



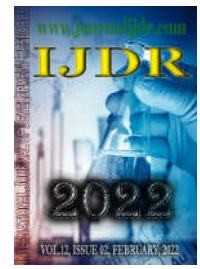
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RESEARCH ARTICLE

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FACTORS CONTRIBUTING TO INFORMATION AND KNOWLEDGE MANAGEMENT IN THE AEROMEDICAL SERVICE

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ABSTRACT

The aeromedical service is a modality of transport intended for critically ill patients in need of removal to a specialized medical care unit in a short period. This study aims to recognize, in the specific literature, the factors that contribute to the theoretical and practical improvement of the aeromedical transport team, through the management and sharing of knowledge. This is an integrative literature review study that had as its starting point the guiding question: "what factors contribute to the theoretical and practical improvement, using knowledge management and sharing, of teams that work in aeromedical transport?". The search for articles was conducted in July and August 2021, in the online portals: Periódicos da Capes, Biblioteca Virtual de Saúde (BVS), and *Scientific Electronic Library Online* (SCIELO). The search found attributions necessary for the development of professionals in the aeromedical service and that are shared through multidisciplinary interconnections through contacts with other professionals and their respective environments.

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INTRODUCTION

When Knowledge Management (KM) is implemented in a healthcare service, it aids and supports quality and learning processes. The practice of sharing solutions by lessons learned in everyday life is an important reality when complex situations are discussed by professionals working in companies that provide aeromedical transport services (PEREIRA, 2021). Pereira (2021) reports that the work routine, multidisciplinary interconnections through various professionals and environments enable the high production of information that, if well managed, can support good Knowledge Management practices. The practice of Knowledge Management can be seen to create value that contributes to the companies that provide this type of service and to everyone involved (DA SILVA; JULIANI; DA SILVA DIAS, 2016). Knowledge management enables improved healthcare services as well as better efficiency and effectiveness of management processes (PEREIRA, 2021). Given the above, the present work aims to recognize, in the specific literature, the factors that contribute to the theoretical and practical improvement, using knowledge management and sharing, of teams that work in aeromedical transport.

Information and Knowledge Management: For Belkin (1978), information is a communicable structure, formed by texts, maps, tables, scores, graphs, and documents that can modify the cognitive structure (knowledge) of the receiver. In this way, as soon as the information is integrated by the receivers, knowledge is formed. Information Management can be perceived in the intercession of knowledge management, in the combination process that will be explained soon after (VIEIRA, SANTOS, 2019). Knowledge management involves complex and dynamic processes that refer to the conversion of the knowledge of the individuals that make up a group or an organization, one can say that there will be two worlds, an objective and/or subjective one. For the conversion process to occur, four processes can be described: (i) socialization, with the conversion of tacit knowledge into tacit, which occur between people as the exchange of ideas and thoughts; (ii) externalization, which has the conversion of tacit knowledge into explicit, with the production of texts and development of technologies; (iii) combination (also present in information management), is the moment of conversion of explicit knowledge into explicit, described as the production of new explicit knowledge from the already explicit knowledge; and finally, (iv) internalization, with the conversion of explicit knowledge into tacit,

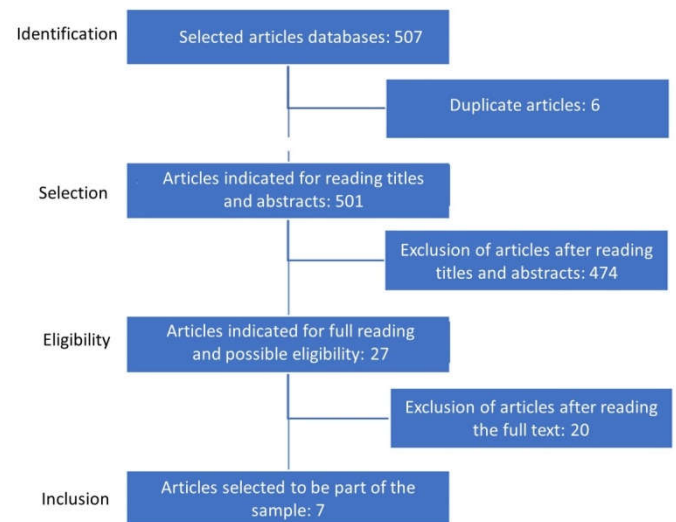
by training or reading texts and protocols (POPPER, 1978; NONAKA, TAKEUSHI, 1995; COSTA 2009; VIEIRA. SANTOS, 2019). When bringing the concept of Knowledge Management to the health area, since 1960 the Pan American Health Organization already referred to a method where one cannot separate Work Management from Knowledge Management (RIBEIRO, 2004). Lemos (2012) and Bezerra *et al.* (2016) corroborate this concept and mention that it is important to know the work environment to be developed in the education process and compose support of the political-pedagogical training process. Ceccim (2005) points out that education in health services cannot be based only on lists of individual performance needs, but based on central and general needs. More subjective topics, such as humanization and integrality of care, should be part of the curriculum. In addition, the author argues that the qualification processes of health personnel should be structured from the problematization of their work process, bringing the reality of the health needs of people and populations. And when crossing the themes of knowledge management and emergency care, it is clear that protocols are used to bring quality care with organization, standardization of safe care and, simultaneously, individualization of each category of care, case, or need of the individual, which may have a delicate and/or serious clinical condition. Such realities are based on protocols, properly associated with continuing or permanent education (BONIN, 2016).

Emergency Care: The aeromedical service is a type of emergency transport intended for critically ill patients in need of removal to a specialized medical care unit and a short period (HERNÁNDEZ, OLIVERA, 2007). The first reports on this type of service date back to 1870, during the Franco-Prussian War, when wounded soldiers on the battlefield were aero-removed by hot air balloons. However, the milestone in the use of air transport occurred during the First World War. Officially, reports describing the participation of nurses in the care process during flight refer to World War II. Since then, war medicine developed several resources applied to soldiers and brought to civilians until the present day (GENTIL, 1997; GOMES, 2013). Regarding the Brazilian legislation, aeromedical transport must be under the technical authority of a medical director who is qualified and trained in a pre-hospital emergency, with basic knowledge of flight physiology and aviation regulations. In addition, it is recommended that the manager be qualified in Aerospace Medicine. Thus, every company that provides aeromedical service must have its registration duly registered in the Regional Council of Medicine (CRM) in its region. This definition is foreseen in the Federal Council of Medicine (CFM) Resolution 1596 of June 9th, 2003, which was updated by the CFM Resolution 1661 of 2003 (CFM, 2003). The Federal Council of Nursing, by Resolution n° 260/2001, regulates the performance of nurses with a degree of specialization in several areas such as pre-hospital, neonatology, intensive care, and aerospace nurses (COFEN, 2001). As mentioned above, the health professional must be trained to act as a professional in aeromedical transport and, according to the Ordinance No. 1863 of 2003 from the Ministry of Health, there must be continuous training for professionals who deal with emergency services, both in fixed and mobile modality, and maybe land or air (MINISTRY OF HEALTH, 2003). Aeromedical transport has two areas with very distinct characteristics, the aviation sector, and the aerospace medicine sector, despite having very similar work processes. The search for optimization of safety and high-quality standards requires that medical-hospital organizations become increasingly specialized and, for this, it becomes necessary to know the form of knowledge involved and the management of it (DIAS; FERREIRA; CARVALHO, 2017).

MATERIAL AND METHODS

This is an integrative literature review study, based on the PRISMA model - *Preferred Reporting Items for Systematic Reviews and Meta-Analyses* (GALVÃO; PANSANI; HARRAD, 2015). The guiding question followed: "what factors contribute to the theoretical and practical improvement of teams working in aeromedical transport through knowledge management and sharing?"

The search for articles was conducted in July and August 2021, in the online portals: Periódicos da Capes, Biblioteca Virtual de Saúde (BVS), and Scientific Electronic Library Online (SCIELO). The keywords used were: "knowledge management", "patient transport", "nurse" and their respective words in English. For the selection of articles, the following criteria were used: studies published between 2016 and 2021 that addressed the training process of professionals in the aeromedical service. Studies not found in full, publications before 2016, and languages other than English and Portuguese were excluded. The selection began by identifying the publications based on their titles, followed by reading the abstracts, and including those that *met all* the criteria after being read in their entirety, as described in Figure 1.



Source: survey data.

Figure 1. Flowchart of study selection, according to the pre-established inclusion and exclusion criteria

In total, 507 publications were located, 43 in SCIELO, 176 in Portal CAPES, and 288 in BVS. When checking the search results, 7 papers were found that were duplicated in the search bases. Next, a selection of the articles that contemplated the subject was made by reading the title and abstract, arriving at 27 articles, and when reading the full text, 20 were excluded and 7 articles were included.

RESULTS AND DISCUSSION

After data collection, seven articles were selected. Three of them contained observations conducted directly from the aeromedical services, three others presented a literature review, and the last one was a retrospective review. Regarding journals, the studies included were international, 71.4% from the *Air Medical Journal*, 14.3% from the *Journal of Nippon Medical School*, and 14.3% from the *Journal of Health Informatics*. All the studies pointed out the need for a qualified and specialized team, but there were no notes on *latu-senso* specialization courses as prerequisites to perform the function of the medical team in aeromedical services. The results are shown in chart. Since World War II, the involvement of nurses in the transportation of the wounded has changed considerably. The professionals were trained by surgeons to provide care to the wounded on board cargo planes that offered minimal support such as oxygen, blood plasma, and devices to try to immobilize the sick. All professionals had to perform in a small space, which required flexibility to care for injuries, altitude hypoxia, stress, and fear related to flying (CURTIS, *et al.*, 2020). With the development of other technologies and the improvement of aircraft, there was the inclusion of helicopters (known as rotary wings) and the maintenance of airplanes (fixed wings). Helicopters have the advantage of being able to reach remote regions such as mountains, places that have suffered natural disasters such as, for example, earthquakes in Japan (MOTOMURA, 2018; GIRI, *et al.*, 2020).

Table 1. Survey results

Title	Authors	Year	Study Type	Sample	Results	Periodical
Challenges and Resources for New Critical Care Transport Crewmembers: A Descriptive Exploratory Study	ALFES, Celeste M.; STEINER, Stephanie; RUTHERFORD-HEMMING, Tonya.	2016	Exploratory descriptive study	Surveys were distributed in 3 major organizations in the aeromedical service industry, with a total of 315 crew members as participants.	The survey responses from the study revealed that more education and training are needed. Novice crew members identified the areas of crew safety, communication, environment, and resource management as particularly challenging. The responses also validate the need for more simulation training, especially for critical patient transport.	Air Medical Journal
Bhutan's First Emergency Air Medical Retrieval Service: The First Year of Operations	GIRI, Sweta, et al.	2020	Retrospective observational study	The Study described how the first year of operation and 171 means of transport made by Bhutan (Asia) aeromedical service went.	The study showed that it is necessary to have a team trained and skilled in "soft skills" to improve care for various situations and pathologies.	Air Medical Journal
"Flight Nurses," or "Nurses Who Fly"? An International Perspective on the Role of Flight Nurses	BRAITHWAITE, Ian; STEELE, Ann-Marie	2020	Systematic literature review	Thirteen articles that reported on the experience of nurses and their training were used.	Eight grouping themes were presented that makes it possible to explain the characteristics of a flight nurse, ranging from the preparation of this professional to his or her experience.	Air Medical Journal
Large-Scale Air Medical Operations in the Age of Coronavirus Disease 2019: Early Leadership Lessons From the Front Lines of British Columbia	OLSEN, Ole, et al.	2020	Literature review	10 aeromedical services and their information-sharing services were evaluated on Coronavirus 2019	This article explores the preparation and early experiences of a large Canadian acute care transport program during the Covid-19 pandemic in 2019, focusing on 6 broad strategic goals centered on staff well-being: regular and transparent communication, networking, evidence-based approach to personal protective equipment, agile mission planning, and an accelerated approach to clinical practice and policy updates and future state modeling.	Air Medical Journal
Celebrating Transport Nurses during the WHO's Year of the Nurse	CURTIS, Timothy J., et al.	2020	Literature review	We used 3 articles that reported on the history and trajectory of flight nurses.	The study depicted the work environment and training process of flight nurses.	Air Medical Journal
Aeromedical Transport Operations Using Helicopters during the 2016 Kumamoto Earthquake in Japan.	MOTOMURA, Tomokazu et al.	2018	Retrospective observational study	A total of 89 patient means of transport were studied.	During the Kumamoto earthquake, there was a need to improve knowledge of logistics, care, train the teams to transport the 89 patients who had trauma cases, pulmonary embolism, pregnant women, and newborns.	Journal of Nippon Medical School
Management of Health Information Produced and/or Published by Ipea	VIEIRA, Fabiola Sulpino; SANTOS, Jhonathan Divino Ferreira dos.	2019	Retrospective study	Analysis of 565 articles indexed in the VHL	A project to improve health information management, which will contribute so that the knowledge produced by the institute in this area can be easily accessed by individuals, becoming useful and strategic information for the promotion of the nation's socio-economic development.	Journal of Health Informatics

Source: survey data

Table 2. Compilation of attributions to be developed and performed in the aeromedical service

Factors to be addressed in the training of professionals	Authors and year of publication
Management of resources and protection equipment	ALFES, STEINER, RUTHERFORD-HEMMING, 2016; MOTOMURA, 2018; CURTIS, <i>et al.</i> , 2018; GIRI, <i>et al.</i> , 2020; BRAITHWAITE, STEELE, 2020; OLSEN, <i>et al.</i> 2020.
Communication	ALFES, STEINER, RUTHERFORD-HEMMING, 2016; MOTOMURA, 2018; CURTIS, <i>et al.</i> , 2018; GIRI, <i>et al.</i> , 2020; BRAITHWAITE, STEELE, 2020; OLSEN, <i>et al.</i> 2020.
Environment (Service region and aircraft cabin)	ALFES, STEINER, RUTHERFORD-HEMMING, 2016; MOTOMURA, 2018; CURTIS, <i>et al.</i> , 2018; GIRI, <i>et al.</i> , 2020; BRAITHWAITE, STEELE, 2020; OLSEN, <i>et al.</i> 2020.
Trained and clinically competent staff	ALFES, STEINER, RUTHERFORD-HEMMING, 2016; MOTOMURA, 2018; CURTIS, <i>et al.</i> , 2018; GIRI, <i>et al.</i> , 2020; BRAITHWAITE, STEELE, 2020; OLSEN, <i>et al.</i> 2020.
Safety, well-being, and health of the professional	ALFES, STEINER, RUTHERFORD-HEMMING, 2016; MOTOMURA, 2018; CURTIS, <i>et al.</i> , 2018; GIRI, <i>et al.</i> , 2020; BRAITHWAITE, STEELE, 2020; OLSEN, <i>et al.</i> 2020.
Planning Ahead	ALFES, STEINER, RUTHERFORD-HEMMING, 2016; MOTOMURA, 2018; CURTIS, <i>et al.</i> , 2018; GIRI, <i>et al.</i> , 2020; BRAITHWAITE, STEELE, 2020
Compassion, empathy, and care	BRAITHWAITE, STEELE, 2020

Source: survey data

To work in aeromedical service, in principle, it is necessary that the professional has skills with patients in critical condition and be trained to deal with the particularities of care in the aircraft, such as the bad weather caused by flight and altitude (OLSEN, *et al.*, 2020). The prevention of damage to health suffered by professionals who work in aeromedical transport is also an aspect to be considered. A study conducted with 315 crew members elected five points that should be discussed: fatigue, diet care, well-being, involvement, and team communication (ALFES, STEINER, RUTHERFORD-HEMMING, 2016). Due to so many aspects, the training for flight crew and aeromedical transport is extensive, involving advanced procedures in aircraft safety, radio communication, use of night vision goggles, and ongoing training in critical care. Professionals working in this type of transport must possess skills, with proven experience, related to the care and transport of critically ill or injured patients (GIRI, *et al.*, 2020; CURTIS, *et al.*, 2020). One of the courses pointed out as necessary for their performance is *Crew Resource Management*, which addresses the need to optimize the man/machine interface and related interpersonal issues, with maximum focus on communication skills and focus also on the resumes of the professionals working in the teams (ALFES, STEINER, RUTHERFORD-HEMMING, 2016).

Unlike doctors, who do not always take on all types of cases (due to their specific specialty), nurses assume responsibility for the patient (infant, child, adolescent, or critically ill or injured adult) during pre-hospital flights and between facilities. The aeromedical service allows an interaction with other areas, Sectors which makes possible a continuous improvement of the assistance provided to the patient. Such improvements are possible due to a process of theoretical and practical training of the onboard team (CURTIS, *et al.*, 2020). This shows how logistics, at certain times or events, makes there is a need for training to care for an individual or multiple victims, as was the case of the 89 removals performed by Japanese teams after the earthquake in Kumamoto in Japan. The cases were diverse and teams with expertise in trauma care, pulmonary embolism, pregnant women, and newborns were needed (MOTOMURA, 2018). The healthcare area has information and knowledge to guide it in adapting to adversity. In the Japanese event, for example, there was a great commitment from the teams in performing services and creating logistics that could solve the continuous challenges present in the operational methods. The author also states that this innovation process generated a process of information sharing and training of teams throughout the organizational structure, which generated material and knowledge for the work of transporting victims of the earthquake in Kumamoto and for other possible future events (MOTOMURA, 2018). As with the histories of war and disasters, the pandemic event caused by the Coronavirus, starting in 2019, brought the need for training and information exchange. Olsen *et al.* (2020) evaluated the information produced and shared by 10 aeromedical services. Six broad strategic goals were noted: centering on team wellbeing, effective communication, networking, evidence-based approach to personal protective equipment, agile mission planning and an accelerated approach to clinical practice, and policy updates and future state modeling.

The results brought about capacity strengthening of the aeromedical services through the preparation and education of the professionals, as there was an increase in the occurrences of airlifts with Covid-19 infected patients (OLSEN, *et al.*, 2020). Another study that presented data on the professional and its development was that of Braithwaite and Steele (2020). In the article, eight grouping themes were presented to explain the characteristics of the crew, which range from preparation to the experience of the professionals who make up the crew. The themes are well-being with oneself, preparation and anticipation, environment, communication and teamwork, clinical competence, operational competence, the pleasures and sorrows of work, compassion, and empathy. The practices and work based on these themes bring greater preparation for care with quality, safety, and efficiency of the assistance provided (BRAITHWAITE, STEELE, 2020). For a presentation of important points for the professionals' development process and performance, a compilation

was developed that points out the recurring categories in the studies and their respective authors, see Chart 2. As shown in the previous table, it can be said that some topics are unanimous for the training process of the professional who will work in the aeromedical service. The management of resources and protective equipment are basic items for the professionals to be able to provide quality assistance and safety. Onboard an aircraft, there may be some conditions that alter the natural course of the flight and that have an impact on the clinical condition of the patient, so the team must be prepared and ready to intervene as the need or unforeseen happens. These changes may come from conditions external to the aircraft such as the environment and may be enhanced by cabin conditions (ALFES, STEINER, RUTHERFORD-HEMMING, 2016; MOTOMURA, *et al.*, 2018; CURTIS, *et al.*, 2018; GIRI, *et al.*, 2020; BRAITHWAITE, STEELE, 2020). For this reason, all possibilities should be described before the flight, using a briefing and thus carry out planning with everyone who will be on the mission (ALFES, STEINER, RUTHERFORD-HEMMING, 2016; CURTIS, *et al.*, 2018; GIRI, *et al.*, 2020; BRAITHWAITE, STEELE, 2020). In this sense, effective communication must happen during the preparation of care, when taking the patient, along the route, and ends after the passage of the patient to the destination hospital with a debriefing between the team. Communication will be a means of expression used by each member of the transport to better serve the patient because each professional has a specific technical competence to better intervene in the patient's clinic and thus act with safety and well-being (ALFES, STEINER, RUTHERFORD-HEMMING, 2016; MOTOMURA, *et al.*, 2018; CURTIS, *et al.*, 2018; GIRI, *et al.*, 2020; BRAITHWAITE, STEELE, 2020). The professional who acts in the aeromedical service must have good conditions to act in aeromedical service, and an important factor is their physical fitness, being with occupational health fit, and maintaining their well-being. All these factors influence their practice when suffering variations in the environment, altitude, pressure, and temperature during flights (ALFES, STEINER, RUTHERFORD-HEMMING, 2016; MOTOMURA *et al.*, 2018; CURTIS, *et al.*, 2018; GIRI, *et al.*, 2020; BRAITHWAITE, STEELE, 2020). Braithwaite and Steele (2020), report that compassion, empathy, and care are important factors in caring for the critically ill since professionals must welcome and promote humanized care for their patients.

Therefore, the professionals who work in aeromedical transport must be aware and able to execute the topics listed above, so that it is possible to provide more efficient, safe, and quality assistance. Vieira and Santos (2019), describe in their work the importance of sharing health studies so that there is information management and the four processes of knowledge management. Such practices are evidenced in the study by Curtis and collaborators (2020), who report that the process of socialization through the interaction of professionals with other sectors and new teams makes continuing education easier and results in higher quality care. Braithwaite and Steele (2020), describe the history of onboard nurses, from the first reports in which the professionals were trained by doctors, through the improvement of the profession with the recognition of the performance, and finally, suggesting new studies to verify new training processes. For the pandemic event caused by COVID-19, externalization occurred, as it was necessary to rethink not only the patient's characteristics but to reinforce the biosecurity issues of everyone involved in the care, reformulating the training objectives and expanding the topics to be addressed (OLSEN, *et al.*, 2020). Motomura (2018), describes a combination of the knowledge management process with information sharing and training as ways to train the teams in natural disasters. GIRI *et al.* (2020), reinforce that training for aeromedical services teams can bring an improvement in *soft skills*. Alfes, Steiner, and Rutherford-Hemming (2016) mention the internalization process, mentioning that the training process is necessary for novice professionals and reinforcing the continuity of training with realistic simulations for professionals already working in the aeromedical service.

Concluding Remarks: This study listed the factors that influence and are necessary for the process of training and performance of professionals who work in the aeromedical service. It was found that

the process of sharing knowledge, through training, qualification, and improvement of practices often occurs peer-to-peer in the environment where the professional is inserted and through interconnections with other aeromedical or hospital services. Therefore, it is possible to assume that there is no model or a study applied to Knowledge Management for aeromedical services, which makes the process of managing this information broader and more diffuse. It has been observed that each type of event such as wars, events caused by natural disasters, or the emergence of lethal and highly contagious diseases generates a mobilization process that allows learning about the etiologies and modes of interventions. Therefore, a movement to share knowledge is generated to improve the efficiency of services and care, which culminates in an increase in the survival of the sick. Therefore, the sharing of information and knowledge has been practiced since the beginning of aeromedical transport through multidisciplinary interconnections and contacts with other professionals and their respective environments. New studies must be conducted to generate models or assumptions of Knowledge Management applied to the aeromedical service.

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