

Qualitative Research on Flight Nurses' Training Needs for Air Transport of Emerging and Virulent Infectious Diseases

Yongbiao Feng, Heyu Qiao, Xueping Ning*, Yifen Liao, Xiao Pan, Gaopeng Li

The Second Affiliated Hospital of Guangxi Medical University, Nanning 530007, Guangxi, China

*Corresponding author: Xueping Ning, 269967530qq.com

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Abstract: *Objective:* To explore the characteristics of flight nurses' training needs for nursing management of air transport of emerging and virulent infectious diseases, and to provide a reference for the transport training of infectious disease patients. *Methods:* Based on purposive sampling, 17 flight nurses were selected for semi-structured interviews, and data were collected, sorted, and analyzed using the grounded theory paradigm. *Results:* Four themes were summarized: theoretical knowledge related to emerging and virulent infectious diseases, participation in infectious disease management practices, and training content needs, including knowledge, skills, and personal traits. *Conclusion:* Flight nurses are in the stage of experience accumulation in the management of emerging and virulent infectious diseases, and they lack theoretical knowledge and practical abilities regarding virulent infectious diseases. Establishing a comprehensive training system, combined with regular drills and assessment feedback, will effectively improve flight nurses' emergency response capabilities and mission execution efficiency, ensuring the smooth progress of missions and the safety of personnel.

Keywords: Flight nurse; Emerging and virulent infectious diseases; Aviation rescue; Training needs

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1. Introduction

With the acceleration of globalization and the continuous expansion of the scope of human activities, the frequency and speed of transmission of emerging and virulent infectious diseases are showing an upward trend, posing severe challenges to public health security^[1]. Based on the increasing incidence and fatality rates of emerging and virulent infectious diseases, as well as the characteristics of no specific vaccines and drugs being available in the early stages of outbreaks, and the general susceptibility of the population, it warns people to pay more attention to the prevention and control of emerging and virulent infectious diseases^[2-3]. Biosafety is an important component of national security. Virulent infectious diseases spread fast, have a wide range of transmission, and have a high

fatality rate, which can easily cause social panic and affect social stability. Emerging and virulent infectious diseases require rapid identification and centralized isolation for diagnosis and treatment ^[4]. As key members of the air transport team, flight nurses not only bear the responsibility of continuous care for patients during transport but also face the threats of biosafety and the pressure of clinical decision-making brought by high-risk infectious diseases. Due to the advantages of fast speed and high safety, aviation rescue and transport have been proven to meet the transportation requirements of patients with virulent infectious diseases during the Ebola and COVID-19 pandemics, as demonstrated by practices in Europe, Japan, and other countries ^[5]. However, compared with routine transport missions, the air transport of patients with emerging and virulent infectious diseases poses higher professional requirements for flight nurses, including infection prevention and control, isolation techniques, emergency response, psychological coping, and team collaboration ^[6]. This study intends to use qualitative research methods to deeply understand the actual feelings, training experiences, and specific needs for ability improvement of flight nurses involved in the air transport of emerging and virulent infectious diseases, aiming to provide a theoretical basis and practical reference for building a more scientific and systematic training system.

2. Subjects and methods

2.1. Subjects

Based on the principle of maximizing diversity, subjects were selected through purposive sampling to ensure a more diversified background and richer interview content. Inclusion criteria were: (1) Currently engaged in nursing practice or management at an aviation rescue base hospital; (2) Completed flight nurse training and obtained qualification; (3) Have practical and training experience in infectious disease prevention and control; (4) Regularly participate in aviation rescue skills training and are willing to participate in this study. Exclusion criteria were: (1) Took a vacation, went out for study or work exchange in the past 6 months; (2) Actual work does not involve issues related to nursing care for emerging and virulent infectious diseases. Subjects who withdrew midway or did not complete the interview were excluded. The sample size was determined by information saturation, i.e., when data information became repetitive and no new viewpoints emerged during material analysis. A total of 17 individuals were interviewed, including 4 males and 13 females; 13 with bachelor's degrees, 3 with master's degrees, and 1 with a college degree; 1 nurse, 15 nurse-in-charges, 1 associate chief nurse, and 1 chief nurse; aged between 29 and 44 years old, with an average age of 35.05 years (**Table 1**).

2.2. Methods

2.2.1. Interview outline development

Based on a multidimensional perspective combining nursing, public health, emergency medicine, and other professions and disciplines, a research team was established. A literature search was conducted, and the research team collectively discussed and drafted a semi-structured interview outline, determining the research subjects. According to the inclusion criteria, three subjects who met the criteria were selected for a pre-interview. Based on the interview results and feedback, the research team revised the interview questions. The final interview outline was as follows:

Are you familiar with the nursing work content related to emerging and virulent infectious diseases? What challenges or difficulties have you faced in such tasks? Have you ever felt uneasy or nervous?

Please share an experience of participating in the air transport of a patient with an emerging or virulent infectious disease, and talk about the difficulties and feelings encountered during the mission.

Table 1. General information on interview subjects

ID	Gender	Age	Education	Professional title	Transport cases
N1	Female	35	Bachelor	nurse-in-charges	13
N2	Female	29	Bachelor	Nurse	10
N3	Female	32	Master	nurse-in-charges	13
N4	Male	33	Bachelor	nurse-in-charges	14
N5	Female	39	Bachelor	nurse-in-charges	15
N6	Female	37	Bachelor	nurse-in-charges	12
N7	Female	39	Bachelor	nurse-in-charges	10
N8	Female	34	Bachelor	nurse-in-charges	10
N9	Female	36	Bachelor	nurse-in-charges	10
N10	Male	32	Bachelor	nurse-in-charges	11
N11	Male	34	Master	nurse-in-charges	13
N12	Female	31	Bachelor	nurse-in-charges	10
N13	Female	42	Bachelor	Associate Professor Nurse	13
N14	Male	37	Bachelor	nurse-in-charges	00
N15	Female	44	college	chief nurse	16
N16	Female	30	Bachelor	nurse-in-charges	12
N17	Female	32	Master	nurse-in-charges	10

Do you think you were well-prepared in terms of knowledge, skills, or emergency response capabilities when performing such tasks? In what areas did you feel inadequate?

What are your experiences and views on personal protection, team collaboration, emergency response, and psychological pressure management during missions?

Based on your experience, what content do you think should be emphasized in training? Do you have any suggestions for the format or arrangement of the training?

2.2.2. Data collection

Before the formal interview, members of the research team explained the purpose, content, interview process, and related rights and interests of the study to the interviewees. They clarified that the interview content would only be used for academic research and would not involve personal privacy information, ensuring that the interviewees were informed, understood, and voluntarily participated in the study. All interviewees signed a written informed consent form. The interview time was negotiated based on the interviewee's work schedule, and a convenient time for them to participate was chosen. The interview location was a quiet, undisturbed office or conference room to ensure privacy and continuity of communication. Each interview lasted between 20 and 40 minutes, adjusted appropriately based on the depth of the communication content. The interviews were conducted in a one-on-one semi-structured format, with two researchers participating. One researcher led the questioning, while the other was responsible for recording and assisting with follow-up questions. Clarification and guidance were provided for

any unclear or ambiguous expressions from the interviewees to ensure comprehensive and in-depth information gathering. The entire interview process was recorded with the consent of the interviewees for subsequent data collation and analysis. Interviewees could discontinue or withdraw from the interview at any time if they felt discomfort, and the researchers respected and cooperated with their decisions.

2.2.3. Data analysis

This study adopted a grounded theory research method from a phenomenological perspective to conduct an in-depth analysis of the experiences and needs of flight nurses in aviation transfer training for emerging and virulent infectious diseases. All interview data were recorded with the consent of the interviewees. Members of the research team used NVivo 14 software to transcribe the audio into text. After initial collation, the interviewees were contacted for content verification and supplementation to ensure the authenticity and integrity of the information. This study adopted the coding method of classical grounded theory. Initial coding: Two researchers studied the transcribed data line by line, extracted keywords, phrases, or key events from the original interviews, and conducted open coding while retaining the original meaning as much as possible. Focused coding: The initial coding results were categorized, filtered, and focused. Similar concepts were merged, and representative important categories were extracted. Theoretical coding: Based on continuous comparison and reflection, the internal connections between various genera or concepts were explored, a theoretical framework was constructed, and a systematic understanding of the research phenomenon was gradually formed. Two researchers independently completed the coding and preliminary analysis, and then compared and discussed the results. If there were disagreements during the coding or theme induction process, other members of the research team were invited to participate in the discussion until a consensus was reached, ensuring the scientific and objective nature of the research conclusions.

2.2.4. Quality control

The establishment of a multi-dimensional professional team ensures the accuracy of research content analysis and the comprehensiveness of collected data. Members of the research team analyze data using a double-person approach, comparing coding and themes to ensure multi-dimensional, deep-level, and high-precision data analysis. Before conducting the investigation, the research group performed a literature search on aviation rescue transport nursing and infectious disease prevention and control. They also studied theoretical knowledge related to qualitative research and techniques to improve the credibility of qualitative research, laying a theoretical foundation for interviews and data analysis. Appointments were made before interviews, and relevant research content was communicated to ensure smooth interviews and content acquisition. Interview content was transcribed into text within 48 hours after each interview. Any unclear content was confirmed and double-checked with the interviewees to ensure the accuracy and completeness of the interview data.

2.2.5. Ethical principles

This study does not involve personal privacy. Interviewers strictly follow ethical principles such as informed consent and confidentiality. They respect participants' rights to autonomous choice and privacy, allowing interviewees to refuse to answer questions or withdraw from the interview. All data is stored anonymously and encrypted, and destroyed after the study is completed.

3. Results

Through analyzing interview data, information themes were formed. Flight nurses who participated in the semi-structured interviews had not received targeted training in aviation transport management for emerging and virulent infectious diseases. Most interviewees were key members of their departments and had experience in infectious disease prevention and control. They expressed high enthusiasm for learning about aviation rescue transport for emerging and virulent infectious diseases. Based on the interview results, flight nurses' training needs for transport management of emerging and virulent infectious diseases are reflected in four thematic areas characterized by competency in infectious disease transport management: relevant theoretical knowledge, systems and process specifications, equipment usage, and training and assessment.

3.1. Knowledge of prevention and control of emerging and virulent infectious diseases

3.1.1. Disease characteristics and transmission routes

The onset of infectious diseases has a certain degree of concealment, and it is difficult to clarify their characteristics during the initial outbreak. This poses a greater exposure risk for contacts and a higher safety risk. In the research phase of emerging and virulent infectious diseases, due to the lack of specific vaccines, the population generally does not have resistance, and there are relatively high requirements for the professional knowledge and protection implementation of transport personnel. N3: "We need to update and dynamically learn about the research trends of emerging diseases in real time, and make preparations for health treatment, transport protection, and training to ensure the safe implementation of missions." N5: "Since I started working in nursing, I have experienced the prevention and control of SARS, H7N9, Dengue fever, Hand-foot-and-mouth disease, and COVID-19. It is crucial for our clinical work to timely obtain the latest research results and guidance." N7: "When emerging and highly infectious diseases break out, many prevention and control points are uncertain. We need to strengthen our knowledge of existing virulent infectious diseases while also paying attention to the dynamics of infectious diseases around the world and following up on learning."

3.1.2. Prevention and control guidelines and research trends

When emerging or highly infectious diseases appear, the National Health Commission will issue relevant notifications and instructions, providing phased updates and guidance on how to conduct scientific management and control. As an important department of health and epidemic prevention, medical institutions can timely obtain relevant prevention and control instructions. Through training, medical staff can acquire cutting-edge knowledge and protective skills about infectious diseases, avoiding unnecessary occupational exposure and spread. N5: "As nursing staff, we are very concerned about the transmission modes of infectious diseases and effective protective measures to ensure safety when contacting patients." N14: "Medical staff must master the basic diagnosis and treatment methods and isolation protection skills for patients with virulent infectious diseases, and be familiar with the procedures and specifications for contact and treatment."

3.2. Professional knowledge and operational norms of aviation transport

3.2.1. Special requirements for aviation transport

The particularity of aviation rescue and transport has a significant impact on both medical staff and patients. Learning relevant knowledge about aviation transport is beneficial for medical staff to avoid potential problems during transport and take preventive intervention measures. There is more practice in the aviation transport of patients with emerging and virulent infectious diseases in developed countries, which is completed by professional

infectious disease prevention and control aviation rescue teams. However, there are only a few case reports in China, and experience is severely lacking. With the rapid development of aviation rescue, strengthening the response capabilities and strategies for sudden health emergencies is also an urgent task for improvement. N8: “Relatively speaking, our knowledge of aviation rescue and transport is very lacking. We hope to receive comprehensive aviation knowledge training before accepting missions, understand the characteristics of the impact of different transport situations on patients and medical staff, and be psychologically prepared for transport.”

3.2.2. Transfer process and isolation procedures

The management of infectious diseases has strict requirements. According to these requirements, priority is given to on-site isolation and treatment. For patients with special transfer needs, it is important to ensure that prevention and control measures are in place during the transfer to safely transport them to their destination. The transfer process for emerging or virulent infectious diseases involves coordination and communication among multiple departments. A well-designed isolation and transfer procedure is a crucial foundation to ensure successful transfers. The transfer of highly infectious diseases requires comprehensive management to ensure the implementation of procedural content. N9: “The transfer of severe infectious disease patients is different from that of ordinary critically ill patients. Isolation procedures need to be activated during the transfer, such as boarding, deplaning, and patient handover, which we all need to learn.” N11: “Important aspects of the transfer include precautions, how to place patients, the division of isolation areas, putting on and taking off personal protective equipment, communication procedures, care for special patients, waste disposal, cleaning and disinfection, logistical planning, and follow-up after the mission.” N6: “We also need to learn how to complete deplaning procedures, conduct patient handovers, dispose of waste, and perform cleaning and disinfection.”

3.3. Specialized equipment usage and protective measures

3.3.1. Use of transfer isolation equipment

Emerging and virulent infectious diseases are highly contagious and can spread through various pathways. To ensure the safe transfer of patients with virulent infectious diseases, effective isolation measures should be taken in addition to basic medical treatment capabilities ^[7-9]. In foreign countries, experience with transferring Ebola patients has shown that some patients are transported using isolation pods, and healthcare workers are equipped with multi-layer protective suits to prevent infection. During the air transport of infectious disease patients, the confined space and poor ventilation can increase the risk of infection. The correct application of equipment can reduce this risk. Negative pressure isolation transfer equipment includes negative pressure isolation stretchers, mobile negative pressure isolation transfer rooms, and negative pressure ambulances for long-distance transfers. N6: “Referring to the requirements for COVID-19 prevention and control during transfers, negative pressure vehicles are used for transportation after air transfers to ensure orderly transfers.” N15: “Compared to mature rescue teams, we are lacking in equipment for infectious disease prevention and control, and it is rarely available for us to use in practice.”

3.3.2. Use and management of personal protective equipment (PPE)

The use of PPE is a basic protective measure when dealing with infectious diseases and is key to ensuring that healthcare workers can continue to work safely. The routine PPE includes protective masks, isolation gowns, gloves, and face shields, which are suitable for protection against common infectious diseases. Following the

outbreak of COVID-19, inadequate personal protection has been a significant cause of infection among healthcare workers facing highly infectious respiratory diseases. Currently, in addition to commonly used masks, hats, and protective suits, biochemical protective suits are even used for isolation and protection during the transfer of uncertain infectious diseases abroad ^[10]. Different protective equipment requires continuous adaptation and practice to ensure foolproof operation in practical situations. N4: “The use of protective equipment is very important. It not only requires practice in putting it on and taking it off but also adapting to working in protective suits for extended periods, which has high demands on physical fitness.” N11: “Proficiency in the correct use of PPE among healthcare workers is the most important measure to reduce infections.”

3.3.3. Adaptability training for protective equipment

Flight nurses universally mentioned in interviews that adaptability training for protective equipment is a core skill in responding to air transport missions involving emerging and virulent infectious diseases. Because protective equipment (such as protective suits, masks, gloves, face shields, etc.) is often bulky and wearing it can limit nurses’ movements and work ^[11], mastering how to adapt to wearing protective equipment for extended periods and ensuring efficient and safe work during high-risk missions is a training aspect they value highly ^[12]. N4: “Wearing protective suits is not easy, especially during high temperatures and long missions, which often make us feel very uncomfortable. Additionally, if the protective suit is too tight or not breathable, it can affect our work efficiency. Therefore, adaptability training is crucial, and we need to get used to working in an environment with protective equipment.”

4. Conclusion

China’s flight nurse training mechanism is not yet perfect, and the professional development of flight nurses still needs continuous improvement. There is still a lack of experience in transporting special medical conditions. Through interviews and analysis with flight nurses, this study reveals the urgent needs of nurses in terms of professional knowledge, skills training, and emergency response during air transport missions for emerging and virulent infectious diseases. Flight nurses generally lack systematic training for emerging infectious diseases, especially in areas such as protective skill updates, mastery of air transport operating procedures, and emergency response capabilities. Nurses emphasize that combining theoretical learning with practical training, especially through scenario simulations and regular drills, can effectively improve their response capabilities during actual missions. Additionally, a regular assessment and feedback mechanism is considered an important means to improve professional ability and ensure mission safety. Overall, establishing a systematic training mechanism, especially targeted training for infectious disease prevention and control, air transport, and emergency management, is significant for enhancing the professional capabilities of flight nurses and ensuring the successful completion of air transport missions.

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Disclosure statement

The authors declare no conflict of interest.

References

- [1] Liao YY, Liao XX, Liao YF, 2024, Construction of an Air Medical Rescue Transfer Process for Patients with Acute Infectious Diseases Based on Evidence-based and Delphi Methods. *Journal of Snake*, 36(4): 438–442.
- [2] Li CP, Yu XM, Zhu SC, et al., 2022, Nursing Safety Management of Inter-hospital Air Rescue for Severe Patients during the Zhengzhou 7.20 catastrophic flood. *Journal of Nursing*, 29(13): 25–28. <https://doi.org/10.16460/j.issn1008-9969.2022.13.025>
- [3] Chen WW, Chen L, Fan RJ, et al., 2022, Construction of an Ability Index System for Flight Nurses in Air Rescue. *Nursing Research*, 36(4): 600–605.
- [4] He JM, Su X, Wang J, et al., 2021, Research on the Construction of an Evaluation Index System for Nursing Safety Management of Air Transport in China. *Journal of Air Force Medicine*, 37(4): 304–307.
- [5] Feng YB, 2021, Research on the Construction of a Quality Evaluation System for Helicopter Transport Nursing care for Critically Ill Patients, thesis, Guangxi Medical University. <https://doi.org/10.27038/d.cnki.ggxyu.2021.001110>
- [6] Lu YS, Zhou XZ, Tang BJ, 2020, Nursing Experience of one Severe Patient Transferred by Fixed-wing Aircraft with VV-ECMO Support. *Medical Diet Therapy and Health*, 18(13): 100–101.
- [7] Borges LL, Aguiar CGB, Haberland FD, et al., 2024, Nursing Competencies in Aeromedical Transport in the Brazilian Air Force: A Descriptive Study. *Revista da Escola de Enfermagem da USP*, 2024(58): e20240129.
- [8] Liang HG, 2020, Research and Development Trend of Vaccines for Emerging and Virulent Infectious Disease Pathogens. *Military Medicine*, 44(9): 1.
- [9] Fu CY, 2020, The Current State of Science Popularization of Virulent Infectious Diseases in China — Taking Ebola Virus Disease as an Example. *Science and Technology Communication*, 12(14): 2.
- [10] Wang Y, Zhang QQ, Xiao QQ, et al., 2022, Discussion on the Current Situation of Health Emergency Management from the Perspective of Medical and Preventive Collaboration and a Three-level Emergency Management Strategy. *Chinese Journal of Modern Medicine*, 2022(4): 24.
- [11] Ren TT, Lu PX, Deng GF, et al., 2023, 2020 WHO Global Tuberculosis Report: Analysis of key global and Chinese data. *Electronic Journal of Emerging Infectious Diseases*, 8(1): 6. <https://doi.org/10.19871/j.cnki.xfcrbzz.2020.04.015>
- [12] Wang J, Lu N, Cui ML, et al., 2020, Reflections on the Development of General Practice Medicine Brought about by the Prevention and Control of COVID-19. *Chinese General Practice*, 23(9): 1090–1094.

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