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Utilization of Emergency Kits by Air Carriers

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16. Abstract The Department of Transportation Emergency Medical Equipment Requirements Rule of January 9, 1986, mandated a period of 24 months (August 1986 - July 1988) during which all air carriers flying under Federal Aviation Regulation, Part 121, would monitor medical emergencies and use of the prescribed medical kits. The reporting airlines were to provide descriptions of how the medical kits were used, by whom, and the outcome of the medical emergency. During the two year monitoring period, a total of 2,322 reports of medical emergencies were documented; these included 33 inflight deaths, with only one of these representing a crew member (secondary to aircraft structural failure and resultant physical trauma). In the 2,293 actual uses of the medical kit, a physician was the provider in over 85% of the cases. The most common presenting symptom was pain, with unconsciousness, impaired breathing, nausea and/or vomiting, and various myocardial diagnoses the most common presenting sign (in descending order of frequency). High frequency recurrent complaints about kit adequacy were not noted during the two year monitoring period; there were scattered references about the poor technical quality of the most frequently employed equipment; the medical kit content might selectively be expanded to include analgesics, antiarrhythmics, antiemetics, and bronchodilators.			
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UTILIZATION OF EMERGENCY MEDICAL KITS BY AIR CARRIERS

Introduction

The Department of Transportation Emergency Medical Equipment Requirements Rule of January 9, 1986, mandated a period of 24 months (August 1986-July 1988) during which all air carriers flying under Federal Aviation Regulation, Part 121, would monitor medical emergencies and use of the prescribed medical kits (2). The discussion section within the rule projected that "an analysis of the results at the termination of the reporting requirement in 2 years will provide the FAA with information on medical emergencies occurring in flight so that any necessary changes can be made to the medical kits, training of personnel, or related matters."

Although the reporting requirements called for a description of how the medical kit was used, by whom, and the outcome of the medical emergency, they permitted the individual records, or a summary thereof, to be submitted to the air carrier's Principal Operations Inspector in the FAA, and the guidelines further permitted wide latitude in the level of detail contained within either individual or summary formats. The resulting heterogeneous data base was made available to Office of Aviation Medicine's Civil Aeromedical Institute staff to assist with summary tabulations (3, 4) and, wherever possible, to extract the salient lessons learned from this data base.

Methods

Only limited data points were uniformly abstractable from all the in-flight medical emergency reports. One could minimally define the total number of reporting airlines, the total number of in-flight deaths, the total number of airlines with medical kit usage, the frequency of diversions for medical reasons, the frequency of use of specific items in the new medical kit, and the type of medical provider. The summary data should be used with the caveat that the level of missed, incomplete, or even faulty data provided by individual airlines could not be evaluated by CAMI.

Another level of analysis incorporated a review of those airline submittals that were voluntarily accompanied by extended case reports, sometimes even full copies of the materials completed by the in-flight health care provider responding to the emer-

gency. Approximately 30% of the carriers reporting in-flight medical emergencies provided this type of data transmittal, but the total cases with such detail represented only about 10% of the total caseload. Nonetheless, these case materials provide better insight into such parameters as medical conditions predisposing to the in-flight event, the actual progression and outcome of the medical event, the specific items of medical kit usage, as well as the registered complaints and suggestions by the in-flight care provider and flight crew directed at improving the existent medical kit and emergency response.

A final level of analysis in this review addresses representative non-FAA data sets that treat the issue of medical kit usage and improvement. We feel these, and future, contributions of the interested aeromedical community will be very useful, especially since it is among the largest carriers that most of the useful clinical data reside, data that were often not available to the FAA in the terse summaries adequate to the regulatory reporting requirements provided by the airlines. The enabling regulation defining the kits had a projected 10-year validity, although mandatory reporting to the FAA was required for only two years. Now that the FAA lacks regulatory access to the kit usage data as of August 1, 1988, the airlines with medical departments will be even more critical to the ongoing evaluation of the kits.

Finally, since the data were provided to the Civil Aeromedical Institute in sets covering full year experiences (August 1986-July 1987 [year I]; August 1987-July 1988 [year II]), we will retain the separation of data summaries by year and by overall total, but would immediately caution that, although the contrasting of year I and year II data permits some relevant comparison and speculation, the paucity of data does not merit any statistically meaningful analysis for trends.

Results

During the 2-year monitoring period, 42 airlines (18-year I; 24-year II) identified instances of medical emergencies (ME), while 62 airlines (30-year I; 32-year II) specifically reported no in-flight ME. A total

**TABLE I. EMERGENCY MEDICAL KIT ITEMS USED IN FLIGHT
IN 2,293 APPLICATIONS (AUGUST 1986 - JULY 1988)**

Kit Items	Reports of Use	Percentage of Total Kit Applications
Sphygmomanometer	1724	75.2%
Stethoscope	1723	75.1%
Nitroglycerin Tablets (10)	227	9.9%
Syringes (3) (as necessary for administration)	142	6.2%
Needles (6) (as necessary for administration)	139	6.1%
Diphenhydramine (2 ampules)	57	2.5%
Epinephrine (1:1000, 2 ampules)	56	2.4%
Dextrose (50%, 50 cc)	41	1.8%
Oropharyngeal Airways (3 sizes)	36	1.6%

Designations reflect actual specifications of kit content. For kit items with multiple subelements, the reports of use do not permit a determination of exact numbers or sizes of subelements actually deployed.

of 2,322 reports of ME's were received for analysis (1,016-year I; 1,306-year II), with the medical kit being used in all but 29 cases (3-year I; 26-year II). A total of 33 in-flight deaths were recorded over the 2 years (9-year I; 24-year II), with only one death representing crewmember death (secondary to aircraft structural failure and resultant physical trauma). When applied, the medical kit content utilization ranged from approximately 75% for the stethoscope and sphygmomanometer, to less than 2% for the injectable dextrose. The accompanying table portrays detailed utilization rates. The medical provider was documented as a physician in approximately 85% of all 2,293 uses of the medical kit, with registered nurses and emergency medical technicians providing an additional 8% of coverage, and the remaining 7% distributed primarily to the "unknown" category, with a host of varied medical professionals helping in scattered instances.

The 2,322 reports were scanned for overlapping medical symptoms, medical signs, and even specific disease entities. The most common presenting symptom was pain (280 reports: 129-year I; 151-

year II), of which chest pain was the most prevalent complaint (205 reports: 95-year I; 110-year II). The most common presenting sign was unconsciousness (241 reports: 123-year I; 118-year II). The next three most prevalent presentations included shortness of breath (137 reports: 62-year I; 75-year II); nausea and/or vomiting (154 reports: 54-year I; 100-year II); and various myocardial (heart) references (97 reports: 49-year I; 48-year II). These are not exclusive presentations; for example, a few cases have been recorded as presenting with chest pain and shortness of breath, a fairly common clinical combination that can be etiologically associated with cardiac, pulmonary, and even other organ disease.

Two hundred forty-seven emergency reports were accompanied by at least partial medical history and a few details on diagnosis and treatment. In these 247 cases, there were 158 (76-year I; 82-year II) with medical history that was directly or indirectly related to the presenting in-flight event; these cases range from relatively obvious sequences as known diabetics or allergy-prone individuals having insulin or allergic reactions, respectively, to less direct associations,

such as passengers on multiple cardiovascular medications who encountered exacerbation of chest pain or shortness of breath. The most prevalent predisposing or related histories in these 247 cases were cardiovascular (27%), endocrinological (6%), gastrointestinal (5%), obstetric-gynecological (4%), pulmonary (4%), neurological (4%), and allergic (3%). Single reports included such examples as an antecedent spider bite and a history of AIDS.

The same pool (247) of cases permitted some insight into the degree of satisfaction the medical care providers had with the medical kit. Six providers decried the quality of the sphygmomanometer and stethoscope with such verdicts as "too cheap and useless," "piece of junk," "leaking," "too small," and "inoperative" for the sphygmomanometer, and comments such as "came apart," "hard to hear," and "piece of junk" for the stethoscope. Additional improvements requested in the nonmedication area included better airway equipment (2) and electrocardiogram (EKG) support (2). Of more minor nature were individual requests for alcohol wipes for cleansing and rubber gloves for the protection of the provider.

No systematic recommendations for medication upgrades were detected, with separate and isolated requests being registered for diazepam, atropine, naloxone, "oral antihistamine," and "antiemetic." In two more complicated cases, lidocaine, atropine, and more syringes were requested in one, while in the second (with five physicians providing care), dilantin, bicarbonate, lidocaine, and saline were requested, in addition to a request for an on-board EKG.

The situations surrounding the 33 deaths might seem the optimal environments within which to do a selective evaluation of medical kit efficacy (or failure); unfortunately, the final reports do not permit this analysis. We estimate that approximately 48% of the 33 deaths were apparently related to cardiac etiology, 6% to accidental causes, another 6% to terminal cancer consequences, 3% to an allergic etiology, 3% to AIDS, and the remaining 33% to unknown reasons.

The final section within **Results** will now review representative individual airline studies of their own ME cases.

A separate analysis of all kit usage on United Airlines (1) during the period August 1986-July

1987 identified 362 uses on 361 flights. Even with extended data tracking efforts, postflight outcome data from the patient or other source were available on only 144 cases. The authors concluded that multiple medication additions were unnecessary, but felt the current kit could be improved by including a bronchodilator.

An unpublished review by Dr. David Millett of Eastern Airlines estimated the costs of the utilized production kits (at about \$58 per kit) and the average costs of kit refurbishment (at about \$33 per kit) during the first year of use as more than covered by the savings from the approximate 50% reduction in unscheduled landings for medical reasons noted in the same first year.

Discussion

Although only two years of data were available for review, the pattern of medical kit item usage in emergencies was very similar in the first and second years. The 26% increase in numbers of cases in the second year, and the 166% increase in deaths from year I to year II seem dramatic but may represent nonstatistically relevant variance. After all, these deaths represent a minuscule proportion of the approximate 450,000,000 annual passenger enplanements.

The 2,322 in-flight emergencies equate to slightly over 3 cases per day across all Part 121 carrier operations. Physicians responded to at least 85% of these emergencies. High frequency recurrent complaints about kit adequacy were not obtained during the two-year monitoring period, but kit assemblers and purchasers should assure consistent quality of the heavily-used stethoscopes and sphygmomanometers, and (because of the prevalent presenting symptoms and signs) the kit's medical content might selectively be expanded to include analgesics, antiarrhythmics, antiemetics, and bronchodilators. Even without expansion, the kit content should be publicized to all interested physicians in advance of flight participation.

The high frequency of related or predisposing medical histories for the actual in-flight events, and the varied specialties and skill levels of the responders, indicate the potential benefit to be gained in allowing medically concerned passengers to register their problems, and also interested doctors to register their willingness to provide standby care, in advance of actual flights.

As expected, some of the more clinically serious presentations might have been helped with a more complete medical kit (e.g., wider range of cardiovascular diagnostic and treatment modalities). Even if we ascribed all deaths to cardiovascular etiologies (and they were admittedly not), and prepared for this eventuality, on average only one in-flight death occurs in Part 121 carrier traffic every 23 days. To be of assistance to this population, one would need to provide both a more sophisticated kit and a more sophisticated user of same; it is not just a matter of having more on-board crewmembers knowledgeable in basic first aid and CPR.

For such a heterogeneous traveling population, it would seem prudent to offer those people with

known health concerns or particular personal perceptions of high risk for illness, and even death, a choice of flights wherein designated professional medical staff are traveling in standby (albeit concurrent passenger) status.

Because the final chapter of consensus building on in-flight medical care has not yet been written, we (within the FAA and the private sector) must continue to explore alternatives for improvement. Ongoing voluntary evaluation of in-flight health care experience by individual carriers will be especially useful as evidence to support action. This pooling of data will be needed to most efficiently meet the joint FAA-industry mandate to refine the "optimal" medical kit and applications.

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