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Experiences of nurses involved in air ambulance service: a qualitative study

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ABSTRACT

Introduction: Nurses undertaking air ambulance service encounter environmental, equipment, and personnel limitations during their work. Moreover, they must cope with various types of injuries and illnesses, as well as changes in patient conditions. These factors pose a significant pressure on nurses. Currently, there is a lack of qualitative research on the experiences of nurses performing air ambulance tasks. The purpose of this study is to explore the experiences of nurses undertaking air ambulance service, with a focus on capturing their personal perceptions regarding this field of work.

Methods: Twelve nurses were selected using purposive sampling, and semi-structured interviews were conducted to collect data. Content analysis was used to analyze the data.

Results: The analysis identified three major themes: "Ambiguous and risky emergency missions," "Challenges during air transfer," and "Nurses' personal limitations." Eight categories were formulated within these themes, including "Mission uncertainty," "Urgency of medical conditions," "Hazards at high altitude," "Cabin environment limitations," "Inadequate equipment," "Incomprehensive operating mechanisms," "Physical discomfort," and "Recognition of professional shortcomings."

Conclusions: Improving the performance and well-being of nurses engaged in air ambulance services necessitates the implementation of a psychological adaptation program. This includes the utilization of psychological stress assessment tools or engaging in role-playing activities. Successful patient rescues demand the establishment of comprehensive standard operating procedures, involving an interprofessional team. Supporting nurses in adeptly managing challenges during air ambulance services requires an expanded scope of education and training, facilitated through initiatives like situational simulation and similar approaches.

Keywords: air ambulance service, content analysis, experience, nurse

Introduction

Air Ambulance is a critical component of emergency medical services and has been demonstrated to deliver rapid treatment to patients in emergency situations, resulting in saved lives and reduced medical costs (Eskandari *et al.*, 2021). It can also efficiently transport patients who are in remote locations without adequate access to intensive care in hospitals (Kulshrestha and

Singh, 2016). Comparable to many other regions or countries that require air ambulance as a vital part of the medical system (Edwards *et al.*, 2019), Taiwan faces similar issues regarding the health inequality of its offshore islands. Despite having relatively smaller populations on the islands, healthcare resources are severely limited. Residents of these islands are confined to basic medical services, necessitating air ambulance service for transferring patients to the main island of Taiwan, particularly in cases of severe conditions or advanced medical care needs. Tragically, in 2018, a Taiwanese rescue helicopter crashed into the sea off the coast of Orchid Island (Lanyu) during an air ambulance mission. This unfortunate incident claimed the lives of all six people on board, including three flight crew members, one nurse, the patient, and a family member (Li, 2018). Such events and the inherently dangerous nature of air ambulance services further heightened the psychological burden on flight nurses, posing greater risks compared to those working in general hospitals.

According to statistical data reported by the Nursing and Health Care Department of Taiwan Ministry of Health and Welfare (2022b), air ambulance missions averaged 230 per year from 2017-2018, and increased to 300 per year from 2019-2021. Notably, 40.58% of the flights during this 5-year period were conducted at night (Ministry of Health and Welfare, 2022a). The rising occurrences of natural disasters and infectious diseases in recent years have led to healthcare paralysis in specific regions around the world. Using Taiwan's data as an example, air ambulance rescues have become more crucial, especially in challenging and remote regions like offshore islands and inland areas. Patients in air ambulances are often critically ill and may require specific medical equipment before or during transport (Dyro, 2004; Zia *et al.*, 2019). When there is a need for higher monitoring capabilities during a mission, complications may arise if the medical equipment is not approved for usage in airplanes. This causes healthcare personnel to face a dilemma of having to choose between unapproved equipment or relying on transporting the patient with fewer monitoring resources (Frost, Kihlgren and Jaensson, 2019). This could mean a reduced ability to continuously track certain vital signs or health indicators during the transport process. While this may present challenges in comprehensive patient monitoring, it may be a necessary compromise in such situations.

Nurses undertaking air ambulance service face numerous challenges, including environmental, equipment, and human resource limitations, as well as managing patients with complex and changing conditions (Dias *et al.*, 2021). Working in the air means nurses are required to be patient-focused at all times, often at the cost of their own safety. The stark vulnerability experienced during prolonged transport also emphasizes the limitations on supplies and the absence of external assistance of air ambulance services as compared to ground ambulance work. All the above-mentioned challenges put significant burdens on nurses. In accordance with this, Aditya et al. (2022) identified patient handling before take-off, patient safety during flight, and preparing the handover of patients as key to the success of an air ambulance service. The distances traveled, climatic conditions, communication, and the precarious structure of some airports were also elements to be considered when planning transportation and screening the patient to ensure their safety (Dias *et al.*, 2021). To ensure both patient and nurse safety, nurses' work stress, perceived workload, and interpersonal teamwork skills play pivotal roles in air ambulance services (Pereira *et al.*, 2021).

Previous studies are centered on investigating aspects such as preparations, patient safety, work-related stress, fatigue, and team dynamics in air ambulance services. Nonetheless, there is limited research on nurses' personal perceptions regarding their experiences throughout the whole process of this work and its dangerous risks, particularly in the psychological aspect. The purpose of this study is to explore the experiences of nurses undertaking air ambulance services, with a focus on capturing their personal perceptions regarding this field of work. Although this study is conducted in Taiwan, the topic of air ambulance services remains globally significant. The research findings can serve as a benchmark for other countries, offering valuable insights into operational practices and contributing to the overall improvement of global air ambulance service quality.

Materials and Methods

Study Design

Content analysis and semi-structured interviews were involved in this qualitative research to gain a rich understanding of nurses' experiences in offshore-island air ambulance service.

Participants and Setting

This study employed purposive sampling, and the participants were selected from the air ambulance nursing departments of three hospitals designated by the Taiwan government. The inclusion criteria for this

study were registered nurses (RN) with more than five years of emergency nursing experience and more than two years of experience in air ambulance services. They were also required to have participated in the initial eight hours of flight nursing training. The exclusion criterion was participants who had not been involved in air ambulance services within the last three months. The sample size was determined by data saturation, which refers to the point at which no new themes or codes emerge from the data (Guest, Namey and Chen, 2020).

Data Collection

This study adopted semi-structured interviews as the data collection method. Interview guidelines were carefully formulated through a comprehensive review of existing literature and panel discussions. These guidelines were specifically crafted to facilitate the interviewees in sharing their perceptions and the challenges they encountered during their experience in the air ambulance service (Table 1).

One researcher, KYW (an RN), who was responsible for visiting the hospitals during the study period to recruit participants for the study, has a PHD background and a sizeable experience in nursing. Equipped with qualitative research training, she highly focused on the air ambulance nursing experience, and had no prior contact with the participants of the study. After compiling a list of participants from three government hospitals, the researcher invited these nurses to join the study and encouraged them to refer additional potential participants. Recruitment involved outlining the research objectives, and participants were given one day to decide on their willingness to participate. Written informed consent was obtained from all 12 participants prior to interviews and data collection. Face-to-face, semi-structured interviews were conducted using the interview guidelines. Each participant was interviewed once in a private area within the hospital without any third parties involved. All interviews were conducted by the same researcher using a voice recorder, with each session lasting approximately 30–60 minutes. Limited demographic information was collected to ensure confidentiality. During the interviews, any ambiguous statements made by the interviewees are promptly clarified. Following the interviews, audio recordings were coded and transcribed verbatim in an anonymous manner. The data were collected from 15 November to 31 December, 2019.

Table 1 Interview guidelines

Questions	Prompts
What are the most profound experiences you have had during air ambulance duty? How did you feel at the time?	Sudden patient emergency, helicopter emergency landing, patient self-extubation, or patient having severe breathing difficulty.
What are your perceptions on air ambulance?	Work that involves helping others, is urgent yet important, or work that poses high risks.
What challenges do you encounter in air ambulance?	Adapting to the high-altitude working environment or being competent in providing air medical care.

Data analysis

The audio-recorded interviews were transcribed verbatim in Chinese within 24 hours post-interview and double-checked against the digital recordings. These transcriptions were then translated into English, back translated into Chinese, and returned to the participants for comment and confirmation. Afterward, two researchers (YFC and CYH) independently analyzed the transcripts using qualitative content analysis (Lindgren, Lundman and Graneheim, 2020) and discussed them with a third researcher (KYW) until a consensus was reached. The researchers immersed themselves in the transcripts and developed a list of data-driven codes. These codes were compared, labeled, and grouped into meaningful units to identify key themes in the data.

Trustworthiness

To ensure the accuracy and trustworthiness of the study, this research has adopted the criteria proposed by Lincoln and Guba (1985), which includes four aspects: (1) Credibility, in which the researcher has extensive interview experience and establishes a trusting and harmonious relationship with the interviewees prior to the interview. Additionally, qualitative research scholars and case members were invited to review the consistency of the text and the meaning units and to summarize the content. (2) Transferability, in which the interview content is faithfully presented in the text. The data were collected from nursing professionals with different disciplines, seniority, advanced levels, and marital status, providing multiple comparisons and richness to the data. (3) Dependability, in which the data collection was carried out by the researcher using in-depth interview techniques, and the audio content was transcribed verbatim into text. (4) Confirmability, in which all interview notes, text, and data analysis files were fully preserved.

Ethical Considerations

All study participants provided written informed consent, and the study protocol was approved by the

Institutional Review Board of the participating hospital (IRB No. 11MMHIS153).

Results

A total of 12 nurses were enrolled in the study. Their ages ranged from 28 to 50 years old (mean = 34 years) and 58% (n = 7) were married. They had 2–6 years of air ambulance working experience (mean = 3.8 years) and 58% of nurses (n = 7) had more than 10 years of emergency nursing experience (Table 2).

The analysis revealed three major themes. The content within these themes was formulated into eight categories and seventeen subcategories (Table 3).

Ambiguous and risky emergency missions

Working in hospitals involves clear and well-developed training, with a high degree of understanding of patient characteristics. However, air ambulance services are always pressing, unpredictable, and dangerous in nature. They fall under three categories: "Mission uncertainty," "Urgency of medical conditions," and "Hazards at high altitude".

Mission uncertainty (subcategories: anxiety during flight operations and apprehension about unclear patient progression)

Patients in need of air ambulance services are usually emergencies where the nurse has no way of knowing when they will be dispatched. They will also have limited access to patient information due to transfers commencing as soon as they receive the assignment. Nurses described these uncertainties as follows:

"I also wonder what kind of patient is being transported because I worry that if the patient is in a bad condition, our lack of equipment may endanger the patient's life." (F-1-031)

Table 2 Participant characteristics (N = 12)

Nurses	Gender	Age	Marital Status	Air Ambulance Experience	Emergency Nursing Experience
A	Female	35	Married	5	16
B	Female	33	Married	4	11
C	Female	32	Married	3	10
D	Female	28	Married	2	6
E	Female	29	Unmarried	2	6
F	Female	31	Unmarried	4	9
G	Female	31	Unmarried	4	9
H	Female	32	Married	4	11
I	Female	47	Married	5	25
J	Female	34	Unmarried	4	12
K	Female	31	Unmarried	3	8
L	Female	50	Married	6	23

Table 3 Air ambulance services experiences (N = 12)

Theme	Category	Subcategory
Ambiguous and risky emergency missions	Mission uncertainty	• Anxiety during flight operations • Apprehension about unclear patient progression
	Urgency of medical conditions	• Time pressure • Patient vital sign instability
	Hazards at high altitude	• Abrupt weather changes • Inherent risks of air travel
Difficulties during air transfer	Cabin environment limitations	• Difficulty to provide care in confined spaces • Low visibility during night flights
	Inadequate equipment	• Insufficient medical equipment • Lack of adequate heating devices
	Incomprehensive operating mechanisms	• Incomplete operational procedures • Absence of auditing procedure mechanisms
Nurses' personal limitations	Physical discomfort	• Discomfort during aircraft descent • Nausea due to the unpleasant smell of patients' blood and vomit • Ear discomfort caused by loud aircraft noise
	Recognition of professional shortcomings	• Limited training period • Inability to handle various situations due to lack of satisfactory training contents

"When we received the assignment for air ambulance transfer, I was quite nervous, as I do not know the patient, I was afraid I wouldn't have a grasp on the patient's condition. My fear only subsided once we arrived at the hospital and had access to the patient's information. Besides fear, I was also quite anxious, worried that I wouldn't be able to perform at my best." (A-1-001)

Urgency of medical conditions (subcategories: time pressure and patient vital sign instability)

Regardless of what they are doing at the time, nurses must be at the airport as soon as they are notified to avoid delay in departure. Moreover, the unstable conditions of the patient being transported can also add to their anxiety. Nurses described the urgency of time and patient instability as follows:

"We are required to arrive at the airport by a specified time, so the fear of being waited on by everyone is very nerve-wracking." (C-1-004)

"After disembarking from the aircraft, I really couldn't feel the patient's pulse in the ambulance, it was

very weak. So, I ended up urging the ambulance to speed up, and when we arrived at the hospital, the patient received CPR." (H-1-017)"

"I once had a patient with acute myocardial infarction (AMI), and I was worried about providing emergency care on board due to his irregular heartbeat." (G-1-020)

Hazards at high altitude (subcategories: abrupt weather changes and inherent risks of air travel)

The weather conditions are unpredictable, and the urgency of the situation demands a race against time to ensure the best treatment opportunities for patients. In addition to this, the flight itself carries dangers that can pose risks to the personal safety of the nurses. The following were the descriptions of each nurse regarding air ambulance service hazards:

"One time during a mission, the poor weather caused the tail section of the helicopter to hit a pillar at the port, causing damage to the rotor. The helicopter then crashed to the ground, and I was thrown around inside, hitting my head and suffering a slight concussion. The patient died thereafter." (J-1-005)

"The wind was strong at that time, and it was shaky, I kept looking out the window out of fear. It felt like the aircraft did not move even though it had been flying for quite some time. I was afraid that the helicopter might plummet to the ground." (H-1-018)

Difficulties during air transfer

Performing air ambulance services during nighttime can be extremely challenging due to low visibility and cramped space inside the helicopter, which makes it difficult to provide proper patient care and promptly assess physical symptoms for appropriate treatment. Effectively managing sudden patient behavior or air emergencies also proves to be a challenge due to the constricted space in the helicopters, limiting the carrying capacity for essential equipment such as medical and heating devices. This situation can lead to heightened anxiety for the personnel involved. Additionally, inadequate briefing on the helicopter's Standard Operating Procedures (SOPs) for the nurses, coupled with the absence of pre-flight audits, can result in non-adherence to the required protocols. Their difficulties were divided into three categories: "cabin environment limitations," "inadequate equipment," and "incomprehensive operating mechanisms."

Cabin environment limitations (subcategories: difficulty to provide care in confined spaces and low visibility during night flights)

The environmental characteristics of air ambulance services are difficult to control completely, such as small cabin space, vibrations in the aircraft due to turbulence, and low visibility during night operations. The following were the descriptions of such challenges as mentioned by the nurses:

"The helicopter cabin is narrow; it is difficult for us to move patients inside the cabin." (F-1-042)

"For patients with gastric bleeding, we must observe whether they have symptoms of anemia by the color and texture of their vomit. But, because of the low light conditions on the aircraft, it can be difficult to tell. Sometimes, things like the drip or the nasogastric tube can slip out without us noticing." (E1-048)

Inadequate equipment (subcategories: insufficient medical equipment and lack of adequate heating devices)

The helicopter's limited capacity, as it is not a conventional medical aircraft, restricts the availability of fully equipped medical and heating equipment that can meet all patients' needs. The helicopter can only carry simple or minimum-capacity equipment. The nurses described this issue as follows:

"The roof area of the helicopter compartment is empty, so there should be basic medical equipment like those in an ambulance such as a blood pressure monitor, oxygen equipment, and sputum suction unit…" (D-1-030)
"The stretcher is not made of plywood, but rather a kickboard-like material, and whenever a patient has to be moved, there is no point of force applicable to carry the patient onto it, so we can only pull the patient by the hem of their clothes." (F-1-048)

"Conducting tasks at night means it can be quite cold. I didn't wear a jacket during my first night duty. It was freezing." (I-1-016)

Incomprehensive operational mechanisms (subcategories: incomplete understanding of operational procedures and absence of auditing procedure mechanisms)

Nurses heavily rely on the information provided by the handover personnel to assess and plan subsequent nursing care during the flight. Incomplete pre-transfer evaluation and missing medical information during transfer can significantly impact the nurses' ability to provide seamless care services. Therefore, implementing an audit process becomes essential to ensure the completeness and accuracy of the information exchange. The nurses shared the following descriptions in regard to this situation:

"On my first flight, the captain didn't give me any earmuffs, so I wondered how come it was so noisy up there. Also, I couldn't even buckle my seat belt when the helicopter was about to take off. But on the second flight, I was given earmuffs, and the captain helped me buckle my seat belt after I put on my life jacket. So, I thought maybe they didn't have a standard operating procedure." (B-1-018)

"Sometimes there is a discrepancy between the information received during a phone handover and what we see on the scene. Once we received a call about a conscious clear patient with abdominal pain who needed to be transferred. Yet the patient's breathing became increasingly labored during the flight and CPR was performed quickly." (E-1-005)

"Before takeoff, the handover personnel did not specify whether intubation was necessary. Later, the patient started to struggle to breathe and could not get enough air after boarding the aircraft." (E-1-021)

Nurses' personal limitations

The colder temperature, higher moisture levels, and stronger winds experienced in an air ambulance, along with flight turbulence, can induce dizziness and discomfort for nurses. The smell of blood or vomit during patient treatment can further add to the discomfort. In addition to this, even experienced nurses may find themselves inadequate in terms of knowledge and technical expertise when participating in air ambulance duties. All of this emphasizes the importance of providing sufficient training time for nurses to learn necessary coping skills and receive training content that adequately prepares them for the unique conditions of an air ambulance. This theme can be categorized into two areas: "physical discomfort" and "recognition of professional shortcomings."

Physical discomfort (subcategories: discomfort during aircraft descent, nausea due to the unpleasant smell of patients' blood and vomit, and ear discomfort caused by loud aircraft noise)

Nurses may encounter physical discomfort during air ambulance services, especially at high altitudes where intense winds can cause discomfort. Additionally, handling patients' wounds may result in olfactory stimulation, leading to feelings of nausea. Furthermore, the aircraft's descent can be accompanied by excessive noise and discomfort, adding to the challenges experienced by the nurses. The following were the descriptions of the nurses:

"I had to bend down while treating a patient's bleeding wound, and the blood smelled really strong. The helicopter was also descending at the same time, which made me nauseous." (H-1-039)

"The space inside the helicopter is very narrow. When I was taking care of a patient with head trauma who was constantly vomiting, I could smell the vomit and it made me feel nauseous too." (J-1-012)

"The helicopter is loud, and my ears would hurt." (B-1-012)

Recognition of Professional Shortcomings (subcategories: limited training period and inability to handle various situations due to lack of satisfactory training contents)

Nurses who have received only a short duration of training with subpar training contents may not have the necessary confidence or preparedness to handle the challenging and unpredictable conditions that arise during air ambulance services. Therefore, hospitals must maintain an ongoing, comprehensive training program that equips nurses for the demands of this particular work. The following were the descriptions of the nurses:

"Air ambulance service courses are usually not enough. I hope for more nursing courses to enhance nurses' abilities to provide care. It is important to receive relevant educational training." (L-1-028)

"During my first flight, I was not informed of the standardized safety procedures on the aircraft, and I did not know how to fasten the safety harness. One time, when I was administering intravenous injection to a patient, I found that the IV drip was not flowing properly and I was unsure if it was due to the high-altitude pressure." (B-1-061)

"Measuring vital signs is difficult. I couldn't get a reading on the electronic blood pressure monitor due to the shakiness and could only feel the pulse manually or use the oximeter to gauge his oximetry." (F-1-017)

"The original design of the program should have focused on selecting nurses with sufficient experience or qualifications in air ambulance service before allowing them to participate in missions." (K-1-060)

Discussions

Theme 1: Ambiguous and risky emergency missions

Air ambulance service is unique and distinct from ground ambulance service. The first theme revealed in this study was "ambiguous and risky emergency missions," which included "mission uncertainty," "urgency of medical conditions," and "hazards at high altitude." Interview participants reiterated the inherently high-risk nature of the job and the operational environment for air ambulance nurses. Not only must they contend with the pressure of patient

care, but also external challenges during mission execution, such as dangerous weather conditions that can endanger crew members and result in the death of patients. Previous studies identified similar themes such as critical patient conditions, weather conditions during flights, and overall unpredictability of the work (Nolan *et al.*, 2020; Dias *et al.*, 2021; Aditya *et al.*, 2022). The complexity of non-hospital environments influences nurses' judgment and decision-making processes, emphasizing the importance of education and practical guidance to encourage reflection and feedback for better patient care (Perona, Rahman and O'Meara, 2019), as the experience of involved personnel will affect the operation of the air ambulance (Sorani *et al.*, 2018). In essence, the experience and qualification of the team will stand in as a safety net while providing professionals with security and tranquility to act under pressure, to some extent making immediate split-second decisions in adverse situations during air ambulance services (Alfes, Steiner and Rutherford-Hemming, 2016; Ericsson, Frenckner and Broman, 2017). To mitigate risks in the air environment, there is a need for an experienced medical team onboard, which is consistent with the results of previous studies (Miller *et al.*, 2016; Santos *et al.*, 2019). In other words, having ample practical experience and teamwork enables professionals to adeptly navigate the limited information available to them.

Air ambulance nurses require resilience and stress-coping abilities when dealing with challenging tasks (Langdalen *et al.*, 2018). This indicates that nurses aspiring to undertake this role require not only expertise but also strong psychological resilience to deal with the special working conditions. In fact, even experienced nurses may face heavy pressure and concerns about making mistakes. The numerous uncertainties arising from patients' conditions and high-altitude rescue operations make it essential for nurses to endure these factors and effectively perform their tasks. Adequate training is crucial in this regard. In the past, training courses in domestic settings have largely emphasized technical capacity building, with little attention paid to developing psychological mechanisms. To address this gap, this study proposes the development of a "psychological adaptation training for air ambulance tasks," which may include: 1) Utilizing psychological stress testing tools and self-observation records to help workers recognize physiological and psychological changes when confronted with stress, ultimately improving their resilience; 2) Incorporating activities like discussions on failures and successes, as well as role-playing to facilitate the learning of effective stress management strategies. This comprehensive approach aims to address both practical and psychological aspects crucial for those working in high-stress environments, particularly within the realm of air ambulance services.

Theme 2: Difficulties during the air transfer

The second theme summarized in this study is "difficulties during the air transfer," which includes three categories: "cabin environment limitations," "inadequate equipment," and "incomprehensive operating mechanisms." The study conducted by Chin et al. (2015) provided an all-encompassing review of air ambulance services in a regional hospital. Their findings were consistent with the results of this study, highlighting factors such as the lack of SOPs and auditing process mechanisms, insufficient medical and heating equipment, and cabin environment limitations. This theme emphasized the importance of handover before transport, injury assessment and patient preparation, transport and in-flight care, and follow-up reports, such as identified by Lo (2017). In other words, the SOPs should cover the period before the patient boards the aircraft, during the air ambulance process, and upon transferring the patient to the hospital on the ground. Clearly defining specific tasks and correct procedures for each period can effectively minimize human errors and their consequences. The study found that nursing training on the ground typically focuses on factors that can be controlled, but air ambulance care involves stressors that affect patients' and nurses' priorities differently.

As reported by the nurses in the present study, the challenges posed by limited space and visibility in nighttime missions make task execution especially difficult. Improving the understanding of operating procedures can lead to more precise and seamless actions. Thus, the establishment of SOPs for air ambulance missions can provide clear guidelines for nurses. The protocols may include patient handover, ensuring the safety of patients and air ambulance team through aeromedical checklists, as well as assessing air and ground conditions. Implementing an audit process mechanism also becomes crucial, as this systematic approach aids nursing management in examining, verifying, and adjusting all work processes. Operational efficiency could be enhanced by creating a comprehensive resource system for information linkage, ensuring a seamless flow of data accessible to the air ambulance team. Furthermore, conducting regular drills with an interprofessional team in the form of Crew Resource Management (CRM) training is key to effective

communication and teamwork among healthcare professionals (Schwartz *et al.*, 2018).

Theme 3: Nurses' personal limitations

There are nine essential aspects that flight nurses' training content should cover, including experience, training, transport environment of care, psychomotor skills, flight nursing knowledge, cue recognition, pattern recognition, decision-making, and actions (Reimer and Moore, 2010). Based on the findings of the present study, the third theme, "nurses' personal limitations," revealed that flight nurses faced these challenges: "physical discomfort" and "recognition of professional shortcomings." Participants recounted stories of painful experiences and unfamiliarity with aircraft-related knowledge, stating, "*the helicopter is loud, and my ears would hurt…*" or "*…when I was administering intravenous injection to a patient, I found that the IV drip was not flowing properly and I was unsure if it was due to the high-altitude pressure*." The former referred to the impact of environmental stimuli on their physical well-being, while the latter was attributed to insufficient time and training to handle clinical practice on the aircraft. Therefore, in addition to possessing professional aviation and nursing care knowledge, there is a need for more practical training courses. Moreover, high-fidelity simulation training is deemed necessary to facilitate adaptation, such as addressing issues like coping with the excessive noise present in an aircraft and other non-technical skills (Winkelmann *et al.*, 2016).

Sufficient training time and diverse learning approaches can enhance nurses' professional competence. Hospitals in charge of air ambulance services are advised to establish a specialized team to provide regular training for flight nurses. This training program may involve physical fitness and adaptation exercises for flight operations. To improve adaptation skills, nurses can engage in simulations of basic tasks such as receiving assignment notification, boarding the aircraft, performing in-flight operations, and disembarking, or emergency scenarios like aircraft malfunctions. Additionally, the training should include diverse patient cases, allowing teams to enhance their problem-solving skills by dealing with scenarios involving patients with varying conditions. Establishing a continuous feedback mechanism can also allow nurses to voice their experiences, helping them to update their service knowledge and reflect on the challenges encountered in practice. In short, the regular training program should incorporate characteristics such as physical operations, situational simulations, case-based teaching, and professional exchanges to effectively address the challenges of air ambulance services.

The participants of this study were nurses undertaking air ambulance services who were stationed in Taiwan's eastern offshore islands. However, nurses from other island regions were excluded, thus the results are limited in terms of lack of transferability. Building upon the existing foundation, the researchers suggest for future research on improvement plans to be approached from four different aspects: 1) The adjustment of participant criteria to enrich the experience feedback from various offshore-island flight nurses; 2) Employing a focus group research method that allows multiple participants to provide richer and more diverse perspectives through discussion and communication; 3) The development of quantitative research derived from the current themes to investigate the influencing factors on the safety operations of air ambulance services; 4) The assessment of work stress status among air ambulance team members, followed by the development of a work stress scale tailored to air ambulance personnel. The research results could then be utilized to propose future intervention strategies.

Conclusion

The nature of air ambulance service is characterized by unpredictability, urgency, and high risk. To ensure successful patient rescues, relevant units must remain vigilant about potential challenges that may arise during transfers, starting from cabin space limitations and lighting conditions. It is essential to prioritize the carrying capacity of sufficient equipment and establish comprehensive protocols for operations and auditing procedures. Additionally, nurses should be aware that air ambulance duties may entail physical discomfort and professional challenges, necessitating the development of appropriate education and training mechanisms to enhance their adaptability to the work environment.

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The authors declare no conflicts of interest.

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