Medical Events Encountered at a Major International Airport and Health Services Provided

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INTRODUCTION:	Travel by airline starts and ends at airports. Thousands of people consisting of passengers, relatives of passengers, and
	employees gather at airports every day. In this study, medical events (MEs) encountered at Istanbul Atatürk Airport (IAA)
	and health services provided were analyzed.

- **METHODS:** The MEs encountered in IAA between January 1, 2016, and December 31, 2018, and health services provided by the private medical clinic in the airport terminal building were retrospectively analyzed.
- **RESULTS:** During the study period, 192,500,930 passengers traveled from the IAA and a total of 11,799 patients were seen at the clinic. There were 4898 (41.5%) male patients. The median age of the 9466 (80.2%) patients whose age was recorded was 34 (28–51) yr. Of 11,799 patients included in the present study, 9228 (78.21%) patients had medical complaints, 1122 (9.5%) patients had trauma complaints, 1180 patients (10%) were transferred to the hospital, and 269 (2.27%) patients required a certificate of preflight fitness. The most common medical complaint was gastrointestinal (1515 patients, 12.84%). The most common trauma was soft tissue injury (345 patients, 2.92%).
- **DISCUSSION:** MEs in airports can be as various and also critical as health conditions seen in emergency departments. It is important to provide medical services with an experienced medical team trained in aviation medicine and adequate medical equipment at airports.
- **KEYWORDS:** airport, air travel, emergency medicine events, prehospital emergencies.

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The number of passengers traveling with airlines is increasing every year for reasons such as transportation speed, comfort, and increased accessibility compared to previous years.^{12,13} This increase in passengers is likely to be associated with an increase of accompanying relatives and friends, and an increase of airport employees, potentially leading to an increase of medical events (MEs).^{9,18} The identification of MEs encountered at airports will guide future health planning. The present study aimed to analyze MEs encountered at a major international airport, Istanbul Ataturk Airport (IAA), and to demonstrate the health services provided by an airport medical clinic in airport terminal building and the necessity of such a clinic.

METHODS

Subjects

At the time of the study, IAA was the largest airport in Turkey with domestic and international flights. Analysis of MEs encountered

and medical services provided in IAA has not been performed so far. This is a retrospective, descriptive, observational study that evaluates the MEs encountered at IAA between January 1, 2016, and December 31, 2018, and the medical services provided by the private medical clinic within the airport. Approval was obtained from the ethics committee of Ankara City Hospital before the study (E.Board-E1-21-1790).

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Procedure

Medical services in IAA were provided by a private medical clinic that provides medical services inside the airport terminal building and campus and 24/7 health services to passengers, accompanying relatives and friends of passengers, and airport personnel. The cost of health care provided by the private health clinic was paid by patients. The medical team consisting of doctors, paramedics, emergency medical technicians, nurses, laboratory technicians, and X-ray technicians was working in the clinic 24/7. X-ray and laboratory services were available in the clinic. MEs in the IAA terminal building are reported to the clinic by security guards, airline staff, and those who witnessed the incident by radio or telephone, and the clinic medical team walks to the scene or travels by ambulance, according to the distance of the local area where the ME occurred. In addition, patients could come to the clinic on their own or be brought over by witnesses of the incident. MEs occurring before takeoff or during flight were reported by aircraft staff to the airport traffic control tower or directly to the clinic and the patient was met at the gate of arrival or aircraft parking apron.

Ambulance transport service was provided to passengers who arrived by air for treatment in hospitals in Istanbul for definitive treatment, who needed to be transported from the airport to hospitals. Similarly, passengers who needed to be transported from the hospital to the airport by ambulance accompanied by medical personnel were transferred to the plane by ambulance. In the present study, this group of patients was categorized as aeromedical evacuation patients. Patients in this category were kept under observation at the airport clinic in cases of flight delay, delayed boarding time, or difficulty in transfer by ambulance, and were treated by airport clinical staff if a new medical condition developed during monitoring. If necessary, certificates of preflight fitness were provided to passengers suffering acute medical events at the airport, or when asked for by the boarding or check-in control team at the airport due to a pre-existing medical condition, by the private clinic located in the airport terminal building.

Electronic medical registration forms were filled out for each patient with information, including demographic characteristics, the place where the incident occurred, complaints, diagnosis and treatment, outcome, and transfer-to-hospital data. Electronic medical records recorded between 2016-2018 were collected from the airport medical clinic. While electronic medical records of patients were taken from the airport clinic, personal information such as patients' identity, addresses, and phone numbers were protected by obscuring. Patient registration forms were retrospectively assessed. Patients with appropriately filled out medical registration forms were enrolled. The examinations of the personnel who applied for routine examination or control other than MEs were excluded from the study. Patients with insufficient data (duplicated or missing parameters, including demographic characteristics, complaints, and the place where the incident occurred) were not included in the study. The demographic characteristics, complaints, outcome, location of the MEs of the patients included in the study, the place where the incident occurred,

the medical complaints of the passengers applying for a certificate of preflight fitness, and whether they were ineligible for the flight were analyzed. The MEs were categorized as medical complaints (nontrauma) and trauma. Patients ages 18 yr and over (including 18 yr old) were considered adult, and patients under the age of 18 were considered children.

Statistical Analysis

Descriptive statistics were used to present the data set. Continuous variables were expressed as median (interquartile range, IQR). Categorical data were shown as frequencies and percentages. Normality of the continuous variables was tested with both calculation of skewness-kurtosis and histogram plots. The Statistical Package for the Social Sciences for Windows, version 22 (IBM, Armonk, NY, United States) was used for the statistical analyses.

RESULTS

During the study period, 192,500,930 passengers traveled from IAA and a total of 11,799 patients were seen at the clinic. There were 4898 (41.5%) male patients and 4767 (40.4%) female patients. The gender of 2134 (18%) patients was not recorded. Of the patients whose age was recorded, 1039 (10.9%) were pediatric and 8427 (89.02%) were adult. The median age of the 9466 (80.2%) patients whose age was recorded was 34 (28–51) yr.

Of 11,799 patients included in the present study, 9228 (78.21%) patients had medical complaints, 1122 (9.5%) patients had trauma complaints, 1180 patients (10%) were transferred to the hospital, and 269 (2.27%) patients required a certificate of preflight fitness (**Table I, Table II, Table III, Table IV**).

The most common medical complaints, respectively, were gastrointestinal (1515 patients, 12.84%), cardiovascular (1450 patients, 12.28%), and syncope/presyncope/fainted (1217 patients, 10.31%). The most common gastrointestinal complaint was gastroenteritis/food poisoning/nausea or vomiting (972 patients, 8.23%) (Table I, Table III, Table IV). The most common traumas, respectively, were soft tissue injury (345 patients, 2.92%), falls (318 patients, 2.69%), head trauma (177 patients, 1.50%), and superficial laceration-abrasion (120 patients, 1.01%) (Table II, Table III, Table IV).

A total of 51 (0.43%) cardiac arrests happened (13 cardiac arrests happened in aircraft while 38 happened in the airport terminal building). Of the 51patients (0.43%) who required cardiopulmonary resuscitation (CPR), 35 patients were transported to the hospital, 10 patients died at the scene in spite of CPR, and the results of 6 patients were not recorded (Table I, Table III). When medical teams arrived at the scene, eight patients (0.06%) had developed signs of death, were pronounced dead, and no CPR was performed (Table I). Two patients developed respiratory arrest inside an aircraft; however, the outcome for these patients was not recorded, (Table I).

Symptoms of 2365 (20.04%) patients occurred immediately before departure (during passenger boarding, in the aircraft parking area on the apron, in the bellows or gate areas) or

COMPLAINTS/SYMPTOMS	N	(%)*
Gastrointestinal	1408	(15.2)
Gastroenteritis/food poisoning/nausea or vomiting	952	(10.31)
Abdominal and pelvic pain	233	(2.52)
Gastritis/epigastric pain/reflux/bloating/constipation	200	(2.16)
Gastrointestinal/hemorrhoids, related bleeding, others	23	(0.24)
Syncope/presyncope/feel faint	1164	(12.61)
Cardiovascular	1130	(12.24)
Hypertension/hypotension	697	(7.55)
Chest pain	267	(2.89)
Cardiac arrest	16	(0.17)
Other cardiovascular complaints	150	(1.62)
Infectious	936	(10.14)
Sore throat/flu symptoms/sinusitis/tonsillitis/fever	871	(9.42)
Chicken pox/possible MERS/other contagious disease	14	(0.15)
Soft tissue infection, other infectious complaints	51	(0.55)
Psychiatric (anxiety/panic attack/hysterical	845	(9.15)
reaction, others)		
Neurological	691	(7.48)
Headache/dizziness	476	(5.15)
Seizures/febrile convulsion	165	(1.78)
Possible stroke/loss or change of consciousness	18	(0.19)
Other neurological complaints	32	(0.34)
Alcohol/drug-related complaints	303	(3.28)
Otolarvngology (epistaxis/earache/barotrauma, others)	289	(3.13)
Musculoskeletal (muscle pain/joint pain/low back pain others)	284	(3.07)
Respiratory	271	(2.93)
Shortness of breath/asthma/COPD exacerbations	229	(2.48)
Pneumonia/bronchitis/pulmonary edema	40	(0.43)
Respiratory arrest	2	(0.02)
Endocrinology (diabetic/hyperglycemia/	177	(1.91)
hypoglycemia. others)		(
Urological (uretheric colic, urinary tract infection, other)	147	(1.59)
Obstetric/gynecological (pregnancy/possible abortion others)	137	(1.48)
Alleray (allergic reactions/urticaria)	112	(1.21)
Ophthalmological	43	(0.46)
Postoperative complications	25	(0.10)
Environmental injuries (insect/tick/scornion bite/	10	(0.27)
sting, others)	15	(0.20)
Deceased patients (death was pronounced or confirmed)	8	(0.08)
Dermatology	7	(0.07)
Others (complaints that do not comply with any system)	475	(5.14)
Patients required aeromedical evacuation	535	(5.79)
Not recorded	222	(2.40)

COPD: Chronic obstructive pulmonary disease; MERS: Middle East respiratory syndrome.
*Percentage rates were calculated using the total number of patients in the table as the denominator.

immediately after landing (in the aircraft parking area on the apron, in the bellows or gate areas). A total of 9428 (79.9%) patients' complaints occurred in the airport campus and other areas within the terminal building. Data about the location of six MEs (0.05%) were missing. There were 7674 (65.03%) patients who were treated at the scene or in a medical clinic inside the terminal building and discharged.

The most common MEs that caused transfer to the hospital were cardiovascular complaints (308 patients, 26.10%) and trauma (286 patients, 24.23%). The cardiovascular complaint that was the most common cause of referral was chest pain

Table II. Trauma-Related Complaints.

COMPLAINTS/SYMPTOMS	N	(%)*
Soft tissue injury	303	(27.00)
Fall	279	(24.86)
Head trauma	120	(10.69)
Superficial lacerations/abrasions	114	(10.16)
Burns/scald	52	(4.63)
Bone fracture	39	(3.47)
Dressing	37	(3.29)
Strains and sprains	36	(3.20)
Traffic accidents	33	(2.94)
Joint dislocation	28	(2.49)
Fight injury	21	(1.87)
Superficial scalp lacerations	13	(1.15)
Hemorrhage	8	(0.71)
Cat/dog bite/scratches	5	(0.44)
Eye injury	4	(0.35)
Self-harming with a sharp instrument	4	(0.35)
Ring tourniquet syndrome	4	(0.35)
Work accident	3	(0.26)
Deep lacerations/limb arterial laceration	3	(0.26)
Falling from escalator	3	(0.26)
Nasal fracture	2	(0.17)
Foreign body in soft tissue	2	(0.17)
Dental fractures/subluxation	2	(0.17)
Tendon laceration/ligament rupture	2	(0.17)
Electrical injuries/lightning	1	(0.08)
Blunt abdominal trauma	1	(0.08)
Golf cart crash inside the airport	1	(0.08)
Foreign body in respiratory tract	1	(0.08)
Spine trauma	1	(0.08)
Total	1122	(100)

*Percentage rates were calculated using the total number of patients in the table as the denominator.

(220 patients, 18.64%). The most common trauma that caused transfer to the hospital was possible bone fracture (64 patients, 5.42%) (Table III).

A total of 1795 (15.21%) patients refused treatment and recommendations of medical teams. There were 511 (4.33%) emergency medical incidents cancelled before the arrival of medical teams following notification; in some cases, the patient had left the scene.

Of patients who required a certificate of preflight fitness, 67 (24.90%) patients asked for preflight fitness for pre-existing medical conditions and 202 (75.09%) patients required a certificate of preflight fitness due to acute/subacute MEs. The reasons for applying for preflight fitness due to acute/subacute MEs, respectively, were diseases of the respiratory system (28 patients, 10.4%), infectious diseases (26 patients, 9.66%), and obstetric/ gynecological conditions (24 patients, 8.92%) (Table IV). Of the passengers, 23 (8.55%) were ineligible for the flight. The most common reason for ineligibility for flight was infectious diseases (10 patients, 3.71%). The most common infectious disease that was not suitable for the flight was chicken pox (7 patients, 2.60%).

DISCUSSION

The present study documents the wide range of MEs encountered at an airport and might help designing and staffing

Table III. Clinical Complaints of Patients Transferred to Hospital.

COMPLAINTS/SYMPTOMS		(%)*
Trauma-related complaints	286	(24.23)
Bone fracture	64	(5.42)
Head trauma	53	(4.49)
Fall/falling from height	45	(3.81)
Soft tissue injury/fight injury	45	(3.81)
Traffic accidents	41	(3.47)
Joint dislocation/amputation	13	(1.10)
Other trauma-related complaints	25	(2.11)
Medical (nontrauma) complaints		
Cardiovascular	308	(26.10)
Chest pain	220	(18.64)
Cardiac arrest	35	(2.96)
Hypertension/hypotension	22	(1.86)
Other cardiovascular complaints	31	(2.62)
Neurological	169	(14.3)
Possible stroke/loss or change of consciousness	83	(7.03)
Seizures/febrile convulsion	68	(5.76)
Dizziness	6	(0.50)
Other neurological complaints	12	(1.01)
Gastrointestinal	94	(7.96)
Abdominal and pelvic pain	59	(5.0)
Gastroenteritis/food poisoning/nausea or vomiting	13	(1.10)
Gastrointestinal bleeding	10	(0.84)
Other gastrointestinal complaints	12	(1.01)
Obstetric/gynecological (pregnancy/delivery/possible	53	(4.49)
abortion/preterm birth, vaginal bleeding, others)		
Respiratory	49	(4.15)
Shortness of breath/asthma/COPD exacerbations	34	(2.88)
Pulmonary edema, spontaneous pneumothorax, others	15	(1.27)
Syncope/presyncope/feel faint	48	(4.06)
Psychiatric (anxiety, psychosis, hysterical reaction, others)	41	(3.47)
Endocrinology (diabetic/hyperglycemia/ hypoglycemia, others)	25	(2.11)
Alcohol-drug related complaints	24	(2.03)
Infectious (fever/flu symptoms/sinusitis/ tonsillitis, others)	17	(1.44)
Musculoskeletal	13	(1.10)
Otolaryngology	8	(0.67)
Urological	5	(0.42)
Allergy (allergic reactions/urticaria)	4	(0.33)
Other (complaints that do not comply with any system)	22	(1.86)
Not recorded	14	(1.18)
Total	1180	(100)

COPD: Chronic obstructive pulmonary disease.

*Percentage rates were calculated using the total number of patients in the table as the denominator.

medical support facilities for air hubs. In this study, the most common medical complaints were gastrointestinal. As mentioned in previous studies, gastrointestinal complaints are common issues both during and after travel.^{3,25} Lo et al. also reported the top three ground-based MEs in airports were associated with neurological, gastrointestinal, and trauma-related conditions.¹⁶ Cummins et al. also reported gastrointestinal complaints as the second most common MEs encountered at the airport and in flight.⁷ During travel, infectious or noninfectious causes can lead to gastrointestinal symptoms.³ Both before and during the trip, provision of advice about preventive medication, dietary precautions (foods, beverages, water-borne risks), and sanitation is recommended.^{7,26}

 Table IV.
 Pre-Flight Medical Evaluation.

COMPLAINTS/SYMPTOMS	N	(%)*
Preflight fitness medical evaluation for pre-existing	67	(24.90)
medical conditions		
Preflight medical evaluation due to acute/		
subacute MEs.		
Trauma-related complaints	21	(7.80)
Fall/soft tissue injury/superficial lacerations/abrasions	8	(2.97)
Bone fracture	6	(2.23)
Head trauma	4	(1.48)
Other traumas	3	(1.11)
Medical (nontrauma) complaints		
Respiratory	28	(10.40)
COPD/asthma exacerbations/shortness of breath	25	(9.29)
Other respiratory complaints	3	(1.11)
Infectious	26	(9.66)
Chicken pox	14	(5.20)
Fever	6	(2.23)
Sore throat and flu symptoms/sinusitis/tonsillitis	3	(1.11)
Other contagious infectious complaints	2	(0.74)
Urinary tract infection	1	(0.37)
Obstetric/gynecological	24	(8.92)
Psychiatric	22	(8.17)
Neurological	19	(7.06)
Cerebrovascular disease	5	(1.85)
Seizures	4	(1.48)
Headache/dizziness	4	(1.48)
Numbness in a limb	1	(0.37)
Loss/change of consciousness	1	(0.37)
Hemiplegia with tracheostomy	1	(0.37)
Other neurological complaints	3	(1.11)
Gastrointestinal	13	(4.83)
Gastroenteritis/other gastrointestinal complaints	10	(3.71)
Abdominal and pelvic pain	2	(0.74)
Cirrhosis	1	(0.37)
Cardiovascular	12	(4.46)
Post-operative complications	8	(2.97)
Syncope/presyncope	5	(1.85)
Endocrinology (diabetic, hyperglycemia,	5	(1.85)
hypoglycemia, others)		
Allergy	3	(1.11)
Alcohol-drug related complaints	1	(0.37)
Otolaryngology	1	(0.37)
Ophthalmological	1	(0.37)
Not recorded	2	(0.74)
Other (complaints that do not comply with any system)	11	(4.08)
Total	269	(100)

*Percentage rates were calculated using the total number of patients in the table as the denominator.

A remarkable finding of the current study was related to psychiatric complaints. It has been reported that stress factors during travel can cause a wide spectra of mental decompensation.²³ Cwinn and colleagues found that psychological complaints account for 5% of the medical incidents at the airport.⁸ During the preflight or postflight period, many physiological stresses, the chaos, and the unusual social environment in the airport are possible causes which may be associated with psychological complaints.^{6,20,23} Having units to guide and provide support to passengers at airports can minimize the psychological stress to which passengers are exposed.²¹

The number of cardiopulmonary arrest incidents and deceased patients in this study was low and is consistent with

previous travel reports.^{10,11,19} Cwinn et al. reported a rate of cardiac arrest at the airport about four times higher than the rate found in this study.⁸ Public settings are the locations where adult out-of-hospital cardiac arrest occurs the second most frequently.²⁷ Increased incidence of out-of-hospital cardiac arrest in crowded public transport areas such as airports and railway stations, especially during rush hour, has been reported, and many of these patients are expected to survive with bystander intervention; therefore, availability of medical services on site, automated external defibrillators on platforms or in trains, and maintenance of CPR training are necessary.^{11,17,22}

Approximately one-fifth of the MEs (20%) encountered in the present study occurred immediately before the flight (during passenger boarding, in the aircraft parking area on the apron, in the bellows or gate areas) or immediately after the flight (inside the aircraft, during passenger landing, in the aircraft parking area on the apron, at the bellows or gate areas). Lo et al. reported that approximately 90% of emergency medical incidents occurring at the aircraft.¹⁶ Training of cabin crew, boarding crew, and the check-in control team for detection of passengers who have health problems or are ineligible for the flight might prevent unintended consequences of in-flight MEs, including aircraft diversion or re-entry.

The most common cause of transfer to hospital was chest pain and was consistent with previous reports.⁸ Long-distance brisk walks inside the airport terminal building, baggage handling, psychological stressors and excitement, and physiological changes in the in-flight cabin environment can precipitate coronary symptoms.^{1,5} Making arrangements for both minimizing stressors that can precipitate coronary symptoms at airports and facilitation of definitive preflight diagnosis of patients with chest pain at the airport clinic might minimize the undesirable effects.

As mentioned in previous studies, the present study also had emergency calls that were canceled when passengers refused medical care.⁸ Providing on-site medical care is important in reducing the burden of unnecessary ME calls on local emergency medical services.⁸

There were passengers who came by air to hospitals in Istanbul for the definitive treatment of their disease and had to be transferred by ambulance accompanied by medical personnel or vice versa (in the present study, this group of patients was categorized as aeromedical evacuation patients). After the flight, the stability of these patients may deteriorate due to the in-cabin environment, or they may be kept under observation at the airport clinic due to delays in flight plans or disruptions in the transfer to the hospital by ambulance and may have to be treated by airport clinical staff. In designing and staffing of medical support facilities for air hubs, such patients should also be taken into account.

In the current study, there were passengers who applied for flight eligibility due to their acute or chronic illness, and some of these patients were not medically fit to travel by air. In the current study, respiratory symptoms were the most common reason for applying for medical clearance. Passengers with respiratory disease may be exposed to medical challenges such as hypoxemia and respiratory distress due to the hypobaric cabin environment in aircraft.^{4,9} A decision regarding suitability for air travel should consider (careful evaluation) a passenger's respiratory condition and significant comorbidities with history and physical examination.⁴ Further assessment by a pulmonologist/respiratory specialist is advised for passengers who are deemed too risky to travel by air.⁴

Moreover, changes in the in-flight cabin environment during travel with the airline can adversely affect passengers who have recently been hospitalized, or have acute or chronic health problems, and the severity of the disease may increase.^{2,14,24} Assessment for a certificate of preflight fitness of passengers with health problems before air travel by doctors experienced in aviation medicine might minimize the deterioration of the passengers' health during the flight and prevent possible risks.^{2,14,15}

The main limitations of this study were retrospective design and limitation of data with a single airport. The patients who refused service, left the scene, or were referred to the hospital did not have a definitive diagnosis and result. It was not recorded whether the patients were passengers, airport employees, or relatives of passengers. It was not recorded that the health events that occurred inside the aircraft were before takeoff or after landing. Information regarding the initial cardiac rhythm (ventricular fibrillation/pulseless ventricular tachycardia/pulseless electrical activity/asystole) of patients who received CPR or use of automated external defibrillators or witness status of the ME were missing.

In conclusion, airports are places where a large number of people gather every day and can encounter specific MEs. MEs in airports can be as various and critical as health conditions seen in emergency departments. It is important to provide medical services from an experienced medical team trained in aviation medicine (to assess passengers' preflight fitness, to minimize deterioration of passengers' health during the flight, and to prevent possible risks) and to have adequate medical equipment at airports.

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