REUE | Original Article

Health emergencies attended by spanish health professionals on commercial flights

Samuel Cabrera Paz[1], Adriana Coello Graffigna[1], Eva Padrón Fontes[1], María Náyade Simón Martín[1], Juan Ignacio Herranz Duarte[1,2], Sebastián Matos Castro[1,3]

BACKGROUND AND OBJECTIVE. Health care professionals who travel on commercial flights may come into contact with various types of health emergency. Spain does not have data on such encounters, however, and the international literature on the subject is scarce. The aim of this study was to estimate the incidence and describe the characteristics of health emergencies attended by Spanish doctors and nurses on commercial flights.

MATERIAL AND METHODS. A questionnaire was developed in November 2022 and posted on Google Docs to survey Spanish health professionals who had traveled on a commercial flight within the past 5 years. We collected data describing the respondents and their work, the types of health emergency attended, and the outcomes.

RESULTS. A total of 863 health professionals responded; 93.5% were nurses. The respondents reported flying a mean (SD) 4.11 (5.19) times per year; in the 5-years before the survey, their trips on domestic flights were more common (mean, 8.57 [14.36] flights) than international ones. A health emergency was witnessed by 23.9% of the respondents (49.1% of the doctors and 22.1% of the nurses; *P* = .001). Involved were a total of 268 emergencies, 57.8% and 35.1% on international and domestic flights, respectively. Most flights (88.8%) continued on to their destinations, and there were no differences between international and domestic flights in that respect (*P* = .23). On landing, 49.3% of the patients were discharged from care, and 44% were transferred to a hospital. Hospital transfer was significantly more common when flights were diverted for an emergency landing (90%, *P* = .001). Most travelers requiring in-flight care had cardiovascular events (62.7%); syncope was the most common type (46.6%). Allergic reactions were the most frequent diagnosis on flights inside Spain. All other diagnoses were more common on international flights. Two deaths (0.7%) were reported. The emergencies that were most associated with need for an emergency landing were cardiorespiratory arrests (50%), other cardiovascular events (17.9%), neurologic events (17.4%), and psychiatric crises (11.8%).

CONCLUSION. More information about health problems that occur on commercial flights is needed for planning training for health professionals that considers the specific pathophysiologic variables affected by high altitudes.

Keywords: Emergency health services. Commercial flights. Health personnel.

Urgencias sanitarias en vuelos comerciales atendidas por personal sanitario español

INTRODUCCIÓN. Los profesionales sanitarios (PS) que viajan en vuelos comerciales pueden encontrarse diferentes emergencias sanitarias. Sin embargo, no existen datos sobre ello en España, así como escasa bibliografía a nivel internacional. El objetivo de este estudio es conocer la incidencia y características de las urgencias sanitarias ocurridas en vuelos comerciales (USVC), atendidas por personal de enfermería y médico españoles.

MATERIAL Y MÉTODOS. Encuesta en línea mediante Google-docs realizada en noviembre de 2022, dirigida a profesionales sanitarios españoles que hubiesen realizado algún vuelo comercial en los últimos 5 años. Se recogieron datos epidemiológicos y laborales de los profesionales, tipo de emergencia sanitaria atendida y resultado final de la misma.

RESULTADOS. Respondieron 863 profesionales sanitarios (93,5% enfermeros/as), que volaron 4,11 ± 5,19 veces al año, con más frecuencia en vuelos nacionales (8,57 ± 14,36). El 23,9% presenció alguna USVC, más habitualmente los médicos (22,1% *vs* 49,1, p = 0,001). Se analizaron 268 asistencias sanitarias, ocurridas fundamentalmente en trayectos internacionales (57,8%) y nacionales (35,1%). El 88,8% de los vuelos prosiguieron su trayecto, sin diferencias significativas en función del tipo de vuelo (p = 0,23). Al aterrizar, el 49,3% fueron dadas de alta y el 44% se trasladaron a centros sanitarios. Esto fue más frecuente en los vuelos que se desviaron de su itinerario (90%, p = 0,001). El principal motivo de USVC fueron las patologías de tipo cardiovascular (62,7%), fundamentalmente síncopes (46,6%). En todos los grupos diagnósticos hubo más incidencia en los vuelos internacionales, salvo en las reacciones alérgicas, las cuales fueron más frecuentes en los vuelos nacionales. Se comunicaron 2 fallecimientos (0,7%). Las patologías más asociadas al desvío del vuelo fueron las paradas cardiorrespiratorias (50%), la patología cardiovascular (17,9%), las de tipo neurológico (17,4%) y las psiquiátricas (11,8%).

CONCLUSIONES. Es preciso mejorar el conocimiento sobre las USVC, para planificar formación específica de los PS, debido a la fisiopatología inherente a la altitud, y el difícil entrono al que se enfrentan.

Palabras clave: Emergencias sanitarias. Vuelos comerciales. Profesionales sanitarios.

Author Affiliations: [1]Departamento de Enfermería, Facultad de Ciencias de la Salud, Universidad Europea de Canarias, La Orotava, Tenerife, Spain. [2]Servicio de Urgencias Canario, Helicóptero Medicalizado de Santa Cruz de Tenerife, Spain. [3]Centro de Salud La Laguna-Mercedes, Gerencia de Atención Primaria de Tenerife, Servicio Canario de la Salud, Spain.
Corresponding Author: Sebastián Matos Castro. Departamento de Enfermería. Universidad Europea de Canarias. España.
E-mail: taburiente1966@hotmail.com
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Introduction

In recent decades, commercial air travel has increased substantially. In 2021, Spanish airports served 120 million passengers[1]. The aircraft cabin is a physiologically hostile environment due to reduced partial pressure of oxygen, lower ambient humidity and temperature, and secondary expansion of gases.[2,3] In addition, emotional stress, fear of flying, and—on long-haul flights—phenomena related to venous stasis and immobility may occur.[4]

There are few studies on medical emergencies during commercial flights (in-flight medical emergencies, IFME), and official data from airlines are also scarce;[5,6] information is occasionally reported in the press, usually when a flight is diverted.[7-9]

The objective of this study was to determine the incidence and characteristics of IFME attended by Spanish nurses and physicians, their typology, and outcomes.

Materials and methods

We conducted an investigator-designed online survey between November 1st and 17th, 2022, targeting Spanish health professionals (HPs) who had been on at least 1 commercial flight in the previous 5 years (2018–2022).

Collected variables for respondents included sociodemographics (age, sex, profession, employment status), workplace (service/unit and years of experience), number and type of trips taken (interisland, domestic, and international), flight type on which the emergency occurred, type of emergency attended, and on-board medical equipment used. If more than one emergency had been attended, respondents were asked to complete details for up to 3 care episodes in which they were involved.

IFME were grouped per Martin-Gill *et al.* classification: substance abuse, cardiovascular, cardiac arrest (CA), gastrointestinal, gynecologic, neurologic, psychiatric, allergic reactions, respiratory, syncope, trauma, and urologic.[10] Logistic variables included flight outcome (diversion yes/no) and patient disposition (discharged in situ, left against medical advice, transported on landing, or deceased). Finally, using a 5-point Likert scale (from "not adequate" to "very adequate"), HPs rated the available/used on-board equipment, whether any equipment or drugs were lacking, and their self-perceived quality of medical care.

Quantitative variables are expressed as mean and standard deviation; inter-group comparisons used Student t tests. Qualitative variables are presented as counts and percentages; comparisons used chi-square tests (or Fisher's exact test when required). A P value < .05 was considered statistically significant. Statistical analyses were performed with SPSS v.28.0.1 (IBM, Armonk, NY, USA).

Results

A total of 913 HPs completed the survey; 50 had not flown in the last 5 years, yielding a final sample of 863 HPs (806 nurses—93.4%—and 57 physicians—6.6%). Women comprised 91.1% overall, with a higher proportion in nursing (P = .001). Mean age was 30.42 ± 7.42 years, and overall work experience was 7.28 ± 7.17 years; both were significantly higher among physicians. Of participants, 92.7% were actively employed. Workplace distribution: 61.6%, hospital; 16.9%, primary care; 4.6%, EMS; and 16.9%, other. Respondents flew 4.11 ± 5.19 times per year; over the last 5 years, domestic flights were most frequent (8.57 ± 14.36), followed by international (5.61 ± 11.49), with greater frequency among physicians. Overall, 23.9% had witnessed an IFME, more often among physicians than nurses (49.1% vs 22.1%, P = .001) (Table 1).

Respondents reported attending 268 IFMEs over the last 5 years, mainly on international (57.8%) and domestic (35.1%) routes. In 88.8% of flights, the journey continued without diversion, with no significant differences by flight type (P = .23). Upon arrival, 49.3% of patients were discharged on site and 44% were transported by ambulance to health facilities; the latter was more frequent when the flight had been diverted (90%, P = .01). Two deaths were reported (0.7%) (Table 2).

The main reason for in-flight care was cardiovascular disease (62.7%), primarily syncope (46.6%) (Table 3). Most events occurred on international flights (57.8%), followed by domestic (35.1%). All diagnostic groups were more frequent on international flights except allergic reactions, which were more common domestically. The 4 CAs oc-

Table 1. Demographic, occupational, and flight characteristics of respondents

	Total N = 863	Nurses N = 806	Physicians N = 57	P Value
Age [mean (SD)]	30.42 (7.42)	30.0 (7.15)	35.84 (7.41)	.001
Sex				.001
Female	786 (91.1)	743 (92.2)	43 (75.4)	
Male	77 (8.9)	63 (7.8)	14 (24.6)	
Years of work experience [mean (SD)]	7.28 (7.17)	7.09 (7.02)	10.02 (8.63)	.003
Employment status				.051
Active	800 (92.7)	745 (92.4)	55 (96.5)	
Retired	3 (0.3)	2 (0.2)	1 (1.8)	
Unemployed	60 (7)	59 (7.4)	1 (1.8)	
Workplace				.001
Primary care	140 (16.2)	130 (92.9)	10 (7.1)	
Primary care emergency	6 (0.7)	5 (83.3)	1 (16.7)	
EMS	40 (4.6)	28 (70)	12 (30)	
Hospital care	301 (34.9)			
Hospital emergency	149 (17.3)	139 (93.3)	10 (6.7)	
Intensive care	81 (9.4)	76 (93.8)	5 (6.2)	
Other	146 (16.9)	141 (96.6)	5 (3.4)	
Average number of flights per year [mean (SD)]	4.11 (5.19)	3.98 (5.09)	6 (6.28)	.003
International flights in the last 5 years [mean (SD)]	5.61 (11.49)	5.36 (11.43)	9.12 (11.84)	.017
Domestic flights in the last 5 years [mean (SD)]	8.57 (14.36)	8.24 (14.32)	13.32 (18.23)	.011
Interisland flights in the last 5 years [mean (SD)]	4.58 (11.34)	4.44 (11.16)	6.61 (13.7)	.16
Have you witnessed a medical emergency during a flight?				
Yes	206 (23.9)	178 (22.1)	28 (49.1)	.001
No	657 (76.1)	628 (77.9)	29 (50.9)	
Number of medical emergencies witnessed, [mean (SD)]	1.33 (0.7)	1.22 (0.5)	2.04 (1.14)	.001

SD: standard deviation; EMS: Emergency Medical Service.

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Table 2. Logistic characteristics of flights with in-flight medical assistance

Flight Type	n (%)	Decision on the flight n (%)			Patient's final destination n (%)				
		Continued flight	Diverted flight	*P* Value		Total	Continued flight	Diverted flight	*P* Value
Interisland	19 (7.1)	16 (84.2)	3 (15.8)	.23	Discharged	132 (49.3)	132 (55.5)	0	.0
National	94 (35.1)	80 (85.1)	14 (14.9)		Voluntary discharge	16 (6)	14 (5.9)	2 (6.7)	
International	155 (57.8)	142 (91.6)	13 (8.5)		Transferred by ambulance	118 (44)	91 (38.2)	27 (90)	
Total	268	238 (88.8)	30 (11.2)		Deceased	2 (0.7)	1 (0.4)	1 (3.3)	

curred equally on domestic and international flights. Conditions most often prompting diversion were CA (50%), cardiovascular disease (17.9%), neurologic (17.4%), and psychiatric conditions (11.8%).

Overall, 92.5% of professionals required medical equipment to attend the patient. Available on-board equipment was rated adequate (score ≥ 3) in 66.8% of cases (Figure 1A). Nevertheless, 41.7% reported missing some equipment or medication during care (Figure 1B). Regarding self-assessment of performance level and outcome, 93% rated their care as at least "average," and 73.2% as "adequate" or "very adequate" (Figure 1C).

Discussion

It is estimated that 1 medical emergency occurs on 1 in every 650 flights or 16 cases per million passengers.[10] Thus, in 2021 alone, based on the 120 million passengers cited above, Spain would have had approximately 1,900 IFMEs.[1] Other studies report incidences up to 130 IFMEs per million passengers. Our sample of 298 cases, therefore, seems representative of IFME attended by Spanish HPs. To our knowledge, this is the first study to address such emergencies in Spain; moreover, few studies have analyzed the entire university-trained health workforce rather than physicians alone.[11] However, the COVID-19 pandemic during the study period—initial lockdown and subsequent mobility restrictions—likely reduced cases in 2020, so the real IFME incidence may be higher than observed.

Providing medical care as a physician or nurse on a commercial aircraft is challenging. Noise, confined space, and aircraft movement complicate history-taking, examination, diagnosis, and treatment. Additionally, the clinician is outside the usual work setting, and the presence of passengers can heighten stress. Nearly 1 in 4 HPs had attended an IFME in the last 5 years outside their professional activity. These findings support implementing, within Health Sciences curricula, specific training on high-altitude physiology, common conditions in commercial flights, and the unique aspects of care in this hostile environment—one in which HPs are unaccustomed to practicing.[11,12] The presence of family members, other passengers, and crew can also influence the clinician's actions and decisions.

As in other international reports, syncope/presyncope was the most frequent IFME (46.6%), slightly higher than Peterson *et al.* (37.5%) for flights between 2008 and 2010,4 and the 2018 review by Martin-Gill (32.7%).[10] In contrast, Sand *et al.* reported 56.5% syncope among 10,189 IFMEs.[4] In our study, the next diagnostic group was cardiovascular disease (14.6%). By contrast, in the above-mentioned works, respiratory and GI symptoms ranked next (10.1%–12.1% respiratory; 9.5%–14.8% gastrointestinal);[4,10] our incidences rate were 7.8% and 7.5%, respectively. Although our case volume is smaller, this may suggest a trend shift, potentially related to the post-pandemic increase in commercial flights and/or older passenger age and comorbidity burden.[13] Unfortunately, airline-provided information is limited or absent.[6,14,15]

Table 3. Classification of in-flight medical emergencies and their relationship with flight type, diversion, and patient outcome

Type of emergency (Martin-Gill *et al.* classification)	n (%)	Tye of flight n (%)				Decision on the flight n (%)			Patient's final destination n (%)			
		Interisland	National	International	*P* Value	Continued flight	Diverted flight	*P* Value	Discharged	Voluntary discharge	Transferred by ambulance	Deceased
Syncope	125 (46.6)	9 (7.2)	45 (36)	71 (56.8)	.75	114 (91.2)	11 (8.8)	.14	79 (59.8)	4 (25)	42 (35.6)	0 (0)
Cardiovascular	39 (14.6)	4 (10.3)	13 (33.3)	22 (56.4)		32 (82.1)	7 (17.9)		12 (9.1)	2 (12.5)	23 (19.5)	2 (100)
Neurologic	23 (8.6)	1 (4)	7 (30.4)	15 (62.5)		19 (82.5)	4 (17.4)		7 (5.3)	3 (18.8)	13 (11)	0 (0)
Respiratory	21 (7.8)	2 (9.5)	9 (42.9)	10 (47.6)		21 (100)	0 (0)		8 (6.1)	1 (6.3)	12 (10.2)	0 (0)
Gastrointestinal	20 (7.5)	1 (5)	5 (25)	14 (70)		19 (95)	1 (5)		6 (4.5)	2 (12.5)	12 (10.2)	0 (0)
Psychiatric	17 (6.3)	0 (0)	8 (47.1)	9 (52.9)		15 (88.2)	2 (11.8)		12 (9.1)	3 (17.6)	2 (1.7)	0 (0)
Allergic reactions	6 (2.2)	1 (16.7)	4 (66.7)	1 (16.7)		5 (83.3)	1 (16.7)		2 (1.5)	1 (6.3)	3 (2.5)	0 (0)
Cardiac arrest	4 (1.5)	0 (0)	2 (50)	2 (50)		2 (50)	2 (50)		0 (0)	0 (0)	0 (0)	0 (0)
Traumatic	4 (1.5)	0 (0)	1 (25)	3 (75)		4 (100)	0 (0)		0 (0)	0 (0)	1 (0.4)	0 (0)
Substance abuse	4 (1.5)	1 (25)	0 (0)	3 (75)		3 (75)	1 (25)		1 (0.8)	0 (0)	3 (2.5)	0 (0)
Gynecologic	3 (1.1)	0 (0)	0 (0)	3 (100)		2 (66.7)	1 (33.3)		1 (0.8)	0 (0)	2 (1.7)	0 (0)
Urologic	2 (0.7)	0 (0)	0 (0)	2 (100)		2 (100)	0 (0)		0 (0)	0 (0)	1 (0.8)	0 (0)
Total	**268**	**19 (7.1)**	**94 (35.1)**	**155 (57.8)**		**238 (88.8)**	**30 (11.2)**		**132 (49.3)**	**16 (6)**	**118 (44)**	**2 (0.7)**

n, number of cases.

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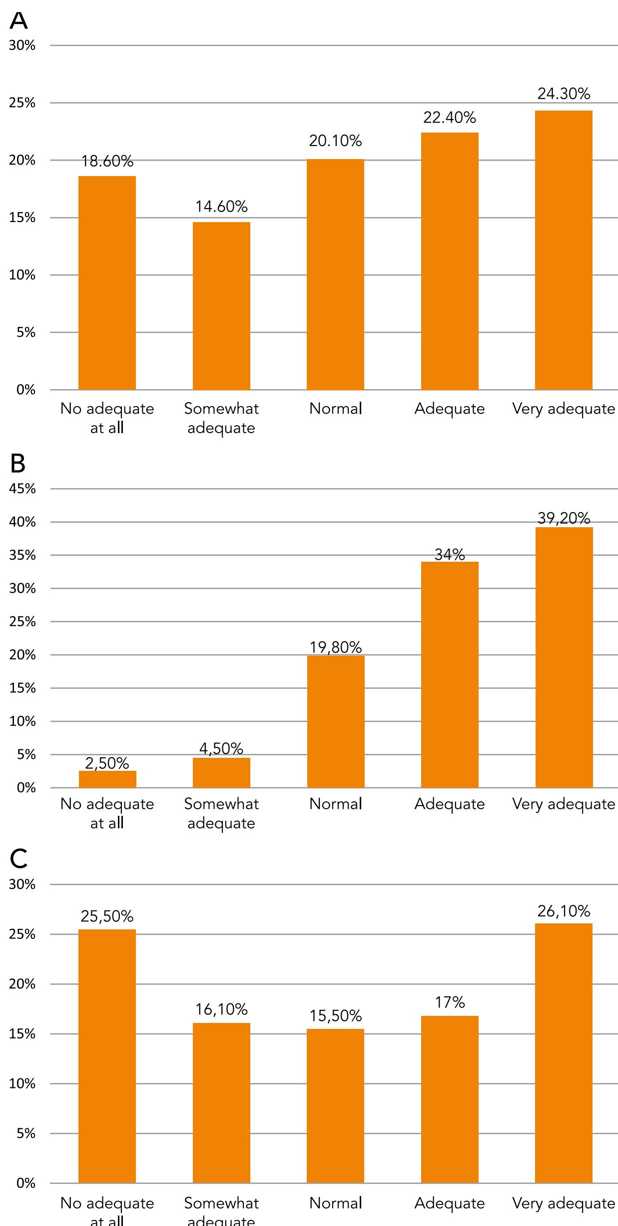

Figure 1. Health care personnel assessments of their in-flight assistance experience. (A) Rating of available on-board medical equipment. (B) Was any equipment or medication lacking during care? (C) Self-assessment of medical performance.

As other authors have noted, the percentage of CA is extremely low—0.3% in Peterson *et al.* and 1.5% in our series—as is mortality (0.7% in our sample vs 0.21% in Borges do Nascimento *et al.*),[16] indicating that flying is very safe from a medical standpoint.

With respect to diversion, although the decision depends on multiple factors (fuel, condition type, patient preference, on-board resources, and the final decision by the pilot and airline ground telemedicine teams), our 11% diversion rate aligns with international series (≈10%[4]–11.7%[10]), though others report 2.8%16 to 4.4%.[17] In our data, there were no significant differences between flight type (interisland, domestic, international) and the need to divert. Lacking additional details (eg, remaining flight time after the event), we could not further analyze diversion incidence. We found no direct relationship either between diversions and IFME diagnostic categories.

On landing, ≈25% of IFMEs are transported by ambulance to hospital in the literature, with only ≈9% being hospitalize.[17] In our series, 44% were transported, more often when the flight diverted—suggesting that respondents' diversion decisions were appropriate. Similarly, in the study by Delaune *et al.*, hospital admission was 49% when a physician was involved in the diversion decision vs 15% without physician input.[13]

It is notable that while 32.2% of HPs rated on-board equipment as not adequate or only slightly adequate, 41.7% reported missing some equipment or medication. In 7.5% of our cases, no medical equipment was used—far lower than the 38% reported by Delaune *et al.*[13] We did not collect more detailed suggestions about equipment and drugs, opening avenues for future work.[14,15] Fortunately, in recent years, on-board defibrillators have become practically mandatory, though other items (eg, pulse oximetry) are not. Several studies advocate improving equipment, which would benefit HPs—whose assistance is uncertain and, above all, voluntary—and, most importantly, patients. Even so, 73.2% of respondents rated their care as good or very good.

This study has some limitations. First, as with any survey, certain responses are subjective and should be considered when interpreting results. Furthermore, we could not explore patient-level data in depth (age,[18] sex, history,[19] nationality, vital signs, procedures performed, etc.), in-flight interventions, or final hospital diagnosis. On the other hand, we did not ask respondents about their place of residence. Multiple respondents may have been involved in the same IFME, and > 1 HP may have attended a given event. On the other hand, limiting each respondent to a maximum of 3 IFMEs may have introduced selection bias toward either more severe or milder cases.

In conclusion, HPs should be familiar with likely IFME, approaches to management, and the equipment and drugs available on commercial flights. There is limited information from the airlines and public authorities on IFMEs, as well as scarce literature. Beyond the data presented—which characterize flights originating from or destined for Spain and the emergencies attended by HPs residing in Spain—this study opens avenues for further research and serves as a hypothesis-generating starting point.

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ARTICLE INFORMATION

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