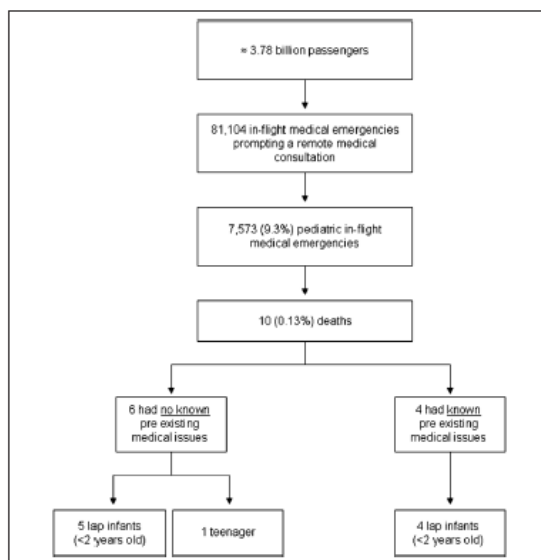
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Case	Age	Gender	Responder	Automated External Defibrillator	Supplemental Oxygen	Region	Diversion	Original Flight Duration (hr)	Time Into Flight (hr)	Previous Medical History
1	15 yr	Male	Crew	Yes	Yes	Middle East	No	2.5	1.1	No
2	2 mo	Female	Nurse	No	No	Middle East	Yes	7.95	4.42	No
3	6 mo	Male	Physician	Yes	No	Middle East	Yes	6.92	4.05	Unspecified; traveling accompanied by an MD
4	2 mo	Female	Physician	No	No	Middle East	Yes	3.25	1.7	Truncus arteriosus
5	3 mo	Male	Physician	No	No	European Union	Yes	10.13	1.58	No
6	2 mo	Female	Crew	Yes	Yes	Middle East	No	8.22	2.62	No
7	1 mo	Female	Physician	Yes	No	North America	No	4.88	3.3	Cardiomegaly; traveling for treatment
8	4 mo	Male	Emergency medical technician	No	No	North America	No	5.7	5.13	No
9	14 mo	Male	Physician	No	Yes	Middle East	No	13.73	11.77	No
10	12 mo	Female	Physician	No	Yes	Middle East	Yes	7.13	6.6	High fever, vomiting, and diarrhea



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My 2 Cents

- Stay hydrated
- No “diuretics”
 - ETOH
 - Coffee
- Caution if pre-existing
 - Anemia
 - Cardio-pulmonary disease
 - Pulmonary hypertension
- Carry-on your medications
- Medical alert bracelet
- Got oxygen?
- Consider the no “lap infant” rule
- No children on aisle seat
- Properly restrain your children



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Questions?

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