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Original Article

Emergency medical events at the Da Jia Mazu's patrol and pilgrimage: A four-year multiple-center experiences in Taiwan, 2007-2010

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Objectives: This study was to investigate the characteristics of emergency medical events and demands at the Da Jia Mazu's patrol and pilgrimage in Taiwan. **Methods:** A form was designed to cover the structured medical treatments used by medical teams during the annual eight-day-and-seven-night rite of Da Jia Mazu's patrol and pilgrimage. Medication details of these patients were documented from 2007-2010 and analyzed descriptively using SPSS. Demographic features, categories of injuries and illness, as well as the demands of emergency medical services were further evaluated. **Results:** In all, 166 patients were required medical treatment during the study period. Almost 60 percent were male (57.8%), 25.9% were aged 41-50 years, and 54.2% were triaged as level 3. Thirty patients (18.1%) were evacuated to hospitals by ambulance transfer due to the severity of their illnesses, which included one out-of-hospital cardiac arrest (OHCA) patient. **Conclusion:** The utilization of emergency medical care and ambulance transfer can be expected during this pilgrimage. Therefore, the emergency physicians and advanced life support-qualified medical personnel should be on duty at this time. Well-planned and sufficient emergency medical care systems are essential to ensure the safety for the ritual participants.

Key words: Emergency medical events, Da Jia Mazu's patrol and pilgrimage, ambulance transfer

Introduction

Thousands of large events take place annually in Taiwan. By holding large events, Taiwan has successfully become a global hot spot promoting its international visibility through overseas real time broadcasting. Among the three major international religious events, Da Jia Mazu's eight-day-and-seven-night patrol and pilgrimage is the largest one with the longest duration. It also involves the largest number of participants. The journey range of patrol and pilgrimage stretches over 280 km across tens of townships in Taichung City, Chunghua County and City, Yunlin County and Chiayi County. Millions of participants are involved and the number of participants is increasing annually. The line-up is expanding year by year and the pilgrimage activities have become more diversified gradually. Hiking is the major activity, mostly in early spring (March and/or April) when the weather is suitable.

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Participants include people of all ages and genders from all over the country.

The rate of medical use is defined as the number of patients divided by the total participants. In large events, previous experiences have reported the incidence of injuries and illnesses ranged from 0.12 to 145.9 per thousand person-time[1-3]. Previous studies reported a rate of 9.4 per thousand person-time for emergency medical service use during the Yilan International Children's Folklore and Folkgame Festival and 6.9 per thousand person-time during the Sun Moon Lake International Swimming Carnival[4,5]. Based on the use of 4-level triage system, most of the patients at Yilan International Children's Folklore and Folkgame Festival were level-3 and level-4 patients who had mild symptoms[4]. It is important and challenging to provide sufficient and qualified medical care for these people, due to the difficulties in predicting the types of injuries and illness that might occur. Experiences encountered during the Boston Marathon and mass-casualty events show that a rapid and exceedingly well-orchestrated medical response is needed. Importantly, clinical teammates must be on call and be able to muster aid for the management of patients and be well-practiced at overall planning, and have sufficient medical skills needed to to rapidly triage, evaluate, and treat these patients. This would undoubtedly reduce the number of injuries and loss of life. Furthermore, the emotional effects on caregivers/bystanders during these unexpected conditions cannot be underestimated and psychological support for people at such events should be considered[6,7].

Da Jia Mazu's patrol and pilgrimage is the most well-known religious rite in Taiwan and is becoming a large-scale, international event. It has been suggested that government authority implement the medical ratio requirements set forth in regulations to define the required medical care manpower for the participants in a large event. This study analyzed medical events and medications at this event to help planning for similar events in the future.

Materials and Methods

The data were collected by multiple medical teams in Taiwan from 2007 to 2010. Moving along with the activities of Da Jia Mazu's eight-day-and-seven-night patrol and pilgrimage, ambulances were used as emergency stations at the prominent locations where they could be easily accessed. Meanwhile, medical team staff members patrolled around and provided primary treatment when medical care was required. The ambulances were equipped with devices for intravenous injection, oxygen supply, self-awakening, intubation, defibrillator, portable radio and mobile telephone. In addition, they were also equipped with devices such as collar, fixed plate, disposable materials for treating traumatic wounds, as well as medications for emergency and general medical care. Each emergency station had one emergency physician and one ambulance driver. These ambulances moved along the ritual routes and were randomly accompanied by pilgrims, tourists, and groups of folk arts between 10 am and 10 pm daily. The patients were treated by the emergency physician. Information including treatment time, location, gender, age, identity (general public or patrol and pilgrimage staffs), triage, major complaint, traumatic site, medical history, diagnosis, on-site treatment, use and dosage of prescribed medicines were recorded on a prepared medical form. After examination by the emergency physician, if the patients had conditions requiring further treatment, such as unconsciousness, chest pain, difficulties in breathing, shock, bone fracture, and wound requiring suturing, the local hospitals responsible for emergency care were notified by the emergency physicians and ambulance drivers prior to transfer. Once transferred, the patients received further treatment in the hospitals.

In this study, Chi-squared test and Kruskal-Wallis H test were used to analyze the differences in age, triage level, identify (general public and activity staffs, and evacuation (yes, no) per year. A p value of less than 0.05 was considered significant. All statistical operations were performed using SPSS software (version 14.0).

Results

A total of 96 males (57.8%) and 70 females (42.2%) presented injuries or illness during the period of Da Jia Mazu's patrol and pilgrimage from 2007 to 2010. They were between 8 and 78 years old (mean 49.7±15.5 years, median 50 years). Those aged 41-50 years were predominant, accounting for 25.9% (n=43), followed by those aged 51-60 and 61-70 years (n=31, 18.7% for both groups). Based on severity of illness or injuries in a 4-level triage system, most (n=90, 54.2%) of the patients were 3-level patients, followed by 4-level patients (n=55, 33.1%). Most of the patients (n=96, 57.8%) belonged to the general public.

As seen in Table 2, the common cold was the most prevalent internal disease (n=57, 24.5%), followed by diarrhea (n=19, 8.1%) and abdominal pain (n=10, 4.3%). The most three conditions requiring first aid were sore muscles (n=39, 16.7%), blisters (n=13, 5.6%) and joint pain (n=9, 3.8%).

Thirty patients were transferred by ambulances to the hospitals for treatment. The rate of ambulance transfers was 18.1%. The transferred patients were categorized as receiving treatment for internal diseases (14/30, 46.7%) or surgical diseases (16/30, 53.3%). One death occurred among the patients transferred. That patient died due to severe posttraumatic cardiac arrest. For details, see Table 3.

This study found significant differences ($p<0.05$) in the severity of triage levels and the years the events took place. Most level-4 cases were noted in 2010 ($p<0.01$) even if non-significant results were compared with annual evacuation rates ($p>0.05$). For details, see Table 4.

Discussion

Da Jia Mazu's patrol and pilgrimage is the best known and the largest religious event in Taiwan. It has become a world famous international religious activity. The journey continues across tens of

Table 1. The analysis of demographic characters

Variable	n	%	mean	SD	min	max
Gender						
Male	96	57.8				
Female	70	42.2				
Age, years			49.7	15.5	8	78
1-10	2	1.2				
11-20	2	1.2				
21-30	14	8.4				
31-40	25	15.1				
41-50	43	25.9				
51-60	31	18.7				
61-70	31	18.7				
71-80	16	9.6				
Missing	2	1.2				
Triage level						
level 1	5	3.0				
level 2	16	9.6				
level 3	90	54.2				
level 4	55	33.1				
Identity						
general public	96	57.8				
activity staffs	70	42.2				
Evacuation						
Yes	30	18.1				
No	136	81.9				

SD: standard deviation.

Table 2. The frequency distribution of injuries and illnesses (n=234)

Variable	Number	%
Internal diseases		
Common cold	57	24.4
Diarrhea	19	8.1
Abdominal pain	10	4.3
Dizziness	8	3.4
Fatigue	7	3.0
Headache	6	2.6
Nausea and vomiting	6	2.6
Collapse	5	2.1
Difficult breathing	5	2.1
Coughing	4	1.7
Abdominal distension	4	1.7
Skin rashes	4	1.7
Fever	3	1.3
Chest pain or chest distress	2	0.9
Hemorrhoids	1	0.4
Changed Consciousness	1	0.4
Surgical diseases		
Sore muscle	39	16.7
Blisters	13	5.6
Joint pain	9	3.8
Wounded by Firecrackers	5	2.1
Traffic incidence	5	2.1
Burns	4	1.7
Sports injuries	3	1.3
Fall	3	1.3
Pinch	2	0.9
Stabbed injury	2	0.9
Lower back pain	1	0.4
Crush injury	1	0.4
Cramps	1	0.4
OHCA	1	0.4
Dental		
Toothaches	3	1.3

* Multiple clinical conditions in some patients.

Table 3. The frequency distribution of transferred patients (n=30)

Variable	Number	%
Internal diseases		
Vertigo/syncope	5	16.7
Dehydration	1	3.3
Heat stroke	1	3.3
Fever	1	3.3
Common cold	1	3.3
Gastroenteritis	1	3.3
Chest pain	1	3.3
Arthritis	1	3.3
Sciatica	1	3.3
Diabetes	1	3.3
Surgical diseases		
Bone fracture	5	16.7
Burns	3	10.0
Lacerations	3	10.0
Blunt trauma	2	6.7
Penetrating Trauma	1	3.3
Head trauma	1	3.3
OHCA	1	3.3

townships and involves millions of participants. Assuming that the daily participants were those who surrounded emergency stations and had access to immediate medical treatment, the number of estimated participants could range from 1000 to 2000 everyday along with Mazu's patrol and pilgrimage. The average rate of medical use was 2.1‰ to 4.2‰ from 2007 to 2010. Compared with 9.4‰ of Yilan International Children's Folklore and Folkgame Festival and 6.9‰ of Sun Moon Lake International Swimming Carnival, the rate of emergency medical utilization was lower in this study. The difference may lie in the fact that

Table 4. The analysis of age, triage level, identify, and evacuation in each year

Variable	(1)2007	(2)2008	(3)2009	(4)2010	p-value	post hoc
Age	48.0	50.5	47.5	48.0	0.711	
Triage level	3	3	3	4	<0.01**	(4)>(2) >(1),(3)
Identity (n,%)					<0.01**	
general public	43(62.3)	39(81.3)	9(37.5)	5(20.0)		
activity staffs	26(37.7)	9(18.7)	15(62.5)	20(80.0)		
Evacuation (n,%)					0.060	
yes	11(15.9)	6(12.5)	9(37.5)	4(16.0)		
no	58(84.1)	42(77.5)	15(62.5)	21(84.0)		

Age and triage were noted median and analyzed by Kruscal-Wallis H test, α = 0.05, *p<0.05 **p<0.01. Post hoc test by Bonferroni method, α = 0.05/4 = 0.0125. Identify and evacuation were analyzed by Chi-squared test, α = 0.05, *p<0.05 **p<0.01.

the emergency stations were not located at fixed sites but moved along the route over 10 kilometers, meaning that some patients may have visited their local emergency medical services directly. Most (63.3%) of the patients aged 41-70 years, mostly because elderly participants were more motivated to attend by their profound religious beliefs. Level-3 and level-4 patients accounted for most of the patients treated, which was consistent with the results reported by Chang et al. (2005), who reported that most of the patients at I-lan International Children's Folklore and Folkgame Festival had mild symptoms[4].

However, it is noteworthy that the triage level-1 and lavel-2 patients accounted for only 10.2%. The rate of ambulance transfer was 18.1%, which was higher than the results of 2.18% reported by Chang et al., 4.26% found in Taiwan Flower Expo, and 3.03% demonstrated in the study of Den et al., respectively[4,5,8]. Missed records for the patients with mild conditions, such as blisters, bruises, and simple wound bandaging are likely to result in a lower enrollment numbers. However, all the transferred cases were recorded on the medical form, and this may have contributed to an increased transfer rate associated with the mild conditions. The most frequently found medical problems were diversified and included the common cold, sore muscle, diarrhea, blisters, abdominal pain, dizziness, and limb weakness. One case had on-site cardiac arrest due to traffic accident-related trauma and died at the nearest hospital in spite of ambulance transfer. It is possible that there may occur severe illness-mediated cardiac arrest with the incidence of 0.3-4.0 per million in various events, and the likely may increase when emotional excitement is involved[1,3]. One previous study has suggested that treatment by a paramedic or personnel qualified in advanced cardiac life support (ACLS) might be preferable to an emergency medical technician (EMT) for safety's sake[9].

Surgical illnesses, including vertigo/syncope, burns, laceration and bone fracture were more frequently found in the transferred patients. Long-lasting patrol and pilgrimage, crowdedness, and heavy physical loads were most commonly associated with the incidence of vertigo/syncope. Higher incidence of traffic accidents arising from crowded automobiles, motorcycles, bicycle and walking people possibly resulted in the increased rates of bone fracture and laceration. In addition, a higher incidence of burns may be due to firecrackers frequently set off in the rite. There was no significant difference in triage levels between genders. In comparison with the participants in younger age groups, the elderly had more severe triage level. Evacuated patients also had a more severe triage level.

With regard to placement of manpower for emergency medical care during the event of Da Jia Mazu's patrol and pilgrimage, three hospitals had contracted with local healthcare bureaus and were authorized by the event organizer. Each ambulance was staffed with 4-6 medical care personnel and one driver. At least one staff member had EMT-I qualifications. However, still this was small in comparison with the demand of tens of thousand participants involved in the rite of Da Jia Mazu's patrol and pilgrimage. In 1999, a report in New England Journal of Medicine suggested that one emergency medical technician is required for per 1,000 participants, an ambulance accompanied by one advanced EMT for per 2,000 participants, and one physician for every 5,000 participants. The demand for medical care services was increased with more participants, the longer lasting time and more elderly participants[11]. During the 4-year study period, the contracted hospitals paid on their own account for the expense of manpower and all medical staff members were volunteers. Except for an obligation to the administration order and the dedication to serving their fellow man, there is no incentive for talented people to contribute themselves in large events in the future. With regard to possible user charges for toll and sustained services, it is suggested that the cost of medical manpower be covered by the Cultural Bureau of Taichung City Council and Da Jia Jenn Lann Temple. In addition to the emergency stations, it is also recommended that a moving medical care group carrying portable communication devices and emergency medical care devices should be provided for immediate

medical service. In USA, Japan, and European countries, automated external defibrillators (AEDs) are installed in popular casinos, airports, and marketplaces. In Japan, AEDs are accessible in three minutes to anywhere in case of emergency of cardiac arrest. During the event of Da Jia Mazu's patrol and pilgrimage, defibrillators were available in ambulances. Although this met the standard requirements for a large event, a large gap still exists when comparing these preparations with those of developed countries. It is suggested that the Ministry of Health and Welfare, Executive Yuan immediately amend Emergency Medical Services Act, followed by mandatory installation of AEDs in public places and training of people in the use of such devices.

It is important and challenging to provide sufficient and qualified medical care, as it is difficult to predicting the types of injuries and illness that might occur in such a large event. Well-orchestrated medical response teams should be organized and overall planning should be done for this annual activity. The 2010 event found more level-4 of triage level issues ($p<0.01$), indicating that more patients with mild symptoms sought medical aid. We consider that more clinical support is needed. Lessons from the Boston Marathon and other mass-casualty events show that such preparations would undoubtedly serve to lessen injuries and loss of life. Furthermore, the emotional damage caused by unexpected conditions might be reduced by further psychological support from caregivers (such as family members or volunteers) or bystanders or both[6,7]. The organizers also need ensure that sufficient personnel qualified for emergency medical care services are in place. An emergency physician is the most preferable candidate when choosing someone to lead the planning for emergency medical care service in large events[12-14].

Conclusion

Da Jia Mazu's patrol and pilgrimage is the most well-known religious event in Taiwan and is becoming a large-scale international event. We suggest that government authority implement the medical ratio requirements set forth to define the required medical care manpower for the participants in a large event. The organizers need to place sufficient personnel qualified for emergency medical care services. Other staff members involved in medical care should also be required to receive regular training in order to gain practical experience. It is essential to provide comprehensive and immediate emergency medical care service to ensure the safety of participants. The international prestige of emergency medical care services operated in Taiwan can be further promoted.

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Original Article

大甲媽祖繞境活動之緊急醫療救護事件：台灣四年經驗，2007-2010年

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目的：本研究旨在調查2007-2010年期間的大甲媽祖繞境活動的緊急醫療救護事件及需求。**方法：**使用預先設計之結構化醫療處置表格，由設於繞境區內隨行救護車上之醫護人員詳細記載大甲媽祖八天七夜的徒步進香活動期間的傷病患資料，加以描述統計與分析，以瞭解傷病患緊急醫療救護的特性及需求。**結果：**2007-2010年研究期間，尋求緊急醫療照護之傷病患共有166人，主要為男性(57.8%)，年齡在41-50歲(25.9%)，急診檢傷三級患者(54.2%)。因病情需要經由救護車後送至醫院治療的傷病患有30人(18.1%)，其中包含一位到院前呼吸心跳停止病患。**結論：**此類大型活動對於緊急醫療照護及救護車後送需求是可以預期的，雖然多數為檢傷三、四級病患，但科別疾病種類繁多，因此急診醫師及受過高級救命術訓練的醫療人員最適合支援救護。預先規劃良好與足夠之緊急醫療救護系統，才能保障參與活動群眾及工作人員的生命安全。

關鍵詞：緊急醫療事件、大甲媽祖遶境活動、救護車後送

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