

# Ground-Based Medical Services for In-Flight Emergencies

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- BACKGROUND:** The aim of this study was to evaluate the use of ground-based medical services (GBMS) by the cabin crew of a major South Korean airline for in-flight medical incidents involving passengers.
- METHODS:** We conducted a survey of cabin crew to identify the anticipated use of GBMS in 2017. We compared the anticipated use to actual use as reported in cabin crew records submitted to the GBMS team and cabin crew logs from May 2013 to April 2016.
- RESULTS:** Among 766 team leaders and assistant leaders, 211 individuals answered the questionnaire. A total of 915 instances of GBMS use were reported during the study period. There were no significant differences between anticipated and actual use in terms of the reasons for needing GBMS, with medication prescription being the most common reason. However, there were significant differences in the specific symptoms that triggered contact with GBMS. Pediatric and digestive symptoms were under-predicted, while neuropsychiatric and cardiac symptoms were over-predicted.
- DISCUSSION:** Cabin crew tended to require GBMS to assist with pediatric and digestive conditions more often than anticipated. Furthermore, digestive and pediatric symptoms often require prescription medications.
- KEYWORDS:** teleconsultation, perception, ground-based medical services, in-flight medical events, prescription medicine.

Kim JH, Choi-Kwon S. *Ground-based medical services for in-flight emergencies*. *Aerosp Med Hum Perform*. 2020; 91(4):348–351.

With increasing numbers of pediatric and elderly travelers, in-flight medical emergencies are becoming more common.<sup>10</sup> When these emergencies occur, cabin crew perform first aid and, if necessary, request voluntary assistance from any medical professionals onboard.<sup>8</sup> However, because medical professionals may be unfamiliar with the onboard medicine and equipment, they sometimes feel uncomfortable providing care to patients outside their specialties.<sup>3</sup> Moreover, they may be hesitant to administer medications to patients in the cabin. To circumvent these problems, many airlines use ground-based medical services (GBMS), through which medical professionals on the ground indirectly provide medical services. Based on their expertise regarding potential physiological changes in the cabin environment and knowledge of equipment available onboard and the epidemiology of in-flight emergencies, GBMS may suggest more relevant treatment options and prescribe medications.<sup>1,5,16</sup>

The International Air Transport Association states that GBMS are essential for providing medical aid during in-flight medical incidents.<sup>9</sup> However, few studies have compared the anticipated and actual use of GBMS. Moreover, the authors are not aware of the existence of studies published in peer-reviewed

journals examining the reasons and specific symptoms for which flight crews contact GBMS.<sup>14,16,17</sup> Thus, the present study had three aims: to investigate the anticipated and actual reasons for contacting GBMS and examine the specific symptoms that trigger the use of GBMS (both anticipated and actual); to analyze the anticipated and actual symptoms that required prescriptions from GBMS; and finally, to investigate the anticipated and actual reasons for prescriptions made by GBMS.

## METHODS

This was a descriptive investigative survey, conducted after receiving approval from the Institutional Review Board of Seoul National University (IRB No. SNU 17-04-071). Data were

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This manuscript was received for review in May 2019. It was accepted for publication in January 2020.

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DOI: <https://doi.org/10.3357/AMHP.5431.2020>

collected from a major South Korean airline operating international and domestic flights. Data regarding anticipated and actual use of GBMS were collected using three methods. Anticipated use, defined as the “usual practice” regarding the use of GBMS by cabin crew, was identified through a survey. Actual use was identified from records obtained from GBMS, which were later supplemented and verified by cabin logs. To identify the actual use of GBMS, 3 yr of records (May 2013 to April 2016) were analyzed. We analyzed cabin crew logs since they could provide supplementary information regarding the details of medical incidents during the same period.

Between June and October 2017, an online questionnaire (<http://ko.surveymonkey.com>) was distributed via email to 766 crew leaders and assistant leaders who were responsible for contacting GBMS and writing cabin logs for in-flight emergencies. All participants received an explanation about the goals and methods of the survey, as well as instructions on how to complete the questionnaire. They were instructed to begin the questionnaire only if they freely consented to participate in the study.

The investigators developed the questionnaire with reference to previous studies.<sup>11,14,16</sup> The content validity of the questionnaire was assessed by one nursing professor with a background in airline medicine and flight physiology, two aviation medicine examiners, and two nurses. Item content validity index (I-CVI) was calculated for each item as the number of experts giving an “acceptable” rating (score 3 or 4) divided by the total number of experts. All five items obtained excellent I-CVI (1.0). The scale-level CVI, calculated as the mean I-CVI for five experts, was also rated excellent (1.0).

The questionnaire consisted of three main subsets with a total of five items: reasons for contacting GBMS (one item), types of symptoms requiring contact with GBMS (two items), and types of medical symptoms requiring medication (two items).

We used both GBMS reports and cabin logs. This was done to verify the GBMS reports by matching them with cabin crew logs and to comprehensively document the medical incidents. GBMS reports only contain information regarding patients' symptoms and any prescribed medication, whereas cabin logs provide detailed passenger information. The airline requires GBMS to compare the reports with the cabin logs to maximize the accuracy of the former. When there are differences, GBMS administrators contact the cabin crew leaders or assistant leaders to resolve any discrepancies after medical incidents. Therefore, there is 100% agreement on the diagnosis following discussion between the crew leaders and GBMS.

GBMS records and cabin logs are entered into a structured electronic record system, organized by the same case number. In this study, in-flight medical incidents were classified based on the categorization developed by Peterson et al.<sup>14</sup> All the data for medical events during the study period were de-identified and abstracted in to an electronic database. Passenger identification was protected by deleting the names.

IBM SPSS Statistics for Windows version 21.0 (IBM Corp., Armonk, NY, USA) was used for all statistical analyses. Frequencies and percentages were used to evaluate nominal data.

To compare the anticipated and actual use of GBMS, the Chi-squared test was used.

## RESULTS

Of 766 cabin crew leaders and assistant leaders, 211 (28%) participated in the survey. There were no differences in age or years of employment between the respondents and nonrespondents. The GBMS reports and cabin crew logs included 915 cases from May 2013 to April 2016. During the study period, a total of 318 in-flight medical volunteers were recorded. They included physicians ( $N = 234$ , 73.6%), nurses ( $N = 63$ , 19.8%), and doctors of traditional oriental medicine or dentists ( $N = 7$ , 2.2%).

There were no significant differences in the anticipated and actual reasons for contacting GBMS; the most common reasons were medication prescription and first aid (**Table I**). However, significant differences were found in the types of symptoms that led cabin crew to contact GBMS. The most common actual reasons for contacting GBMS were neuropsychiatric symptoms ( $N = 146$ , 16%), cardiac symptoms ( $N = 140$ , 15.3%), and pediatric symptoms ( $N = 135$ , 14.8%). In contrast, the most common anticipated reason for contacting GBMS was neuropsychiatric symptoms ( $N = 132$ , 32.3%), followed by cardiac symptoms ( $N = 111$ , 27.1%) and obstetric/gynecological symptoms ( $N = 83$ , 20.3%) (**Table I**).

Since neuropsychiatric, cardiac, and pediatric cases were the most common actual instances of GBMS use, we further subclassified those cases to identify their details. The logged neuropsychiatric symptoms ( $N = 146$ ) were anxiety ( $N = 42$ , 28.8%), migraine or severe headache ( $N = 36$ , 24.7%), and psychotic behavior ( $N = 18$ , 12.3%). The symptoms were reported to have occurred during flight ( $N = 37$ , 46.3%), preparation for takeoff ( $N = 35$ , 43.8%), and boarding ( $N = 7$ , 8.8%).

The most common types of cardiac symptoms ( $N = 140$ ) were chest pain ( $N = 66$ , 47.1%), hypertension ( $N = 42$ , 30%), and palpitations ( $N = 13$ , 9.3%). The most frequently reported pediatric symptoms ( $N = 135$ ) were allergy ( $N = 28$ , 20.7%), nausea and vomiting ( $N = 25$ , 18.5%), fever ( $N = 23$ , 17.0%), and abdominal pain ( $N = 21$ , 15.6%).

We also found that the most common prescription requests to GBMS—both anticipated and actual—were for medications to treat digestive symptoms (**Table II**). However, the actual requests for prescription medications to treat neuropsychiatric ( $N = 85$ , 58.2%) and pediatric ( $N = 82$ , 60.7%) symptoms were much more common than anticipated ( $N = 51$  and 1, 38.6% and 2.8%, respectively) (**Table II**).

The most common reasons for prescription requests to GBMS were the absence of onboard medical volunteers ( $N = 165$ , 35.2%), patients' requests for specific medications without an examination by onboard medical volunteers ( $N = 121$ , 25.8%), and lack of improvement after an examination by medical volunteers ( $N = 106$ , 22.6%). The medications most commonly prescribed by GBMS were analgesics ( $N = 170$ , 36.2%), antihypertensives ( $N = 46$ , 9.8%), antispasmodics ( $N = 45$ , 9.6%), antihistamines ( $N = 45$ , 9.6%), and hypnotics or sedatives ( $N = 33$ , 7.0%) (**Table III**).

**Table I.** Comparison of Anticipated and Actual Reasons and Symptoms for Contacting Ground-Based Medical Services.

REASONS FOR CONTACT AND SYMPTOMS	ANTICIPATED (N = 211) N (%)	ACTUAL (N = 915) N (%)	$\chi^2 P$
Reasons for contact			4.265; 0.119
Medication prescription	117 (55.5)	496 (54.2)	
First aid methods	88 (41.7)	359 (39.2)	
Advice on administrative procedures	6 (2.8)	60 (6.6)	
Symptoms*			318.951 < 0.001
Neuropsychiatric	132 (32.3)	146 (16.0)	
Cardiac	111 (27.1)	140 (15.3)	
Obstetric/gynecological	83 (20.3)	22 (2.4)	
Syncope or presyncope	37 (9.0)	121 (13.2)	
Pediatric	36 (8.8)	135 (14.8)	
Digestive	10 (2.4)	112 (12.2)	
Trauma	0	66 (7.2)	
Respiratory	0	54 (5.9)	
Urologic	0	41 (4.5)	
Allergy	0	20 (2.2)	
Other	0	58 (6.3)	

\* Multiple answers were allowed for anticipated use (N = 409).

## DISCUSSION

This study investigated the anticipated use of GBMS by the cabin crew of a major South Korean airline in 2017 and compared it to the previous 3 yr of records from GBMS and cabin crew. More specifically we were looking to see to what extent cabin crew's expectations of use (anticipated use) resulting from their past experience and airline policy matched actual use as reported in the study period. Since airline policy had not changed, and since the volume and content of calls to GBMS remained consistent during the study period, we assume that a valid comparison could be made between the respondents' anticipated use of GBMS and the prior 3 yr of actual use. To the best of our knowledge, this is the first study to compare the actual and anticipated use of GBMS by cabin crew.

We found that the most common reason for contacting GBMS—both anticipated and actual—was to request medication prescription. Even though the in-flight medical volunteers were predominantly physicians (234 cases, 73.6%), followed by nurses (63 cases, 19.8%), they were reluctant to prescribe medications. There may be several reasons for this, such as concerns about legal liability (N = 25)<sup>3</sup> and patients' requests (N = 121) for specific medications without an examination by in-flight medical volunteers.

Many patients (N = 64) had medicine in their checked-in luggage but were not able to access it in the cabin. Of particular

note, passengers often asked for antihypertensive medications (N = 24) and nitroglycerin (N = 8) to relieve cardiac symptoms, one of the most common symptoms reported to GBMS.

We found that neuropsychiatric symptoms were the most common in both the anticipated and actual use of GBMS. However, the actual use of GBMS for neuropsychiatric symptoms was two times higher than the anticipated use of GBMS for medication prescriptions. This may have been because of the unexpectedly high incidence of headache or migraine. In fact, we found that the most commonly requested medicines were

analgesics (N = 170). We also found that anxiety was the most common neuropsychiatric symptom, which may have been due in part to the in-flight environment and specific stimuli such as the sound of the cabin door closing.<sup>12</sup> During flight, seating conditions, noise, and vibrations may further aggravate anxiety.<sup>2,12</sup> In an additional subanalysis, we found that 53% of reported psychiatric symptoms occurred while boarding and preparing for takeoff, when the plane was still on the ground. Interestingly, we found that the use of hypnotics or sedatives was higher than has been reported previously.<sup>11,16</sup> Our results, therefore, suggest that all aircraft should be equipped with sedative drugs for psychiatric symptoms, even though it might be difficult to manage sedatives in accordance with some jurisdictions, namely Act on the Management of Narcotic Drugs.

Interestingly, we found that the most frequently prescribed medications were for digestive symptoms. Lower pressure causes air volume expansion and, therefore, bloating, which can be aggravated by prolonged sitting, especially when additionally constrained by the seatbelt;<sup>6</sup> these gastric issues can be easily relieved with medication. Another reason for the high frequency of requests for digestive medications might be the high-fiber Korean diet, which may aggravate symptoms by delaying gastric emptying and causing bloating.<sup>7</sup> We found that 80% of passengers with digestive symptoms experienced relief after taking medications and that antispasmodics (46%) were more frequently used than antiemetics (21%) and antacids (2%). According to the Aviation Act, however, while airlines are not required to stock antispasmodics, they are required to have antiemetics and antacids on board. Adding antispasmodics for passengers who consume a high-fiber diet should be considered.

We found that pediatric symptoms and the associated

**Table II.** Discrepancies Between Anticipated and Actual Use of Medication.

CATEGORY OF MEDICATION	ANTICIPATED*† N (%)	ACTUAL N (%)	$\chi^2 P$
Cardiac	68 (61.3)	91 (65.0)	0.373; 0.542
Neuropsychiatric	51 (38.6)	85 (58.2)	10.639 < 0.001
Digestive	9 (90.0)	90 (80.4)	0.558; 0.455
Obstetric or gynecological	9 (10.8)	6 (27.3)	3.568; 0.059
Syncope or presyncope	6 (16.2)	39 (32.2)	3.834; 0.05
Pediatric	1 (2.8)	82 (60.7)	38.227 < 0.001

\* Multiple answers were allowed for anticipated use.

† Anticipated use data were analyzed for cases that required medical advice from ground-based medical services.

**Table III.** Actual Use of Ground-Based Medical Services for Prescribing Medication.

REASONS FOR PRESCRIPTIONS AND TYPES OF MEDICATION	N (%)
Reasons	
Lack of medical volunteers	165 (35.2)
Patient requests without examination by medical volunteers	121 (25.8)
No improvement after examination by medical volunteers	106 (22.6)
Inquiry about in-flight medications	25 (5.3)
Legal limitations of medical volunteers	25 (5.3)
Other	27 (5.8)
Type of prescribed medication	170 (36.2)
Analgesic	46 (9.8)
Antihypertensive	45 (9.6)
Antispasmodic	45 (9.6)
Antihistamine	33 (7.0)
Hypnotic/Sedative	25 (5.3)
Nitrate	24 (5.1)
Antiemetic	23 (4.9)
Bronchodilator	21 (4.5)
Fluid	12 (2.6)
Antidiarrheal	10 (2.1)
Digestant	15 (3.2)
Other	

medication requests to GBMS were more common than anticipated. Although only 3% of respondents anticipated making such a request, 61% actually did so. This may be explained by several factors. First, onboard medications are usually for adults and the dosage may have to be adjusted by medical professionals for use in children. Second, cabin crew sometimes call GBMS to ask about how to administer the medication when children experience difficulty swallowing.<sup>13</sup> Most airlines tend not to provide pediatric medications in liquid form since liquid medicine is bulkier, more expensive, and more difficult to manage owing to temperature changes in the cabin. Moreover, the Aviation Act does not mandate that airlines be equipped with pediatric medications at all. The final reason may have been the higher occurrence of symptomatic incidents in pediatric passengers. According to our survey, allergic reactions, nausea and vomiting, and fever were among the most commonly reported symptoms in children. These may be easily controlled by medication,<sup>15</sup> and urgent administration of medicine is needed before symptoms worsen.<sup>4</sup>

In conclusion, GBMS are useful for treating in-flight medical incidents, especially through prescription medication. As the cabin crew tends to rely on GBMS to assist with pediatric and digestive conditions, ground-based medical providers must be prepared to deal with these conditions. Moreover, although this airline was equipped with sedative drugs, most do not have them onboard. Therefore, onboard sedative drugs for psychiatric symptoms should be considered for all airlines.

Our results may be limited because of the relatively low response rate: only 28% of the 766 team leaders and assistant managers whose participation was solicited actually participated. However, the average age and years of employment of our respondents matched those of the whole group of 766 team leaders. Another limitation is that we surveyed only one airline, which may limit the generalizability of our findings. Our study

also lacked patient medical history and follow-up data. Finally, data collection periods for anticipated and actual use of GBMS differed because of GBMS outsourcing beginning in May 2017.

## ACKNOWLEDGMENTS

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

**Financial Disclosure Statement:** The authors received no financial support for the research, authorship, and/or publication of this article. The authors have no competing interests to declare.

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