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Original Research

Does Medical Staffing Influence Perceived Safety? An International Survey on Medical Crew Models in Helicopter Emergency Medical Services

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A B S T R A C T

Objective: The competence, composition, and number of crewmembers have generally been considered to influence the degree of patient care and safety in helicopter emergency medical services (HEMS), but evidence to support the advantages of one crew concept over another is ambiguous; additionally, the benefit of physicians as crewmembers is still highly debated.

Methods: To compare perceived safety in different medical crew models, we surveyed international HEMS medical directors regarding the types of crew compositions their system currently used and their supportive rationales and to evaluate patient and flight safety within their services.

Results: Perceived patient and flight safety is higher when HEMS is staffed with a dual medical crew in the cabin. Tradition and scientific evidence are the most common reasons for the choice of medical crew. Most respondents would rather retain their current crew configuration, but some would prefer to add a physician or supplement the physician with an assistant in the cabin.

Conclusion: Our survey shows a wide variety of medical staffing models in HEMS and indicates that these differences are mainly related to medical competencies and the availability of an assistant in the medical cabin. The responses suggest that differences in medical staffing influence perceived flight and patient safety.

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Despite new treatment modalities in prehospital critical care,¹ the medical staffing model in helicopter emergency medical services (HEMS) has remained largely unchanged in many systems over the last 40 years. Additionally, the heterogeneity in medical staffing in HEMS is large, and systems with similar mission profiles may have very different medical crew compositions.²⁻⁶

Patient safety is the prevention of errors and adverse effects to patients associated with health care.⁷ Transporting critically ill patients involves a significant risk of adverse events.⁸ Although the number of reported incidents in air medical transports is low,⁹ the

difference between the observed and self-rated performance of air ambulance clinicians may indicate that the problem is larger than the numbers reported.¹⁰⁻¹²

The competence, composition, and number of crewmembers may play a role in creating adequate redundancy in patient care to ensure patient safety, but supportive documentation regarding one crew configuration over another has thus far proven inconclusive. The benefit of including physicians in HEMS is highly debated.¹³⁻¹⁵ Some studies have found that HEMS physicians contribute to improved survival,^{16,17} whereas other studies showed no difference.¹⁸ In trauma patients who were transported either with the combination of a flight nurse and a flight paramedic or with 2 flight nurses, the outcomes were also indistinguishable.¹⁹ It has been suggested that it is the training and not the profession that is essential.^{20,21}

The aim of this study was to describe the diversity of medical crew compositions currently used in HEMS and supportive

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rationales of these decisions. Our hypothesis is that the medical crew composition influences perceived patient and flight safety as reported by medical directors representing HEMS systems using different medical crew models.

Material and Methods

Questionnaire

Medical directors of HEMS in Europe, North America, Australia, New Zealand, and Japan were invited to participate in an HEMS Medical Crew Survey developed by 2 of the authors (K.R. and S.J.M.S.). This study region was chosen to include the entire spectrum of medical staffing models from well-established HEMS services. Before distribution, the questionnaire was tested on a number of HEMS professionals and revised according to their feedback. The Cronbach alpha for the 2 patient safety items and the 6 flight safety items was 0.943 and 0.952, respectively. The survey was distributed as a Web-based questionnaire (SurveyXact; Rambøll Management Consulting, Aarhus, Denmark).

To gather responses from a cross section of different crew models currently in use, participants were identified through the European HEMS and Air Ambulance Committee (EHAC), the European Prehospital Research Alliance (EUPHOREA), the Association of Critical Care Transport (ACCT), the Association of Air Medical Services (AAMS), the Aeromedical Society of Australasia (ASA) and the Emergency Medical Network of Helicopter and Hospital (HEM-Net). In North America, the invitations to participate in the survey were distributed through ACCT and AAMS, and in Japan through HEM-Net. In all other continents, the invitation was distributed directly. All invitations were sent via e-mail with a link creating a unique survey response. Two reminders were sent to all participants. All respondents were blinded to the researchers.

In the absence of a universally accepted definition of safety and a method of measuring the safety level, researchers in the oil industry have found “perception of risk” useful for understanding feelings of safety, attitudes to safety, risk-taking behavior, and accident involvement.^{22,23} “Perception of flight safety” has been used as the primary outcome in HEMS research and was found to be significantly influenced by personal experience of a crash or serious incident.²⁴

We asked the respondents to evaluate patient and flight safety during various mission types in their own service on a 7-point symmetric Likert scale, ranging from “totally unacceptable” (1), “unacceptable” (2), “slightly unacceptable” (3), and “neutral” (4) to “slightly acceptable” (5), “acceptable” (6), and “perfectly acceptable” (7).²⁵ Because we expected that medical directors respond favorably on their own systems as a sort of acquiescence bias or confirmation bias, negative or less positive scores were of interest because these responses probably represent a real negative attitude. This allowed us to dichotomize the responses and consider the difference between positive ratings (“acceptable” [6] or “perfectly acceptable” [7]) and less positive or negative ratings (“slightly acceptable” [5] or less) to be of particular clinical relevance.

To obtain the greatest degree of comparable data, respondents were asked to evaluate their program’s flight and patient safety based on the regular crew configuration used to operate under similar and, in this survey, poor weather conditions. A definition of “poor weather” was not given because this varies according to each HEMS operator’s procedures.

Approval

The study was approved by the Data Protection Official for Research, Norwegian Social Science Data Services, Bergen, Norway (date of approval: April 23, 2014, ref. no. 38659), and was exempt from ethical approval by the Regional Ethical Committee of Western

Norway, Bergen, Norway (date of approval: April 20, 2014, ref. no. 2014/760).

Definitions and Classifications

“One service” in this study is defined as the number of HEMS bases for which 1 medical director is responsible. Many professional titles are based on different regional educational models and lack universally approved definitions. Thus, for the questionnaire, we provided definitions for all relevant professional groups that can be found in an HEMS crew. “Medical competence” in this survey is defined as formal education and not level of experience.

We decided to regard physicians as 1 group despite differences in specialty and competence among systems. Studies have shown that airway management proficiency is similar in systems with the 2 most predominant specialties of HEMS physicians— anesthesiologists and emergency physicians.²⁶⁻²⁹

Registered nurses were defined as nurses with a bachelor’s degree or its equivalent and certified nurses as registered nurses with an additional certification examination. Nurse specialists, such as nurse anesthetists, intensive care nurses, and neonatal nurses, were defined as nurses with a college or a university education corresponding to a master’s degree.

Emergency medical technicians (EMTs) and paramedics were defined and categorized according to their airway skills (ie, basic [“only supraglottic airway devices”], intermediate [“endotracheal intubation but not rapid sequence induction” (RSI)], and advanced [“endotracheal intubation including RSI” and “may use a mechanical ventilator”]). This categorization was chosen because airway control has the highest treatment priority in emergency medicine, is considered the single most important factor for good outcomes,^{30,31} and contributes to paramedics’ professional identity.³²

In this study, crewmembers unavailable to assist the medical crew in patient treatment during flight were not included as part of the medical crew. Nurses and EMTs/paramedics with a combined role as a medical assistant and a pilot’s assistant during flight and obliged to sit in the cockpit under normal flight operations were categorized as an HEMS crewmember (HCM).

Services with variable staffing were categorized according to the staffing variation with the lowest level of medical education; for example, a crew staffed intermittently by paramedics or nurses was classified as paramedic staffed. Similarly, additional medical personnel used by demand, most often a physician, perfusionist, respiratory therapist, nurse, or midwife, were not counted as part of the regular crew in our analysis.

For the safety analysis, we assigned the responses into 6 groups according to the common denominators of the crew configuration; services with a single medical provider were compared with those with a dual medical provider configuration, services without a physician were compared with services with a physician, and services with a physician working alone were compared with those with a physician working with a medical assistant.

Statistical Analysis

Dichotomous data are presented as counts and valid percents. Ordinal data are presented as medians and quartiles and visualized with box plots. Before analysis, we decided that a relevant break point was between “slightly acceptable” (5) and “acceptable” (6). Group differences of the Likert scale data dichotomized into the 2 groups Likert scale 1 to 5 and 6 to 7 were tested with the Fisher exact test using a significance level of $P \leq .05$. To our knowledge, no other studies exist with a comparable method or scale. We believe we have a good rationale behind the choice of break point and did not test others in search of significant results. All statistical analyses were performed using Microsoft Excel 2011 for Mac (Microsoft

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