



Descriptive Analysis of the Characteristics of Patients' Referral from Matsu Islands to Taiwan: A Single Medical Center Experience

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Background: Patients at the offshore islands need to be transported to the Taiwan mainland to be able to reach the advanced health-care facilities. **Aim:** The purpose of this study was to identify the characteristics of patients transferred from Matsu islands to a medical center. **Methods:** This study was conducted at a medical center in the northern Taipei City. Medical records were reviewed from the department of emergency medicine and hospitalization system. Adult patients over 18 years old were enrolled between January 2019 and September 2023. All the data were handled using the SPSS version 24.0 software (IBM, Armonk, NY, USA). **Results:** Of the 316 adult patents, with the majority being more than 50 years old, male, and local residents. There were a total of 500 visits including the hospitalization from the emergency department (ED) (61.4%), hospitalization from the outpatient department (30.6%), and only visit to the ED (8.0%). Dominant reasons were injury, poisoning, and certain other consequences of external causes (23.6%), neoplasms (16.0%), and diseases of the circulatory system (11.8%). Nearly half of the visits (46.6%) needed the operation therapy, 15% of patents were disposed to the intensive care unit, and a large proportion of them (36.8%) accepted the treatment from the different specialties. **Conclusion:** Our results have illustrated the features of medical utilization of the patients from Matsu islands. Injury was the main cause which led to the advanced medical care. In addition, the necessity of the multidisciplinary care was also observed from the medical records.

Key words: Emergency air medical transport, emergency department, outpatient department, International Classification of Diseases, 10th Revision, clinical modification, intensive care unit

INTRODUCTION

To pursue health equity and increase health coverage, The Ministry of Health and Welfare (MOHW) in Taiwan

Received: May 31, 2024; Revised: June 28, 2024;
Accepted: June 28, 2024; Published: October 30, 2024

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provides adequate and accessible health care and medical services in offshore islands in recent years.¹⁻³ The Integrated Delivery System, initiated in 1999 through initiatives like the "Improvement Plan for Medical Underserved Areas" and "Upgrading Medical Services in Underserved Areas Plans" has significantly enhanced health care in offshore islands. This program encourages mainland hospitals to send doctors and nurses to these regions.^{4,5}

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How to cite this article: Lo YP, Lai CY, Hsieh PH, Huang YC, Chen YC, Tsai SH. Descriptive analysis of the characteristics of patients' referral from Matsu islands to Taiwan: A single medical center experience. J Med Sci 2025;45:7-12.

Due to the geographical barriers and limit of medical resources in the remote islands, patients suffering from major traumas or critical illnesses could take either a civil aircraft or a ship to the larger hospital located on Taiwan's main island. The service of emergency air medical transport (EAMT) is available and efficient for the severely injured and critically ill patients.^{6,7}

In accordance with the public data released by the MOHW, there were 264 patients permitted to be transported by air in Lienchiang County (known as "Matsu islands") from the 2019 to 2023. These responsible regional receiving hospitals include the Tri-Service General Hospital (TSGH), the Taipei Veterans General Hospital, and the National Taiwan University Hospital.⁸ However, there are still a lack of detailed information of those patients after their delivery to the hospitals.

In addition, patients in Matsu islands are confirmed by the local healthcare professionals that they need a referral to the Taiwan medical facilities due to certain shortages of emergency medical resources. After attending the hospital by themselves, they will apply for the subsidy based on the Directions for Subsidizing Medical Referral Fees of Outlying Island Patients in Severe or Acute Conditions.⁹ Nevertheless, almost no research focuses on the analysis of those patients' data. Hence, this study aims to comprehensively understand the characteristics of patients transferred from Matsu islands to a designated northern receiving hospital in Taiwan. Meanwhile, it will highlight the type of preventive countermeasure development, the necessity of medical services and specialties, and the efficiency of health policy for the authority reference.

MATERIALS AND METHODS

Study design and eligible patients

This was a retrospective, observational study conducted in the single northern medical center in Taipei city. The senior medical doctor took charge of reviewing the medical record of each individual patient from the emergency department (ED) and the hospitalization system containing the information of the patients from Matsu islands. After the encryption, all authors examine and approve the data completeness and accuracy. Adult patients were aged more than 18 years and then enrolled from January 2019 to September 2023.

During the study period, there were 316 patients transported from Matsu islands. Among them, the accumulation of 500 visits to receive the proper treatment was recruited into the final analysis from this study hospital.

Definition of the outcomes and covariates

The patients' characteristics included age (categorized into eight groups: 18–29, 30–39, 40–49, 50–59, 60–69, 70–79, and ≥80 years), gender (female, male), local resident (no,

yes), times of attending the physician, and readmission condition (no, yes).

Details of the visits contained the types (hospitalization from the ED, the outpatient department [OPD], and only ED visit) and length of hospitalization (stratified into no hospitalization, 1–3, 4–7, 8–14, 15–30, and >30 days).

Description of each visit was based on the charge of the attending physicians' specialty.

The International Classification of Diseases, 10th Revision (ICD-10), clinical modification was used to illustrate the main diagnosis determined by the attending physician in the receiving hospital. The proportion of the demand and prognosis listed the operation reception (no, yes), intensive care unit (ICU) admission (no, yes), consultation service (no, yes), and the final outcome (survival, mortality, or transfer to another hospital).

Statistical analysis

The distribution of the continuous variables was presented as mean ± standard deviation. Number and percentage were applied to display the component for discrete variables. All the study data were managed by the SPSS software version 20.0 for Windows (IBM, Armonk, NY, USA).

Ethics approval

Ethics approval was reviewed and approved by the ethical committee of the Institutional Review Board of Tri-Service General Hospital in Taipei City, Taiwan (Approval number: B202405050; approval date: 04/08/2024). After the encrypted and anonymized process, the individual cases cannot be traced and recognized. Data collection and study protocol regarding the patients that underwent medical treatment were classified as low risk, and the study was determined to be exempt from written informed consent. The study was conducted in accordance with the Declaration of Helsinki.

RESULTS

Within the 5-year study period, a total of 316 adult patients from Matsu islands underwent treatment in TSGH. Over 60% of patients were more than 50 years old (mean age: 54.5 ± 19.9 years) and the males were about 70%. The majority of them (99.1%) were residents and over one-fourth of the study subjects were asked repeatedly to attend the physician. Thus, the readmission rate in TSGH was up to 25.9%, as shown in Table 1.

In Table 2, there were a total of 500 physician visits including hospitalizations from the ED (61.4%), hospitalizations from the OPD (30.6%), and only visits to the ED (8.0%). Furthermore, 13.6% of the patients had a hospital stay of 1–3 days, and 28.0%, 26.0%, 16.8%, and 8.4% of the

Table 1: Characteristics of study patients at the baseline ($n=316$)

Variables	Mean $\pm$ SD/ n (%)
Age	54.5 $\pm$ 19.9
18–29	46 (14.6)
30–39	30 (9.5)
40–49	43 (13.6)
50–59	65 (20.6)
60–69	61 (19.3)
70–79	32 (10.1)
≥ 80	39 (12.3)
Gender	
Female	96 (30.4)
Male	220 (69.6)
Local resident	
No	3 (0.9)
Yes	313 (99.1)
Number of attending the physician	
1	234 (74.1)
2	46 (14.6)
3	14 (4.4)
4	4 (1.3)
≥ 5	18 (5.6)
Readmission condition	
No	234 (74.1)
Yes	82 (25.9)

SD=Standard deviation

patients had a hospital stay of 4–7 days, 8–14 days, 15–30, and >30 days, respectively.

The specialties of medical treatment for those patients are shown in Table 3. The top two specialties were orthopedic (17.6%) and general surgery (10.6%). The other dominant specialties by rank order were emergency medicine (8.8%), hematology, and oncology (8.6%), pulmonary medicine (7.4%), cardiology (7.2%), gastroenterology (6.6%), neurological surgery (6.6%), infectious diseases, and tropical medicine (6.0%).

The main diagnosis of the medical referral reasons was classified by the ICD-10 codes, as displayed in Table 4. There were 118 cases (23.6%) attended the TSGH due to injury, poisoning and several other consequences of external causes (S00-T98). Neoplasms (C00-D48), diseases of the circulatory system (I00-I99) and symptoms, signs and abnormal clinical and laboratory findings, and not classified elsewhere (R00-R99) were the following main diagnosis as the cause of the medical referral procedures.

Table 2: Descriptive analysis of medical referral cases ($n=500$)

Variables	Mean $\pm$ SD/ n (%)
Referral by EAMT	
No	365 (73.0)
Yes	135 (27.0)
Types	
Hospitalization from the ER	307 (61.4)
Hospitalization from the OPD	153 (30.6)
Only visit to the ER	40 (8.0)
Length of hospitalization	13.3 $\pm$ 20.9
No hospitalization	39 (7.8)
1–3 days	68 (13.6)
4–7 days	140 (28.0)
8–14 days	130 (26.0)
15–30 days	81 (16.8)
>30 days	42 (8.4)

EAMT=Emergency air medical transport; OPD=Outpatient department; SD=Standard deviation; ER=Emergency room

Surgery was required for 46.6% of the referred patients and there were 74 more ill or injured to attend the ICU. Nearly 40% of them were simultaneously treated and cared by other specialty doctors. For survival, 91.0% of the study patients survived and were discharged as illustrated in Table 5.

DISCUSSION

In this observational study, we analyzed the characteristics of patients transferred from Matsu islands to a medical center on the Taiwan mainland between January 2019 and September 2023. Most of these patients were local residents, predominantly male, and older. One-fourth of the patients had experienced repeated transfers. The primary reasons for transfer were injuries leading to limb fractures (including the forearm, femur, and lower leg), followed by neoplasms and diseases of the circulatory system. During hospitalization, a significant number of these patients required surgery, ICU admission, and care from other healthcare professionals.

Our study showed that more than 40% of patients were above 60 years and the mean age 54.5 $\pm$ 19.9 years who were transferred to this single medical center in Taipei city, compared to 54.1% in Penghu and the mean age 54.5 $\pm$ 21.5 in Kinmen County.^{6,7} These study results revealed that the middle aged and elderly people on offshore island areas are the main users of the EAMT service. Our findings also revealed that the male patients were more likely to be transferred by the aircraft similar to the past studies conducted in Penghu and Kinmen Counties.^{6,7}

Table 3: Specialties of medical treatment (n=500)

Specialty	n (%)
Orthopedic	88 (17.6)
General surgery	53 (10.6)
Emergency medicine	44 (8.8)
Hematology and oncology	43 (8.6)
Pulmonary medicine	37 (7.4)
Cardiology	36 (7.2)
Gastroenterology	33 (6.6)
Neurological surgery	33 (6.6)
Infectious diseases and tropical medicine	30 (6.0)
Urological surgery	19 (3.8)
Neurology	17 (3.4)
Plastic and reconstructive surgery	16 (3.2)
Thoracic surgery	14 (2.8)
Cardiovascular surgery	7 (1.4)
Otorhinolaryngology, head-and-neck surgery	5 (1.0)
Gynecology and obstetrics	5 (1.0)
Rheumatology, immunology, and allergy	5 (1.0)
Colon and rectal surgery	3 (0.6)
Family medicine	3 (0.6)
Nephrology	3 (0.6)
Endocrinology and metabolism	2 (0.4)
Ophthalmology	2 (0.4)
Psychology	1 (0.2)
Rehabilitation	1 (0.2)

In the Matsu islands, the majority of the diagnosis as medical referral reasons was due to “limb injuries and external caused fractures” followed by “neoplasms” and “diseases of the circulatory system.” Main demands of medical specialty services include orthopedic (17.6%), general surgery (10.6%), emergency medicine (8.8%), hematology, and oncology (8.6%). Healthcare providers can allocate the medical resources and hold the training courses to lower the referral cases. Responsible medical centers should be aware of the primary causes of limb injuries and fractures caused by falling and traffic accident in the Matsu islands. They should prioritize addressing the major types, implementing social education program and preventive measures, especially for the elderly and providing necessary support for healthcare professionals and medical resources, based on the identified unmet medical needs. However, there were still some discrepancies of initial referral diagnosis observed between this work and the former studies in Penghu and Kinmen Counties.^{3,6,7} The potential explanations might be that firstly in Penghu and Kinmen Counties, many patients with circulatory-related diseases, such as cardiovascular

disease, stroke, and intracranial hemorrhage, are transferred to Taiwan for treatment. In contrast, Matsu islands see more patients with limb injuries being transferred to Taiwan, likely due to the fallings and traffic accidents. Second, unlike Kinmen and Penghu areas, which feature flat terrain and wide roads, hilly terrains at the Matsu islands might also contribute to the different injury patterns. Furthermore, Lienchiang County has higher rates of cancer patients transferred to Taiwan compared to Penghu and Kinmen Counties, due to the absence of a chemotherapy compounding room at the local hospital. Finally, the enrolled subjects in this study contained the patients referral by the EAMT and self-see cases (also called non-EAMT cases); nonetheless, other researches merely presented the information of the cases received by the EAMT. Or the characteristics of the patients were indeed various in these areas.

Some studies described the prognosis and disposition of these patients after the EAMT in Taiwan. We further illustrated the medical utilization such as operation reception, consultation service, and readmission condition. However, the findings of this current work revealed the lower rates of ICU admission, the mortality rate, and the higher proportion of the hospitalization days <3 days in the Lienchiang County islands. Variations might be caused by the different types of patients, severity of illness, and effects of policy implementations, etc.^{1,10} In addition, there were still 8.2% of patients transferred from Matsu islands that stayed in hospital for more than 1 month. Based on the main referral reasons described above, we tried to clarify the factors related the one-fourth readmission rate by further examining the medical records. It might be that cancer patients regularly attend the physicians for chemotherapy and radiation therapy and patients return to OPD follow-up after the surgery. This could reflect that Matsu islands should prioritize to invest the medical resources and infrastructures for major trauma, acute myocardial infarction, ICU capacity, cancer treatment, etc., to reduce the readmission events. In the meantime, the total transferred cases will be expected to reduce after the implementation. In Taiwan, the unit entitled the National Aeromedical Approval Center is responsible for the evaluation of these cases fit or not fit to be transported by air. From 2019 to 2022, MOHW released that there were 176 cases permitted to be transported by the aircraft from Matsu islands to Taiwan mainland. More than 63% of EAMT cases received by this medical center in this study. Therefore, our samples were highly representative of the EAMT patients in the Lienchiang County. In future, the authority could collaborate with main receiving hospitals and develop the surveillance system of EAMT cases. Meanwhile, these observed rates and number of EAMT might be as the benchmarks to evaluate the effectiveness of different policy implementations.

Table 4: Main diagnosis of medical referral reasons (*n*=500)

ICD 10	Contents	<i>n</i> (%)
A00-B99	Certain infectious and parasitic diseases	25 (5.0)
A41	Other septicemia	23
C00-D48	Neoplasms	80 (16.0)
C22	Malignant neoplasm of liver and intrahepatic bile ducts	28
C83	Diffuse non-Hodgkin's lymphoma	12
C92	Myeloid leukemia	10
E00-E90	Endocrine, nutritional, and metabolic diseases	3 (0.6)
F00-F99	Mental and behavioral disorders	3 (0.6)
G00-G99	Diseases of the nervous system	12 (2.4)
H00-H59	Diseases of the eye and adnexa	4 (0.8)
H60-H95	Diseases of the ear and mastoid process	1 (0.2)
I00-I99	Diseases of the circulatory system	59 (11.8)
I21	Acute myocardial infarction	11
J00-J99	Diseases of the respiratory system	29 (5.8)
J96	Respiratory failure, not elsewhere classified	13
K00-K93	Diseases of the digestive system	48 (9.6)
K35	Acute appendicitis	10
L00-L99	Diseases of the skin and subcutaneous tissue	10 (2.0)
M00-M99	Diseases of the musculoskeletal system and connective tissue	23 (4.6)
N00-N99	Diseases of the genitourinary system	13 (2.6)
O00-O99	Pregnancy, childbirth, and the puerperium	4 (0.8)
R00-R99	Symptoms, signs, and abnormal clinical and laboratory findings, not elsewhere classified	58 (11.6)
R10	Abdominal and pelvic pain	11
S00-T98	Injury, poisoning, and certain other consequences of external causes	118 (23.6)
S52	Fracture of forearm	11
S72	Fracture of femur	19
S82	Fracture of lower leg, including ankle knee	19
Z00-Z99	Factors influencing health status and contact with health services	7 (1.4)
U00-U99	Codes for special purposes	3 (0.6)

ICD=International Classification of Diseases

There were several existing limitations and strengths in our study. First, the results based on a single medical center might be limited to the generalized and to the other remote island areas. Next, non-EAMT patients can attend any clinics and hospitals based on their needs and convenience. It is not like that EAMT cases must be sent to the designated hospitals due to the regulations. The total number of self-see cases was unavailable in this study; hence, a combination of insurance database and referral data must be taken into consideration. Third, due to the data limitation, there were no further details of the patients transferred from the study hospital to another hospital on Taiwan's main island. It will be worthy to increasingly analyze the information, lessen this situation, and lower the impact on the patients.

Afterward, to the best of our knowledge, this is the first study to examine the characteristics of patients from Matsu islands who were transferred to a healthcare facility for medical treatment. Ultimately, the receiving hospital will use these findings to improve and streamline the medical treatment process for these patients.

CONCLUSION

This was the first retrospective study to analyze the characteristics of these patients who were transferred from the medical unit on the remote islands. Based on the results, we recommend that responsible regional receiving hospitals in Taiwan should establish the "green

Table 5: Demand and prognosis of medical referral patients ($n=500$)

Variables	n (%)
Operation reception	
No	267 (53.4)
Yes	233 (46.6)
ICU admission	
No	426 (85.2)
Yes	74 (14.8)
Consultation service	
No	301 (60.2)
Yes	199 (39.8)
Final outcome	
Mortality	21 (4.2)
Survival	455 (91.0)
Transfer to other medical facility	24 (4.8)

ICU=Intensive care unit

channel” to benefit the patients and their families and shorten the waiting time for medical treatment. Meanwhile, enhancement of the accessibility to the proper intervention is through the multilateral communication and collaboration. Finally, the authority continues to invest in the medical professionals and recourses, prompt the capabilities of the local medical hospital, and expect a decline of the referral patients.

Data availability statement

Data sharing is not applicable to this article as no datasets were generated or analyzed during the current study.

Financial support and sponsorship

Nil.

Conflicts of interest

Dr. Shih-Hung Tsai, an editorial board member at Journal of Medical Sciences (Taiwan), had no role in the peer review process of or decision to publish this article. The other authors declared no conflicts of interest in writing this paper.

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