



Experiences and perceptions of nurses and air ambulance service providers in carrying out aeromedical evacuations in Indonesia: A qualitative research

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Abstract

Background: Basic non-military flight nurse training is essential for enhancing nurses' competency in conducting aeromedical evacuations. Trained nurses possessing flight nurse proficiency are indispensable for ensuring stable patient conditions amidst the unique physical, physiological, and psychological challenges encountered during flights.

Objective: This study aimed to describe the experiences and perceptions of nurses and air ambulance service providers regarding aeromedical evacuations.

Methods: This study employed a qualitative descriptive design. Data were gathered from February to July 2023 through semi-structured online interviews with seven nurses and air ambulance service providers engaged in aeromedical evacuation. Content analysis was utilized to interpret the interview data.

Results: Seven themes were generated: 1) Experiences in aeromedical evacuation experiences, 2) Challenges faced by nurses and air ambulance service providers during aeromedical evacuations, 3) Essential knowledge for nurses involved in aeromedical evacuations, 4) Efforts to improve nurses' knowledge and skills, 5) Leveling of flight nurse training, 6) Flight nurse training methods, and 7) Flight nurse training evaluation strategies.

Conclusion: Nurses and air ambulance service providers acknowledge the significant influence of the flight environment on changes in patient conditions during aeromedical evacuations. To effectively manage alterations in patient conditions during flights, healthcare workers equipped with aviation health competency are imperative. One approach to enhancing the competency of healthcare workers is through flight nurse training. The findings from this study serve as a valuable resource for policymakers and health-related institutions endeavoring to formulate aeromedical evacuation strategies.

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Background

Indonesia, an archipelago comprising 16,766 islands separated by oceans (Central Bureau of Statistics Indonesia, 2021a), relies significantly on air and sea transport to connect various parts of the archipelago for civilian and military purposes. Air transport, in particular, plays a crucial role, offering much shorter travel times than sea transport. In 2021, the air transport sector in Indonesia showed promise, recording a total of 15,991,284 passengers traveling to domestic and international destinations (Central Bureau of Statistics Indonesia, 2021b).

While air travel is generally safe, it can bring discomfort at altitudes exceeding 10,000 feet. These effects include potential hypoxia caused by a decrease in oxygen saturation

of between 4% and 6% (Cheung & Ainslie, 2022), an increased risk of blood clots/deep vein thrombosis (DVT) on flights lasting longer than 8 hours, with double the risk of calf muscle DVT (Krasinski et al., 2021), dehydration, and dry skin due to very low humidity (Vijai et al., 2018). Additionally, trapped gas in the body cavities is possible, leading to issues such as earaches, toothaches, and stomach discomfort. Long-haul flights can also contribute to the experience of jet lag (Thomson, 2015), which may be even more pronounced for passengers with health issues, including those requiring medical evacuation by air (Evans et al., 2016).

Aeromedical evacuation involves the coordinated transfer of victims or patients from one location to another, using air transport facilities and skilled personnel such as flight doctors, nurses, and nurse assistants. This process ensures that

individuals receive care in facilities with resources and healthcare personnel better suited to their specific needs (Ministry of Defense Indonesia, 2014). Aeromedical evacuation is often used to transport people quickly to hospitals equipped with comprehensive healthcare facilities (Abdillah et al., 2019). Every year, around two million Indonesians seek healthcare abroad, traveling to Singapore, Malaysia, Japan, the United States, and other locations (Ministry of State Secretariat, 2021). According to the Indonesian TPI Malang Class I Immigration Office, there were 920 passport applications for medical treatment abroad from 2021 to October 2023 (Wicaksana, 2023).

Conducting an aeromedical evacuation requires a proficient medical team capable of providing care to patients facing diverse and unique physical, physiological, and psychological stresses during the flight (Davis, 2012). Nursing plays an essential role in patient care during aeromedical evacuation, necessitating nurses to possess aviation health knowledge. This knowledge is necessary for providing nursing care and engaging in interactions with clients across the spectrum of aeromedical evacuation stages, from pre-medevac and medevac to post-evacuation stages (De Jong et al., 2017). In accordance with Regulation No. 4 of 2021, issued by the Ministry of Health, it is stated that health personnel operating air ambulances must have aviation health capabilities, as evidenced by a certificate issued by an institution authorized to provide training (Ministry of Health Indonesia, 2021). Gaeed and Hassan (2020) conducted a review of evacuation training research focusing on overseas air medical care. The review findings showed an improvement in the ability of air medical teams to care for patients undergoing aeromedical evacuation after receiving specialized training in this area.

Currently, in Indonesia, the only training available for flight nurses is offered by the Indonesian Air Force. The curriculum and instructional materials are tailored to meet the needs and responsibilities of health personnel in the Air Force serving in air squadrons, specializing in aeromedical evacuation, which aligns with the main tasks of the Air Force. The aeromedical evacuation training materials provided mainly focus on combat trauma and mass casualties. However, there is currently no training program for flight nurses in Indonesia that specifically addresses aeromedical evacuation using commercial or chartered aircraft. Curricula and modules for such training do not exist for nurses outside the Indonesian National Armed Forces environment.

Our preliminary study involved 25 nurses who had participated in interviews regarding their experience carrying out aeromedical evacuations. Of these, 80% (20 out of 25 nurses) had never attended flight nurse training (Ambarwati, personal communication, March 2, 2019). The five nurses who had received military nurse training reported that the curriculum mainly focused on mass casualty evacuation and cases related to war casualties, which may be less applicable to non-military aeromedical evacuation scenarios. Based on the preliminary findings, it can be concluded that there is a significant demand for basic (non-military) flight nurse training. Therefore, this study aimed to describe the experiences and perceptions of nurses and air ambulance service providers regarding aeromedical evacuations, which can be an input to

develop curricula and modules specifically designed for basic flight nurse training.

Methods

Study Design

A qualitative descriptive study design was employed to yield in-depth information about a particular phenomenon (Doyle et al., 2020). This study constituted the initial phase of mixed methods research (Ambarwati, 2024) to develop basic flight nurse training. A qualitative descriptive study can be the primary component in mixed methods research (Doyle et al., 2020), particularly in the exploratory sequential design.

Participants

Nurses and aeromedical evacuation service providers who were available and willing to share their thoughts about aeromedical evacuation were purposively recruited for the qualitative study. The sampling technique employed was purposive sampling. The inclusion criteria for participation were as follows: 1) nurses who had conducted aeromedical evacuation at least two times, 2) air ambulance service providers who had been involved in aeromedical evacuation for at least five years, and 3) participants who voluntarily agreed to participate in the research.

Data Collection

Data collection was conducted online through semi-structured interviews by the main researcher/first author (DA) to maintain consistency in the questions. Interviews took place from February to July 2023. Participants were individually interviewed based on a mutually agreed schedule between them and the researcher to ensure free and comprehensive expression of personal experiences. Before the interviews, the study's purpose was explained, and participants provided expressed consent. Demographic data, including gender, age, education, length of service, and experience in performing aeromedical evacuation, were collected. Each interview lasted 45 to 60 minutes. The interviews were recorded using an audio recorder, backed up using a cellphone, and then transcribed verbatim. Transcripts were organized and sent back to the participants for confirmation.

Questions were open-ended, focusing on activities related to aeromedical evacuation. All authors collectively developed an interview question scheme consisting of seven questions. The interview questions, presented as an interview guide, were validated through the judgment of six experts. The following questions were: 1) What experience did you gain from carrying out an aeromedical evacuation? 2) What challenges did you face when carrying out an aeromedical evacuation? 3) What knowledge should a nurse who will carry out an aeromedical evacuation have? 4) How can nurses improve their knowledge and skills in carrying out an aeromedical evacuation? 5) How important is flight nurse training for nurses performing aeromedical evacuations? 6) Is there a need for standardization in flight nurse training? 7) What is the appropriate method for conducting training and evaluations for flight nurse trainees? Data were re-verified with the original informants to ensure their quality.

Data Analysis

Qualitative content analysis was used to analyze data concurrently with data collection, including the selection of units of analysis, coding, grouping, categorization, interpretation, and identification of main themes (Graneheim & Lundman, 2004). Initially, the first author transcribed each interview verbatim. Subsequently, the interview transcripts were carefully read to gain a comprehensive understanding. Recurring words, phrases, and sentences were highlighted, and meaningful codes were extracted. Next, themes were generated through the categorization of codes. The themes were reviewed with the participants in the final step to confirm their perspectives. Researchers (DA and SW) independently conducted steps two and three. A consensus was reached, followed by the validation of the second author (SW).

Trustworthiness

This study ensured the accuracy and reliability of data through the operation of an experienced research team in qualitative research. The first author (DA) summarized the main issues raised and verified whether these issues accurately reflected the participants' descriptions and thoughts during the interviews. Then, each participant was asked whether they would like to include any revisions or additional points. All participants agreed with the summary of key issues. Additionally, all authors held online meetings every two weeks to discuss the collected data, further explore topics, outline plans, and conduct data analysis.

Ethical Considerations

Ethical aspects have been approved by the Ethics Committee of the Faculty of Medicine, Public Health, and Nursing, Universitas Gadjah Mada, Ref. No: KE/FK/0576/EC/2023. Participants were fully informed about the study aims and procedures before interviews were conducted. They had the option to refuse participation or withdraw from the study (until data collection was concluded), as their involvement in the interviews was voluntary. The sound recording process could also be terminated if any participant expressed objection. All participants' personal information and spoken words were anonymized and securely stored to prevent accidental disclosure.

Results

The study participants comprise nurses and air ambulance service providers. Among nurses, there are males and females, ranging from 40 to 44 years old, with educational backgrounds including bachelor's and master's degrees in Nursing and Health. Their years of service range from 15 to 18 years, with varying experiences in aeromedical evacuation, from 2 to over 20 times. Similarly, air ambulance service providers include both genders, aged 40 to 43, with educational backgrounds such as specialization in medical-surgical nursing and a bachelor's degree in public health. They have between 13 and 16 years of service, with aeromedical evacuation experiences ranging from 40 to over 50 times (Table 1).

Table 1 Participants' demographic data

Code	Status	Gender	Age (year)	Education	Years of service	Aeromedical evacuation experience
R1	Nurse	Female	42	Nursing bachelor	18 years	2 times
R2	Nurse	Female	44	Masters in Health	17 years	±20 times
R3	Nurse	Male	43	Nursing bachelor	18 years	±15 times
R4	Nurse	Male	40	Nursing diploma	15 years	±10 times
R5	Air Ambulance Service provider	Female	43	Sp. KMB (Medical-surgical nursing specialist)	16 years	±50 times
R6	Nurse	Female	42	Nurse	17 years	±15 times
R7	Air Ambulance Service provider	Male	40	Bachelor in Public Health	13 years old	±40 times

Seven themes were generated as follows: 1) Aeromedical evacuation experiences, 2) Challenges faced by nurses and aeromedical evacuation service providers during aeromedical evacuations, 3) Knowledge that must be mastered by nurses in performing aeromedical evacuations, 4) Efforts to increase nurses' knowledge and skills, 5) Leveling of flight nurse training, 6) Flight nurse training methods, and 7) Flight nurse training evaluation methods.

Theme 1: Aeromedical Evacuation Experiences

This theme describes the experiences of nurses and service providers in aeromedical evacuations, with eight emerging sub-themes, namely the types of transportation used, flight duration, patient position, patient cases handled, aeromedical evacuation flight destinations, the reasons for evacuation, experienced ignorance, and the preparations made.

Subtheme 1.1: Types of transportation used

The means of transportation used to carry out aeromedical

evacuation include commercial aircraft, charter aircraft, air ambulances, and helicopters. The type of transportation used has a different influence on caring for patients during flights, which creates a separate experience for nurses.

"My experience so far has been carrying out aeromedical evacuations by commercial aircraft, both large and small." (P3)

"Because I work in a remote area, if someone needs to be evacuated, I will usually use a charter plane, or the passengers will pay for the rent themselves." (P4)

"I have carried out aeromedical evacuations by various types of aircraft, including air ambulances." (P5)

"I have worked in disaster emergencies. The modes of transport used during aeromedical evacuations include helicopters." (P6)

Subtheme 1.2: Flight duration

Evacuation experience is also associated with flight duration. Long-distance flights are usually with a flying

duration of more than six hours. Flight duration will impact the patient's condition during the flight, making them experience flight physiology for a relatively long time. Therefore, nurses should provide nursing interventions during the flight.

"Of the 20 evacuations I have carried out, the majority took more than 6 hours by domestic plane." (P2)

"I have frequently carried out aeromedical evacuations for more than 6 hours, both at home and abroad." (P5)

Subtheme 1.3: Patient position

The experience in aeromedical evacuation is also related to the patient's position, whether seated or lying down, according to their condition, during transport by airplane.

"(If) the patient's condition is stable, he will have a seated position." (P1)

"And there are also those who lie down depending on their condition." (P2)

Subtheme 1.4: Patient cases handled

The next experience sub-theme when carrying out aeromedical evacuations is related to cases of patients being evacuated. Patient cases include psychiatric patients, patients using assistive devices, patients of all ages, patients with cardiovascular problems, patients with post-operative issues, patients with respiratory problems, and patients with burns. Aeromedical evacuations for various types of patient cases are special experiences nurses gain during pre-flight, in-flight, and post-flight periods because the care provided during flights differs from the care provided on the ground.

"It is a different challenge when I evacuate patients with mental disorders." (P2)

"I have been handling various cases in aeromedical evacuations. For example, during the COVID-19 pandemic, I handled cases of stroke patients, post-op patients, burn patients, and many other patients, which certainly provided different experiences." (P5)

"Yes, I have carried out aeromedical evacuations for various patient cases, including patients with chronic obstructive pulmonary disease, MCI patients, surgical patients, and others." (P6)

"Medical evacuations of patients with ventilators provided a unique experience in itself due to the influence of flight physiology." (P7)

"The ages of the patients I have evacuated varied depending on the demand. Some were babies, children, and adults, and many were elderly... Yes, there were many, and they were of various age levels." (P5)

Subtheme 1.5: Aeromedical evacuation flight destinations

The destinations of aeromedical evacuation flights nurses are headed for include domestic destinations, i.e., other islands or cities in Indonesia and overseas destinations.

"Domestic destinations for reasons of seeking treatment at a hospital with more complete services and returning home after receiving treatment from the said hospital." (P2)

"Thank God, I have often carried out aeromedical evacuations overseas, both in Asia and Europe." (P5)

Subtheme 1.6: Reasons for evacuation

Reasons for aeromedical evacuation include seeking treatment at a more comprehensive healthcare facility, returning to an area of origin after receiving healthcare, and repatriating foreign nationals under certain conditions. These reasons are affected by national and international aviation regulations.

"Because it is in an area with limited access, and patients must be immediately evacuated to a more complete health facility with a travel time of approximately 6 hours." (P4)

"Foreigner patients often undergo aeromedical evacuation due to repatriation, or returning to their country of origin, mostly due to health factors." (P5)

Subtheme 1.7: Experienced ignorance

Nurses are oblivious that airplane equipment, including the medical equipment used on airplanes, such as oxygen cylinders, differs from that on the ground. This was demonstrated by one of the participants, who stated the following:

"When I first carried out an aeromedical evacuation, I didn't understand that the oxygen cylinders used in flights were different from those on the ground. I thought they were the same." (P2)

Theme 2: Challenges Faced by Nurses and Service Providers in Conducting Aeromedical Evacuations

This theme describes the challenges that emerge in the implementation of aeromedical evacuations. It consists of two sub-themes: the challenges faced by nurses and the challenges faced by aeromedical evacuation service providers.

Subtheme 2.1: Challenges faced by nurses in carrying out aeromedical evacuation

Nurses face several challenges, including changes in the patient's condition due to changes in flight physiology that impact the body, constraints posed by the limited space on the aircraft, and communication difficulties. Given these challenges, complete aeromedical evacuation preparations, including equipment preparation, good communication and coordination, and placement of patients and equipment on board the aircraft, are needed to run smoothly. The goal of aeromedical evacuation can be achieved by keeping the patient stable throughout the flight until arriving at the intended health facility/destination airport.

"The challenges faced when accompanying psychiatric patients on flights make an interesting story, where we must always be alert so that the patients do not become aggressive during the flights." (P2)

"To perform evacuations abroad for durations of 8 to 12 hours, of course, we have to thoroughly prepare the equipment and facilities that will be utilized in very detailed aeromedical evacuations, and this includes coordination with the airline for the availability of oxygen during the flights and the availability of electrical power for the equipment involved. We'll take it." (P5)

"The limited space on the plane poses a challenge to the placement of the patients and the medical equipment that is carried along so that care can still be provided properly." (P4)

"Equipment preparation must be carried out properly, especially when calculating oxygen and electrical power needs. We must

be able to anticipate any possible changes in the patient's condition and in the flight route that may occur at any time.” (P3)

“Because I am stationed in a remote area, the challenge is that signal problems often hamper communication. Thus, sometimes I have to climb the hill to get better signals.” (P4)

Subtheme 2.2: Challenges faced by service providers in carrying out aeromedical evacuations

The challenges felt by aeromedical evacuation service providers include challenges to the preparation for an aeromedical evacuation (i.e., facilities, personnel, and communication and coordination must be prepared well before a flight according to the patient's condition) and limited aeromedical evacuation aircraft operators. It takes time to prepare the patient and aircraft adequately. In addition, there is an absence of regulations and standard operating procedures (SOPs), which leads to an urge for service providers to create SOPs independently according to their needs, as well as national and international aeromedical evacuation regulations.

“It often takes a relatively long time for the airline to make oxygen cylinders available, which will affect the whole evacuation process.” (P7)

“It is extremely necessary to communicate with the patient or the patient's family regarding departure plans and preparations because sometimes it takes some time to process permits and arrange for aircraft availability prior to carrying out an aeromedical evacuation at both the departure and destination airports.” (P5)

“There are limited aircraft operators hired for aeromedical evacuations of patients with certain conditions.” (P7)

“Regulations from the center regarding aeromedical evacuation are unclear and are altered frequently, so each aeromedical evacuation service provider needs to create its own SOP.” (P7)

Theme 3: Knowledge that Nurses Must Master in Carrying Out Aeromedical Evacuations

This theme describes the knowledge required by nurses to conduct aeromedical evacuations. It includes three sub-themes: basic understanding of flight physiology, aeromedical evacuation concept, and specific procedures for aeromedical evacuation based on disease type.

Subtheme 3.1: Basics of flight physiology

Nurses must possess basic knowledge of flight physiology, including atmospheric layers and flight biodynamics, which is fundamental to aeromedical evacuation.

“Flight physiology is subject to differences in pressure, where the higher you fly, the lower the pressure. It affects the body during the flight.” (P4)

“It is mandatory to have the knowledge of the basics of aviation, stressors in flight, and changes in air pressure, including hypoxia, and their effects on patients.” (P6)

Subtheme 3.2: Aeromedical evacuation concept

The concept of aeromedical evacuation relates to the interventions to be made by nurses to cope with changes in the flight environment and to considerations regarding contraindications for flying. The preparation for an aeromedical evacuation includes the preparation of patients and families, equipment, aircraft, and health workers,

communication and coordination, and calculations of the needs for oxygen and electrical power, which must be prepared according to the condition of the patients who will be transported by aircraft.

“Patient contraindications for flying for determining who among patients can fly and who cannot fly.” (P2)

“Aeromedical evacuation preparation includes patient preparation.” (P1)

“Evacuation preparation starts from the infrastructure, from the airport of origin to the health facility/destination airport, in which case electrical power for medical equipment during flights is needed.” (P7)

“Preparation for an aeromedical evacuation starts with aircraft preparation.” (P6)

“Preparations for aeromedical evacuation include good communication and coordination with ground officers at the origin and destination airports as well as with the aircraft crew.” (P6)

“Aviation regulations include standards for the use of oxygen in flights.” (P2)

“Preparation of health workers who will accompany patients.” (P5)

“Calculation of oxygen requirements for patients undergoing an aeromedical evacuation.” (P4)

Subtheme 3.3: Aeromedical evacuation of various patient cases

Patients receiving aeromedical evacuation include patients with respiratory disorders, cardiovascular disorders, neurological disorders, pediatric patients, obstetric patients, and infectious patients. These patients have the potential to have a changed condition under the influence of physiological changes in the flight environment, which makes it necessary to provide special treatment during their stay on the flight so that their condition remains stable until they reach their point of destination.

“Nursing care during a flight is, of course, appropriate to the disease and condition of the patient undergoing an aeromedical evacuation.” (P3)

“Aeromedical evacuations for various types of cases, including cardiovascular, respiratory, infectious, pediatric, and obstetric cases, range from pre-flight to in-flight and post-flight evacuations.” (P5)

Theme 4: Efforts to Increase Nurses' Knowledge and Skills regarding Aeromedical Evacuation

This theme describes the efforts to increase nurses' knowledge and skills regarding aeromedical evacuation. It consists of three sub-themes of efforts, including efforts to increase knowledge, improve skills, and the urgency of training.

Subtheme 4.1: Efforts to increase knowledge

Efforts to increase knowledge are made through training, seminars, and reading books related to aeromedical evacuation and flight physiology.

“One way is to take part in training so that knowledge will increase.” (P7)

"Including attending available seminars as a refresher to increase your exact knowledge." (P5)

"Reading books and related references will also broaden your knowledge." (P2)

Subtheme 4.2: Efforts to improve skills

Efforts to improve skills are made through simulations, practices, and experiences carrying out aeromedical evacuations.

"The more experiences you have in carrying out aeromedical evacuations, the more your skills will increase." (P1)

"Simulations, especially in scenarios akin to real conditions, will improve skills." (P5)

"In my opinion, it is best to improve skills through practice because with practice, a person will have real experience." (P7)

Subtheme 4.3: Urgency of training

The training of flight nurses is considered urgent due to the nature of the aviation environment being different from that on the ground. Changes in the physiology of the aviation environment can cause a risk of changes in the patient's condition. Apart from that, aviation has limitations, including limited activities, infrastructure, and human resources. Therefore, nurses need to obtain special aviation health qualifications through flight nurse training.

"It is very important that nurses have knowledge and skills related to aeromedical evacuation." (P5)

"The airplane environment is different from the ground environment, where in the former there are limitations both in terms of movement space and communication." (P2)

"It is a special qualification that a nurse must have before carrying out an aeromedical evacuation. In my place, if the nurse has not undergone any training, we will provide a short briefing regarding aviation health before they are assigned to carry out an aeromedical evacuation." (P6)

Theme 5: Flight Nurse Training Standardization

This theme explains the need for standardization in the delivery of flight nurse training. It consists of two sub-themes: the definition of training levels, which includes the identification of specific levels and the competencies required for each level.

Subtheme 5.1: Number of levels

Two levels of training are expected: basic and advanced. Several participants expressed the need to design training into two levels, but one disapproved of leveling in training.

"I think there needs to be training leveling." (P5)

"Basic and advanced, but for the initial stage, I think just the basic level first." (P4)

Subtheme 5.2: Competencies required for each level

After participating in basic training, nurses are expected to have the competency to carry out aeromedical evacuations on patients who have a stable condition and require no assistive devices. Meanwhile, after participating in advanced training, nurses are expected to be able to carry out aeromedical evacuations on critical patients or patients who use assistive devices.

"The basic level is specifically for aeromedical evacuations of patients who do not require any respiratory assistance like a ventilator." (P3)

"Advanced training is designated for nurses who will carry out medical evacuations on patients in a critical condition who require special equipment such as ventilators and incubators." (P2)

Theme 6: Flight Nurse Training Methods

This theme describes learning activity strategies, learning methods, and training duration.

Subtheme 6.1: Learning activity strategies

According to participants, training learning activities are conducted by lectures, assignments, and practices. Lectures are held to provide nurses with theoretical and conceptual knowledge of aeromedical evacuation. Assignments are given in the form of case studies, where nurses are assigned to analyze cases related to aeromedical evacuation involving various cases of patients. Practices are conducted through simulations and chamber practices in aircraft or aerophysiology simulations to give nurses an accurate picture of carrying out aeromedical evacuations and the physiological changes that occur during flights.

"Starting with lectures on relevant topics first." (P7)

"Also, with case studies to provide an overview and an opportunity to carry out a case analysis." (P6)

"Simulations are important for skills-related materials, which can be conducted using videos or field practices." (P5)

"Practice materials can be provided through chamber flight simulations to allow nurses to gain a direct experience of changes at an altitude, for example, with signs of hypoxia, disorientation, etc." (P7)

"Because training is aimed to improve skills, it is best also to carry out practices." (P2)

Subtheme 6.2: Learning methods

Learning methods can be implemented online and offline. Online methods are applied to discuss theoretical topics, while offline methods are used to improve skills. The participants expressed their wish for training to be carried out entirely offline.

"Even though theoretical materials are delivered online, skills-related materials are better-delivered face-to-face." (P6)

"I agree that conducting training fully face-to-face is more effective. Online training will result in less than optimal outcomes." (P7)

Subtheme 6.3: Duration of training

Basic flight nurse training is expected to last for three days, while advanced flight nurse training will likely extend for a maximum of seven days.

"I think three days is enough for basic training." (P6)

"A maximum of five days for advanced training." (P2)

"Training should not take less than one week." (P7)

Theme 7: Methods for Evaluating Flight Nurse Training

This theme describes appropriate evaluation methods to use for flight nurse training. Nurses and aeromedical evacuation

service providers expect training evaluations to be conducted in both written and performance-based manners. The written assessment is aimed to see the improvement in the nurses' knowledge and attitudes regarding aeromedical evacuation following their participation in flight nurse training. In contrast, performance-based evaluation is aimed to determine the extent to which the nurses' skills in carrying out aeromedical evacuation have increased.

"Because the training is conducted in theory and practice, the evaluation should be conducted accordingly." (P3)

"I hope that the evaluation be conducted in written and performance-based manners so that we can see how far our levels of knowledge and skills have advanced after attending the training." (P7)

Discussion

According to the findings of this study, aeromedical evacuation experiences vary based on the type of air transport used. Fifty-seven percent of participants reported aeromedical evacuation experiences using multiple types of transport, including fixed-wing and rotary-wing commercial aircraft and charter aircraft. On the other hand, the remaining 43% of participants experienced aeromedical evacuations using only commercial aircraft. Previous studies have reported that aeromedical evacuation involves different types of aircraft, including commercial and charter aircraft and helicopters. This diversity of transport modes contributes to other experiences in providing patient care during the flight (Imbriaco et al., 2021; Koh, 2021; Thomson, 2015).

All participants had experience conducting aeromedical evacuations on patients in various positions, including seated or lying, while on the airplane. They also handled multiple types of cases, including infectious patients, patients with cardiovascular disorders, patients with neurological disorders, and others. This diversity will undoubtedly influence nursing care delivery during flights (Maddy et al., 2017; Mitchell et al., 2014; Savell et al., 2019). An early examination of the middle-range theory of flight nursing expertise by Reimer et al. revealed that experience and training in aeromedical evacuation contribute to the ability of health workers to provide patient care during flights (Reimer et al., 2013).

The challenges nurses and aeromedical evacuation service providers face are categorized under two sub-themes. All nurse participants experienced challenges in conducting aeromedical evacuations due to changes in the patient's condition during the flight, which were caused by changes in the physiological environment during the flight (Morales et al., 2019), especially on longer flights (Maddy et al., 2022). Therefore, nurses must be able to intervene despite the many constraints in the aircraft. The aviation environment presents a considerable number of challenges and limitations, especially in the provision of nursing care, which include changes in air pressure, temperature fluctuations, hypoxia, gravitational forces during take-off and landing, air humidity, noise, vibration, turbulence, limited space, and inadequate lighting (Butler et al., 2018; Koh, 2021; Thomson, 2015). Limited space that constrains access to the patient while in flight may limit treatment capabilities (Thibeault & Evans, 2015). Flight nurses' proficiency or lack of confidence in their

psychomotor skills influences their ability to care for patients during flights (Yadollahi & Yazdani, 2020).

The knowledge nurses must master in conducting aeromedical evacuations is classified into three sub-themes: the basics of flight physiology, the concept of aeromedical evacuation, and the aeromedical evacuation of patients with various types of illnesses. An aeromedical evacuation team must possess knowledge regarding handling patients during flights, which may be influenced by changes in flight physiology (Gregoire et al., 2017). Nursing is a profession that plays a crucial role in patient care during aeromedical evacuations. Therefore, nurses must have knowledge related to aviation health to provide nursing care and interact with clients during all stages of aeromedical evacuations, from pre-medevac to medevac and post-medevac stages (De Jong et al., 2017; Matsumoto et al., 2013).

Caring for pre-medevac, medevac, and post-medevac patients requires nursing experience, specialized skills, and aviation health education. According to the Minister of Health Regulation, health personnel staffing air ambulances must possess aviation health capabilities, validated by a certificate issued by an authorized training institution (Ministry of Health Indonesia, 2021). Aeromedical evacuations demand a proficient medical team to ensure patients facing unique physical, physiological, and psychological stresses during flights receive appropriate care (Davis, 2012). The success of an aeromedical evacuation heavily relies on nurses' awareness and understanding of aviation nursing concepts. Therefore, nurses must have the knowledge and skills to effectively fulfill their roles.

Efforts to enhance nurses' knowledge and skills regarding aeromedical evacuation are described under three sub-themes: efforts to increase knowledge, improve skills, and the urgency of training. According to Martin and Kumar (2020), aviation nurses require specialized training to prepare and care for patients during flights. Training is highly effective in enhancing the knowledge of aeromedical evacuation teams (Gaeed & Hassan, 2020). Flight nurse training is a specialized program designed to improve nurses' skills in conducting aeromedical evacuations from pre-medevac to medevac and post-medevac stages (De Jong et al., 2017).

The participants in this study recognized two levels of nurse training: basic and advanced. This contradicts the leveling of nurse training and expertise in a previous study, which involves three levels: basic, intermediate, and advanced (Indonesian National Nurses Association, 2022).

The flight nurse training methods are discussed under five sub-themes: lectures, simulations, practice, learning strategies, and training duration. While Boutonnet et al. (2017) strongly recommend conducting aeromedical evacuation training using the lecture method, Martin and Kumar (2020) stated that simulations and case studies are suitable methods to enhance nurses' skills.

The last theme, flight nurse training evaluation methods, includes two evaluation methods: theory-based and performance-based methods. Theory-based evaluation is conducted through written exams. According to Mason et al. (2019), pre-test and post-test assessments should be used to determine the increase in nurses' knowledge after training. On the other hand, performance-based evaluation is used to

determine the improvement in nurses' skills after training (DeForest et al., 2018).

Implications of the Study

This research holds direct implications for hospital organizations, aviation entities, educational institutions, and the healthcare sector. Multidisciplinary coordination emerges as a primary challenge due to variations in work culture. Hospitals should establish standardized aeromedical evacuation procedures to streamline the process for patients seeking air transportation for medical purposes. Educational institutions need to design short courses focusing on aeromedical evacuation. Aviation organizations and healthcare professionals should establish regulations concerning aeromedical evacuation practices to serve as guidelines for professionals involved in such operations. Moreover, nursing institutions should conduct research initiatives on aviation health to inform policy development and enhance aeromedical evacuation practices. The Indonesian National Nurses Association should formulate guidelines for flight nurses engaged in aeromedical evacuations and promote knowledge management regarding the impact of flight physiology on both healthy and ill passengers.

Limitations

A limitation of this study was that the data collection method utilized online interviews conducted via video conferencing. Previous research that collected data through telephone/online interviews demonstrated valid results; however, it often yielded brief responses, leading to incomplete data (Drabble et al., 2016).

Conclusion

The results of this study highlight the necessity for resources to facilitate the implementation of basic non-military flight nurse training to support aeromedical evacuation. These findings were derived from experienced nurses and aeromedical evacuation service providers conducting aeromedical evacuations. The study outcomes offer guidance and recommendations with implications for nursing practices, health policy, education, and research. It is suggested that flight nurses develop nursing care plans for aeromedical evacuations, educate themselves on the impact of the flight environment on patients and their families, and enhance their knowledge and skills in aeromedical evacuation through educational initiatives.

Declaration of Conflicting Interest

The authors declared no conflict of interest.

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Authors' Contributions

All authors contributed equally to this study in substantial contributions to the conception or design of the work, analysis, or interpretation of data for the work, drafting of the work, and final approval of the version to be published.

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Data Availability

The datasets generated during and analyzed during the current study are available from the corresponding author upon reasonable request.

Declaration of Use of AI in Scientific Writing

The authors have declared that no generative AI was used in writing.

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