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SCHOOL OF HEALTH CARE ADMINISTRATION

MASTER'S THESIS

Burned Patients in a Taiwanese medical center: a five-year utilization study

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ABSTRACT

Title of Thesis: Burned Patients in a Taiwanese Medical Center: a five-year epidemiology study

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BACKGROUND: A burn injury is a disastrous trauma that can have wide-ranging impacts on burn patients and profound consequences for their families. A devastating injury that can cause severe impact in a human life such as permanent disfigurement, psychological morbidity, physical dysfunction and even death. During the past 50 years, the chances of survival after burn injury have increased substantially. At the end of World War II, only 50 percent of patients with 40 percent of their total body-surface area burns have survived. Today over 50 percent of all patients with 80 percent of their total body-surface area burns may survive. Why this remarkable success? Because of the therapeutic developments: fluid resuscitation, the new therapeutic decision such as an early excision of burn wounds, research in critical care and nutrition, the usage and application of topical and systemic antibiotics. The evolution of specialized and multidisciplinary burn centers has his role in this big improvement. Today, burn care has changed considerably. All this new way of management of the burn patient (early surgery, nutritional support, novel skin replacement techniques) are well established.

METHODS: This study described the epidemiological characteristics of a retrospective cohort of 137 admitted burn patients in a Taiwanese Medical Center. The data was from the medical record of those patients in the years from January 2006 to December 2010

RESULTS: This descriptive study includes 78 male and 59 females with a male to female ratio of 1.39:1 and an average age of 43 years. The leading type of burn injury was scalding followed by burn caused by flame then other types of burn; electric, contact and chemical burn have the less patients suffered from them. The mean percent total body surface area (TBSA) for adults was 0.51 with 94 patients having 0-9% TBSA. Adults with more than 50 years old and between 40 and 49 years old are two high-risk groups for burn injuries. The average length of hospital stay was less than 10 days.

CONCLUSION: Adequate and better care of the burned patients is the most effective way to reduce hospital complications, shorten the length of stay, decreases the medical resources utilization (MRU), improve the quality of life and enhance survival. These results showed the unique distributions that reflected the social, economic and cultural background of Taiwan.

Keys words: burn injury, TBSA, length of stay, complications, medical resources utilization (MRU)

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LIST OF ABBREVIATIONS

MRU	Medical resources utilization
LOS	Length of stay
TBSA	Percent total body surface area burned

Chapter I.

INTRODUCTION

Health is the general condition of a person in different aspects. In 1948, when the World Health Organization (WHO) was created, health was defined as being “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity”. Health is a resource for everyday life and a positive concept emphasizing social and personal resources as well as physical capacities. The concept of health is therefore broader that sidebar care but under no circumstances would justify their absence because it’s a right that every human in the earth had.

Health is an important issue and a country should provide healthcare to his population through his medical institutions such as hospital, clinics and make sure that the population as the best quality of care. In a country, the healthcare system is paramount and mandatory. Managers should develop some strategies and plan to help the optimization of the hospital.

The purpose of this chapter is to:

1. Present the background
2. Discuss the significance of the problem
3. Describe the purpose of the study

4. Introduce the objectives

Part 1 Background

A really important factor for the physicians involved in the management is the prognosis of a patient. Clinical experience has shown that risk factors have significant value in the patient's outcome.

During the past 50 years, the chances of survival after burn injury have increased a lot. At the end of World War II, only 50 percent of patients with 40 percent of their total body-surface area burns have survived. Today over 50 percent of all patients with 80 percent of their total body-surface area burns survive. Why this remarkable success? Because of the therapeutic developments: fluid resuscitation, the new therapeutic decision such as an early excision of burn wounds, research in critical care and nutrition, the usage and application of topical and systemic antibiotics. The evolution of specialized and multidisciplinary burn centers has his role in this big improvement. Today, burn care has changed considerably. All this new way of management of the burn patient (early surgery, nutritional support, novel skin replacement techniques) is well established.

One of the most expensive aspects of current health care system is the health care of burn patient. It's possibly one of the least studied in the medical field in terms of cost and results. The economical burden of recovery of a burned patient is substantial, long-term rehabilitation is often

required by the burned survivor to return to their quality of life and independence before the burn injury. Several and repetitive reconstructive surgeries may be required to improve the self-image and promote the reintegration to the society of the burn survivors.

Part 2 Significance of the problem

In the United States, every year 1.25 million burn patients are treated, of whom at least 50000 require hospitalization. We also know depending of the severity and the type of the burn, the treatment of that patient will cost a lot to the family and to the hospital.

During this period, improving the survival rate of the patients was the primary goal of many burn centers. To reach these objectives, they have used many statistical tools such as equations to calculate survival and statistics. In the issue of the Journal, Ryan et al. have present reports documenting progressively better outcomes for patients with burn who have been treated at their institutions.

A patient suffering from burn injuries will go to the closest health institution to seek for help. After passing through the admission procedures and when this patient is finally admitted to the hospital for burns, the medical personnel need to know exactly what kind of decision to take. This patient will be subject to the classification known as diagnosis-related groups (DRGs). With the DRG, the patient suffering from burn injuries will be either transferred to another acute care

facility or will have a treatment. Although few subdivisions (see table 1) are used, such classification is really important to the cost theoretically incurred by the hospital.

Table 1-. Table of DRG's code and their definition

DRG Code	Definition
Code 456	Burns, transferred to another acute care facility
Code 457	Extensive burns without operating room procedure
Code 458	Non extensive burns with skin graft
Code 459	Non extensive burns with wound debridement or other operating room procedure
Code 460	Non extensive burns without operating room procedure
Code 472	Extensive burns with operating room procedure

Part 3 Purpose of study

Numerous studies have examined the effects of burn size and depth, the age of the patient, presence or not of concomitant injury and illness upon burn patient mortality and duration of stay in hospital. To our knowledge only few study were been published about the total costs and results of treatment of burn patients. In this study we will try to analyze all the aspects of the burn injuries.

Part 4 Objectives

The aim of this research is to study the epidemiology of burn in this region of Taipei, to discover the medical resources utilization (MRU) of burn patients admitted to a Taiwanese Medical Center and try to establish a prediction of burn patient for decision making.

Chapter II.

LITERATURE REVIEW

This chapter will provide the literature review related to some relevant research about burns patient. The contents will be a summary of: anatomy and physiology of the skin, the definition, the epidemiology, the physiopathology, the classification and the treatment of a burn patient, followed by a review of prior studies concerning the burn patient.

Over the past 20 years, the outcomes of burn patients have been improved but burns still cause substantial morbidity and mortality. Proper evaluation and management help minimize suffering and optimize results when we are dealing with burn injury patients.

Part 1 Anatomy and Physiology of the skin

The anatomy of the skin is complex and there are three layers:

- Epidermis, the outer layer of the skin, composed of epithelial cells
- Dermis formed by connective tissue is made up of collagen and elastic fibers where nerves, blood vessels, sebaceous glands, lymph vessels, sweat glands and hair follicles reside. The dermis supplies nutrition to the epidermis.
- Hypodermis or subcutaneous tissues where larger blood vessels and nerves are located. The most important layer in temperature regulation.

Two layers of skin: epidermis and dermis cover the subcutaneous tissue layer under the dermis.

The skin is the elastic, self-generating, waterproof covering of the body. It played an important role in the fluid and temperature regulation mechanism of the body, if an enough area of the skin is injured the ability to maintain this control would be lost. The skin acts also as a protective barrier against heat, cold, chemicals, fungi, bacteria and viruses.

The major functions of the skin are: thermoregulation, prevention of loss of body fluid, protection from infection and injury, secretion and sensory reception.

Part 2 Definition of burn injury

Type of injuries to flesh affecting most of the time the skin (epidermal tissue and dermis), rarely deeper tissues such as muscle, bone and blood vessels can also be injured caused by extreme heat, flame, friction, electricity, light, radiation, contact with heated objects or chemicals.

According to the World Health Organization (WHO), burns are defined as a disorder either in one or in all cells layers forming a skin. The disorder was provoked by close contact with hot liquids causing scalds or with hot solid objects causing contact burns or with flame and open fire. Respiratory injuries are also considered burns being the consequence of the smoke inhalation.

Managing burns is really important because they are common painful and can be complicated by shock, infection, multiple organs dysfunction syndrome, electrolyte imbalance and respiratory distress.

Part 3 Epidemiology of burn

Burn injuries, the major global public health crisis, are among the most devastating of all injuries. Burn are the fourth most common type of trauma worldwide following by traffic accidents, falls and interpersonal violence. Approximately 90% of burns occur in low to middle income countries, region that are generally lack the necessary infrastructure to reduce the incidence and severity of burns.

In recent years, burn injuries, which have reached epidemic proportions, are considered a health care problem. In the past several years, the medical profession has begun to recognize and understand all the problems associated with burns.

In a domestic setting when cooking as a common activity are where most of the burn injuries occur. Pediatric burns occur more commonly in the home 84% and while children are unsupervised 80%. Adults can be burn in the home, outdoors or at work: for female mostly at home while for male adults in their work location or outdoor.

The worldwide incidence of fire-related injuries in 2004 was estimated to 1.1 per 100000 populations with the highest rate in Southeast Asia and the lowest in the Americas. The incidence of burns in low and moderate incomes countries (LMC) is 1.3 per 100000 populations compared with an incidence of 0.14 per 100000 populations in high income countries.

Burn accident statistics show that at least 50% of all burn accidents can be prevented, for example one of every 13 structure fire deaths in the United States was caused by a child causing

a fire. Children who are playing with fire, account for more than one-third (1/3) of preschool child deaths by fire.

Some information's about burn injuries from United States have been presented:

- The winter season increases the number of children who suffer burn-related injuries: a study by researchers at the Center of injury research and policy at Nationwide Children's Hospital estimates that there are approximately 10000 pediatric burn injuries annually in the United States. The study found that children aged two years and younger were more likely to be hospitalized for burns to their hands and wrists due to coming in contact with hot liquid or objects. Children aged three to seventeen were more likely to be injured by fire. Children two years and younger accounted for half the children who were hospitalized with burn injuries. (Source: Burn Injuries Take Devastating Toll on Nation's Children from Medical News Today)
- In the United States approximately 2.4 million burn injuries are reported per year. Approximately 650000 of the injuries are treated by medical professionals, 75000 are hospitalized, of those hospitalized 20000 have major burns involving at least 25% of their total body surface. Between 8000 and 12000 of patients with burns die and approximately 1 million will sustain substantial or permanent disabilities resulting from their burn injury (Journal of Burn Care & Rehabilitation, May/June 1992)

The estimated number of burn injuries each year ranges from 1.4 to 2 million. The burn rank is the fourth leading cause of death due to unintentional injury. Deaths occur during the summer

months and close to one third of these deaths are outdoor workers. Male have twice the risk of females.

Part 4 Physiopathology of burn

Tissue burn involves direct coagulation and microvascular reactions in the surrounding dermis that may result in extension of the injury. Large injuries are associated with a systemic response caused by a loss of the skin barrier, the release of vasoactive mediators from the wound and subsequent infection. This results clinically in interstitial edema in distant organs and soft tissues, with an initial decrease in cardiac output and the metabolic rate.

After successful resuscitation, a hypermetabolic response occurs with near doubling of cardiac output and resting energy expenditure. Accelerated gluconeogenesis, insulin resistance and increased protein catabolism accompany this response. Modifications of this physiology through the administration of beta-adrenergic blockage, beta-adrenergic supplementation, non steroidal anti-inflammatory agents, recombinant growth hormone, androgenic steroids and insulinlike growth factor 1 have been proposed to modify this physiology. Currently, data doesn't support the routine use of these therapies.

Part 5 Classification of burn

Burns are characterized by degree based on the severity of the tissue damage. To help the physician to take the good therapeutically decision, burns are classified upon their depth, mechanism of injury, extent and associated injuries and comorbidities.

Currently, burns are described according to the depth of injury to the dermis and are loosely classified into first, second, third and fourth degrees. This system was devised in by the French barber-surgeon Ambroise Pare and remains in use today:

- A first degree burn: superficial and causes local inflammation of the skin. Sunburns often are categorized as a first degree burns. The inflammation is characterized by pain, redness and a mild swelling. The skin may be very tender to touch.
- Second degree burns: deeper and in addition to the pain, redness and inflammation, there is also blistering of the skin.
- Third degree burns: are still deeper, involving all layers of the skin in effect killing that area of skin. Because the nerves and blood vessels are damaged, third degree burns appear white and leathery and tend to be relatively painless. (figure 1)

It is often difficult to determine the depth of a burn accurately especially in the case of second degree burns which can continue to evolve over time. Distinguishing between the superficial-thickness burn and the partial-thickness burn is important as the former may heal spontaneously whereas the latter often requires surgical excision.

Burns are also classified in:

1. Burn severity

With regards to classification, burns are also grouped into degrees of severity. This is assessed based on a number of factors including total body surface area burnt, the involvement of specific anatomical zones, age of the burn victim and associated injuries.

2. Burn surface area

Burn can also be assessed in terms of total body surface area (TBSA) which is the percentage affected by partial thickness or full thickness burns. First and second degree superficial-thickness are not included in this estimation.

The “rule of nines” is used as quick and useful way to estimate the affected TBSA. More accurate estimation can be made using Lund & Browder charts which take into account the different proportions of the body parts in adults and children.

According to the WHO’s International Classification of Diseases version 10(ICD-10), burn injuries are classified by site of injury in chapter XIX as "burns and corrosions" (T20-T32) and in terms of etiology, they are classified as those caused by exposure to smoke, fire and flames (X00-X09), contact with heat and hot substances (X10-X19), exposure to electric current (W85-87), lightening(X33) and exposure to corrosive substances (X46, X49). Therefore burns include scalds as wells as injuries caused by heat from electrical heating appliances, electricity, flame, friction, hot air and hot gases, hot objects, lightening and chemical burns (both external and internal corrosions from caustic chemicals). Radiation-related disorders of the skin and subcutaneous tissue and sunburn are not included in this classification of burns.

In addition to the type and degree of burn, there are other factors that help determine the severity and treatment of a burn. The American Association has identified three (3) risk groups of burn patients. Using this information they have divided burns into major, moderate and minor burns based on severity of burn and the patient risk group.

Table 2-. The American Association risk groups of burn patients

Major burns	Moderate burns	Minor burns
Any burns in infants or the elderly	Partial-thickness burns of 15 to 25% body surface area in the low-risk group	Less than 15% body surface area in the low-risk group
Any burns involving the hands, face, feet and perineum	Partial-thickness burns of 10-20% body surface area in the higher-risk group	Less than 10% body surface area in the higher-risk group
Burns complicated by fractures or other trauma	Full-thickness burns of at least 10% body surface area or less in others	Full-thickness burns that are less than 2% body surface area in others
Burns complicated by inhalation injury	-	-
Burns crossing major joints	-	-
Burs extending completely around the circumference of a limb	-	-
Electrical burns	-	-
Full-thickness burns of greater than 10% body surface area in any risk group	-	-
Partial-thickness burns more than 20% body surface area in the higher-risk group	-	-
Partial-thickness burns more than 25% of the body surface area in the low-risk group	-	-

Risk groups by age and health include:

a) Low-risk patients: between the ages of 10 and 50 years
b) Higher-risk patients: under 10 years of age and over 50 years
c) Poor-risk patients: underlying medical conditions such as heart disease, lung disease and diabetes

Part 6 Causes and Symptomatology of burn

Burns are caused by a wide variety of substances and external sources. It may be caused by even a brief encounter with heat greater than 120°F (49°C). The source of this heat may be the sun causing sunburn, hot liquid steam, fire, electricity, friction causing rug burns and rope burns, and chemicals causing a caustic burn upon contact.

- Chemical: most chemicals causing severe chemical burns are strong acid and bases (caustic chemical compounds such as sodium hydroxide or silver nitrate or acids such as sulfuric acid)
- Electrical: caused by either an electric shock or an uncontrolled short circuit.
- Radiation: caused by protracted exposure to UV light, tanning booths, radiation therapy (patients who are undergoing cancer therapy), sunlamps, radioactive fallout and X-rays.
- Scalding: caused by hot liquids (water or oil) or gases (steam) most commonly occurring from exposure to high temperature tap water in baths or showers or spilled hot drinks.

Signs of burn are localized redness, swelling and pain. The skin may peel, appear white or charred and feel numb. A burn may trigger a headache and fever. Extensive burn may induce

shock, the symptoms of which are faintness, weakness, rapid pulse and breathing, pale and clammy skin and blush lips and fingernails.

Table 3-. Symptomatology of burn injuries

	First degree burns	**Second degree burns**	**Third degree burns**	**Fourth degree burns**
Symptomatology	Skin: • Redness • Pain • Tenderness • Mild swelling	Skin: • Redness • Pain • Tenderness • Swelling	Charring of the skin (skin appear white or dark) No skin: • Redness • Pain • Tenderness	Tissue of the bones are damaged Compartment syndrome
	No blisters from the skin surface	Blisters common	Second degree burns may surround the third degree burn	

Part 7 Treatment of burn

A variety of acute treatments have been used for burn injuries in the last decades, although most of these agents have little or no scientific evidence to support their use. The earliest known record of burn treatment comes from the Ancient Egyptian Ebers Papyrus (dated 1500BC) which contains prescriptions of applications of mud, excrement, oil and plant extracts on different days after the burn injury has occurred and the application of frogs boiled in oil or of fermenting goat dung.

Greek and Roman medicine used dressings impregnated with rendered pig fat, resin and bitumen (Hippocrates, 4th century BC), a mixture of honey and bran followed by cork and ashes (Aulus Cornelius Celsus, ancient Rome), or a lotion of wine and myrrh for burns (1st century AD). Although Galen (AD 129-199) was credited with the first reported application of cold water for burn treatment, a direct reference to him is unknown; his treatments for most wounds included wine, vinegar and water compresses.

By 1901, the recommendations for first aid treatment of burn were clearly segregated depending on wound depth. It was not until 1965 that the use of cold water treatment started to appear in St John Ambulance first aid manuals, also with recommendations to not apply any lotions to the burn and for the patient to go to hospital. The manuals stated that the immediate need after a burn injury was to "lessen the spread of heat in the tissues and alleviate pain by immersing the part in cold water if possible or any other non-flammable fluid to hand, then keep the part dry and clean" By 1969, guidelines had progressed to irrigation with cold water followed by cold compresses and then covered with a clean sterile cloth. These are the recommendations still promoted by many organizations today.

The treatment for burns depends upon their cause, location and severity. Treatment of burns may include:

a) Burn wound care
b) Burn cream that contains silver sulfadiazine
c) Surgery for burns: skin grafts
d) No steroidal anti-inflammatory medications for pains: ibuprofen, ketoprofen, naproxen

e) Narcotic pain medication: for moderate to severe pain and only for short term use

f) Burn rehabilitation

g) Physical therapy for burns

Part 8 Summary

In Taiwan, burn injuries are not among the leading causes of injury-related deaths but do count among the most costly of non-fatal injuries suffered by people in that country. Burn injury is the fifth leading cause of accidents and adverse effects death in Taiwan (Taiwan Department of Health 2008) and the fourth in the USA (Modjarrad et al 2007).

Each year, over 500000 people seek medical assistance for acute burn injuries and approximately 40000 per year sustain burn injuries requiring hospitalization in the USA (Beth 2005). Over one-third of admissions exceeded a 10% TBSA (total body surface area) wound and 10% exceeded a 30% TBSA burn. Most of these admissions included severe burns of vital body areas such as: face, hands and feet (American burn association 2008).

In addition to the economic impact, the after burn period can cause a lot of trouble for the patient; disfigurement and burn-related scars can often cause body image disturbances, significant impairment or loss of physical function and are frequently associated with anxiety and depression (Van Loey & Van Son 2003). These problems can be confounded by economic challenges for burns patients, many of whom have problems in their work because of scar contracture limiting their ability to perform certain jobs (Van Loey & Van Son 2003). Closely

related to this, many patients spend enormous amount of money on reconstructive surgery (American Burn Association 2008)

Burn victims are often faced with devastating problems resulting not only from the initial event but subsequent hospitalizations, loss of body image and self-esteem, and lengthy periods of rehabilitation.

The epidemiological information concerning the burns patients and the management of the care they have received will help us understand how Wan Fang Medical Center takes care of that particular situation. We will see a highly representative picture of the epidemiology of burns patients in that hospital.

Chapter III.

METHODS

In the recent aging society, studies on health care sector have been actively conducted to provide quality services to medical consumers. In this chapter, we will present the methods and materials providing useful information such as the construction model with the conceptual framework, the operational definition, the research hypothesis, the study sample, the data collection and the data analysis.

Part1 Conceptual model

The purpose of the conceptual model is to describe and evaluate the relationship between the demographics variables, the location in the subject medical center, the distribution of burn, the severity of burn, the type and the treatment of the burned patients with the LOS, MRU and the medical complications.

In this conceptual framework, a number of independent and dependent variables will be showed. Figure 1 illustrates the conceptual model of the study.

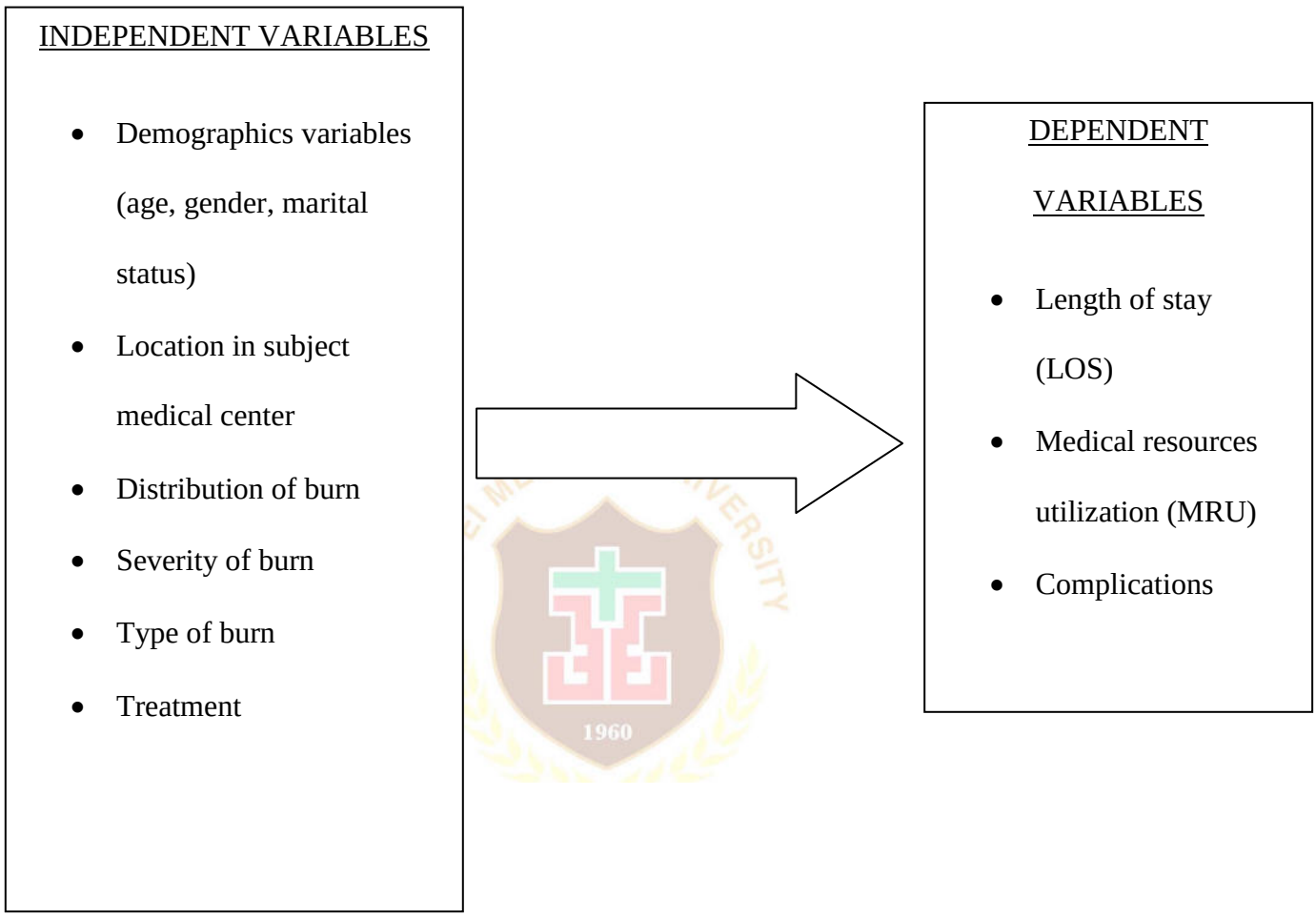


Figure 1: Conceptual model

Part 2 Operational definitions of variables

Dependent variables

Our dependent variables include: length of hospital stay (LOS), the cost and the complications.

2.1 Length of stay

In this study the length of stay will be define by the time that a patient suffering from burn injuries spend in the hospital for his treatment, starting from the first day that he was admitted to the hospital to the day of his discharge.

2.2 Medical resources utilization (MRU)

Total MRU will be consider including the therapeutics procedure fees and the surgery payment.

2.3 Complications

All the medical complications that happen during LOS including post-burn infections, acute gastrointestinal ulcer, hypertrophic scars and keloids and some respiratory complications.

Independent variables

The independent variables that will be consider in this research are: the demographics variables, the location in the Taiwanese subject medical center, the yearly and monthly distribution of burn, the severity of burn, the type of burn and the treatment.

i.1 Demographics variables

The demographics variables will include the age, the gender and the marital status of any burn patients coming at the subject medical center.

i.2 Location in the Taiwanese subject medical center

In this study, we will consider if the burn patient are located in the Ward or in the Burn Unit (BU).

i.3 Distribution of burn

Monthly and yearly distribution of all patients with burn injuries comes to the hospital.

i.4 Severity of burn

Degree of burn

The degree of burn will be define by the first, second and third degree of the classification of burn injuries

Burn extent

The burn extent will be define by the "rule of nine" that will help know the percentage of total body surface area burn

i.5 Type of burn

The causes of the burn injuries will be showed there.

i.6 Treatment

The treatment will be defined by the guidelines that the Taiwanese subject medical center is using to treat their burn patients. We will show the infection report, the surgery procedures and the number of surgery.

Operational definitions of variables

	Scale
Dependent variables	
LOS	Continuous
MRU	
1. Therapeutic procedures fees	Continuous
2. Surgery payment	Continuous
Complications	Discrete
Independent variables	
Demographics variables	
1. Age	Continuous
2. Gender	Discrete
3. Marital status	Discrete
Location in subject medical center	Discrete
Distribution of burn (yearly and monthly)	Discrete
Severity of burn	
1. Degree of burn	Discrete
2. Burn extent	Continuous
Type of burn	Discrete
Treatment	
1. Infection report	Discrete
2. Surgical procedures	Discrete
3. Surgical number	Continuous

Part 3 Research hypothesis

From the administrative data, there's a close relationship between the LOS, the cost, the complications and the mortality that a patient suffering from burn injuries with the demographics variables, the degree, the burn extent, the anatomical site, the treatment and the date of his admission and discharge. At the early stage of burn injuries, all the dependent variables can be predicted by the independent variables from the patient medical records (family history, other concomitant diseases)

Hypothesis 1: The demographics variables (age, gender and marital status) and the severity of burn can influence LOS in the hospital for the burned patient

Hypothesis 2: The severity of burn (degree and TBSA) has an effect on MRU of a burned patient

Hypothesis 3: The severity of burn (degree and TBSA) and the type of burn can predict if the burned patient will have some complications or not

Hypothesis 4: The demographics variables, the treatment and the severity of the burn can influence LOS in the hospital and MRU for the burn patients and their families

Hypothesis 5: There's one or several independent variables that can affect simultaneously LOS, MRU and the complications for the burned patients admitted to a medical center or any medical facilities.

Part 4 Study sample

4.1 Presentation of subject hospital

The subject hospital is an academic medical center with 758 beds, employing 320 physicians and surgeons. Located publicity owned but privately operated hospital a major mass rapid station in Taipei, the subject hospital has been operating since 1997 as Taiwan's first.

The vision of this hospital is to become an internationally renowned university hospital with the highest quality of care. Their mission is to provide patient-centered healthcare, to train excellent healthcare professionals, to be innovative research center and to accomplish international accredited standards.

This hospital has several core values:

1. Excellence: quality is been putting as first
2. Innovation: is the key to achieve high standard of patient care
3. Integrity: honest practices and inspire trust through leadership
4. Compassion: patient has been treated as a family
5. Social responsibility: to improve the health of the community

4.2 Data sources

The data source of this study was obtained from the clinical records of patients from the plastic department of the medical center.

4.3 Study population

Patients admitted for burns basing on ICD-9-CM and DRGs classification.

4.4 Method of sampling

A retrospective cohort of 137 patients to investigate the burned patient obtained from the Plastic Surgery department records of this hospital from January 2006 to December 2010.

III. 5 Data Collection

A consecutive case series from retrospective administrative data were used for research purposes, drawn from a hospital in the municipality of Taipei and the choice of that subject medical center was made.

This study will use the medical records data from the internal data base of the subject medical center. The data will be extracting by the researcher.

Strict confidentiality will be assured to the head of the hospital. No data will be used for the identification of any patients of the subject medical center and will be only use for the purpose of this study and nothing else.

III.6 Data analysis

The analysis of the study will be performed as follows:

The descriptive statistics will be used to summarize the data sampling, to provide all the information's related to the sample characteristics and means. This part of the analysis will include the "mean" and "standard deviation" for the continuous variables and the "frequency" and the "percentage" will be used for the distribution of the discrete and continuous variables.

The Student t-test or analysis of variance (ANOVA statistical analytical method) with the Scheffe's method for multiple comparisons or the Kruskal-Wallis test will be used to investigate the continuous variables. The Chi-square test or Fisher's exact probability test will be also used for categorical variables.

The relationship between the independent variables and the dependent variables will be analyzed by the multi-dimensional regression analysis (linear) where we will do a synthesis of all the variables.

A two tailed $p<0.05$ was considered statistically significant.

The SAS statistical package, SAS system for Windows version 16.0 and Microsoft Excel were used to perform analyses in this study.

Chapter IV.

RESULTS

In this chapter, the results of the research findings will be presented look at the relationship between the objectives of the study and the patterns of results. A summary statistics will be provide and the analysis of what's have been found.

In this research, the data profile was consisting by the medical reports of 137 burn patients in the subject medical center. As illustrated in Table 4, we have the complete data of those patients.

The study population had a mean age of 43 years (range 2 years to 89 years) with a majority of men (56.9%). The most common burn etiology was scald (52.6%), followed by contact burn (30.7%), others (7.3%), electric and contact (3.6%) and chemical (2.2%). The mean % TBSA was 51% (range 0% to more than 30%). The mean length of hospital stay was 0.64 days (range 0 to 3 days) (Table 4)

Table 4 Descriptive statistics of the burned patient admitted from 2006 to 2010

Descriptive statistics of the burned patient admitted from 2006 to 2010	***Frequency (N=137)***	***%***	***Mean***	***Median***	***SD***
Gender			0.43	0.00	0.497
Male	78	56.9			
Female	59	43.1			
Age			40.31	43.00	23.317
0-9 years old	20	14.6			
10-19 years old	14	10.2			
20-29 years old	10	7.3			
30-39 years old	20	14.6			
40-49 years old	22	16.1			
> 50 years old	51	37.2			
Marital status			0.15	0.00	0.362
single	116	84.7			
married	21	15.3			
Location in subject hospital			0.40	0.00	0.492
ward	82	59.9			
burn unit (BU)	55	40.1			
LOS			0.64	0.00	0.923
0-9 days	82	59.9			
10-19 days	33	24.1			
20-29 days	12	8.8			
>30 days	10	7.3			
Month of admission			5.90	6.00	3.311
January	14	10.2			
February	12	8.8			
March	17	12.4			
April	9	6.6			
May	10	7.3			
June	16	11.7			
July	16	11.7			
August	10	7.3			
September	8	5.8			
October	10	7.3			
November	7	5.1			
December	8	5.8			
Type of burn			1.21	0.00	1.522
Scald burn	72	52.6			
Contact burn	5	3.6			
Flame burn	42	30.7			
Electric burn	5	3.6			
Chemical burn	3	2.2			
Others	10	7.3			

Table 4 Descriptive statistics of the burned patient admitted from 2006 to 2010 (cont'd)

Descriptive statistics of the burned patient admitted from 2006 to 2010

	Frequency (N=137)	***%***	***Mean***	***Median***	***SD***
Degree			2.09	3.00	0.996
1 degree	1	0.7			
2 degree	59	43.1			
3 degree	4	2.9			
2-3 degree	73	53.3			
TBSA					
0-9%	94	68.6	0.51	0.00	0.892
10-19%	26	19			
20-29%	7	5.1			
>30%	10	7.3			
Surgical procedures			0.23	0.00	0.425
No surgical procedures	105	76.6			
Had a surgical procedures	32	23.4			
Surgery number			0.61	0.00	1.226
no surgery	105	76.6			
between 1 and 3 surgeries	28	19.6			
between 4 and 6 surgeries	3	3.1			
> 7 surgeries	1	0.7			
Complications			0.05	0.00	0.221
No complications	130	94.9			
complications	7	5.1			
Infection report			0.32	0.00	0.674
culture: no	109	79.6			
culture: yes	28	20.4			
culture, no growth	12	8.8			
culture positive	16	11.7			

Table 4 Descriptive statistics of the burned patient admitted from 2006 to 2010 (cont'd)

Descriptive statistics of the burned patient admitted from 2006 to 2010	***Frequency (N=137)***	***%***	***Mean***	***Median***	***SD***
Therapeutics procedure fees			1.58	1.00	1.846
0- 10000NT	57	41.6			
10000-200000NT	29	21.2			
20000-30000NT	16	11.7			
30000-40000NT	8	5.8			
40000-50000NT	4	2.9			
>50000NT	23	16.8			
Surgery payment			0.69	0.00	1.508
0- 10000NT	105	76.6			
10000-200000NT	11	8			
20000-30000NT	3	2.2			
30000-40000NT	5	3.6			
40000-50000NT	2	1.5			
>50000NT	11	8			
MRU			0.94	0.00	1.299
0-100000 NT	79	57.7			
100000-200000NT	15	10.9			
200000-300000 NT	23	16.8			
300000-400000 NT	16	11.7			
400000-500000 NT	0	0			
> 500000 NT	4	2.9			

Part 1 Demographic variables

In this research, we have collected the medical records of burns male and female patient that have been admitted to the Taiwanese subject medical center.

I.1Gender

The study population consisted of 78 males and 59 females. From 137 burned patients admitted, 56.9% were male patients and 43.1% were female patients, giving an overall male to female ratio of 1.32 to 1 (Table 4 & Figure 2)

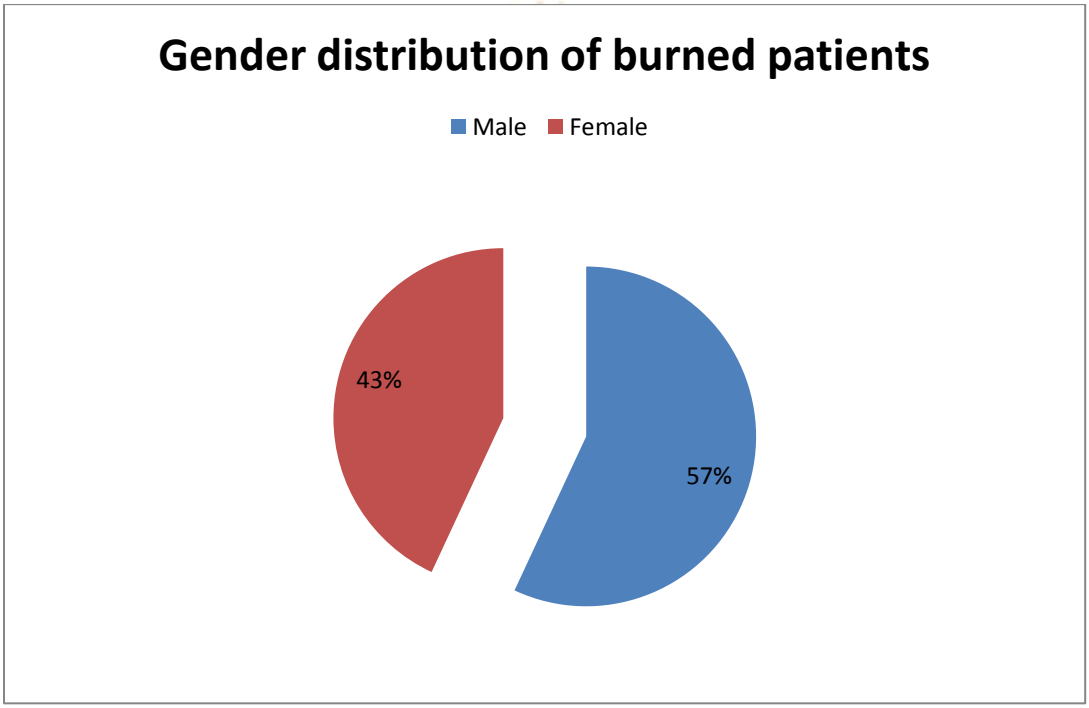


Fig 2 Gender distribution of burned patients

I.2 Age

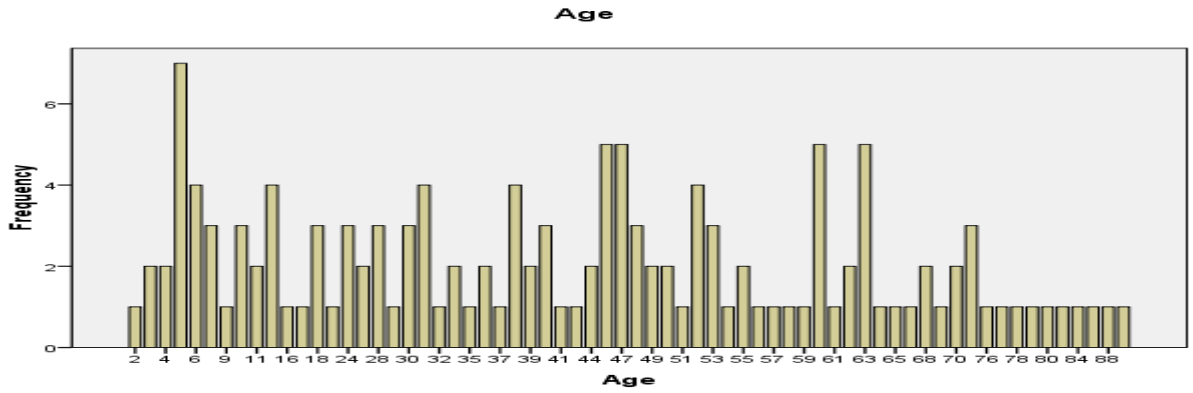


Figure 3 Age distribution

A total of 137 patients were collected in the medical record of the Taiwanese subject medical center during the 5-year study period. The median age of burns patients was 43years with a range of 2 to 89 years old. The age distribution shows one peak in the adults over 50 years old, the most frequently hospitalized burned patients who accounted for 37% of patients. Adults between the ages of 40 and 49 years (16% of patients) accounted for slightly more patients than the remaining age groups. Children under 10 years old and adults between the ages of 30 and 39 years accounted for the same 15% of patients. (Table 4 and Figure 3)

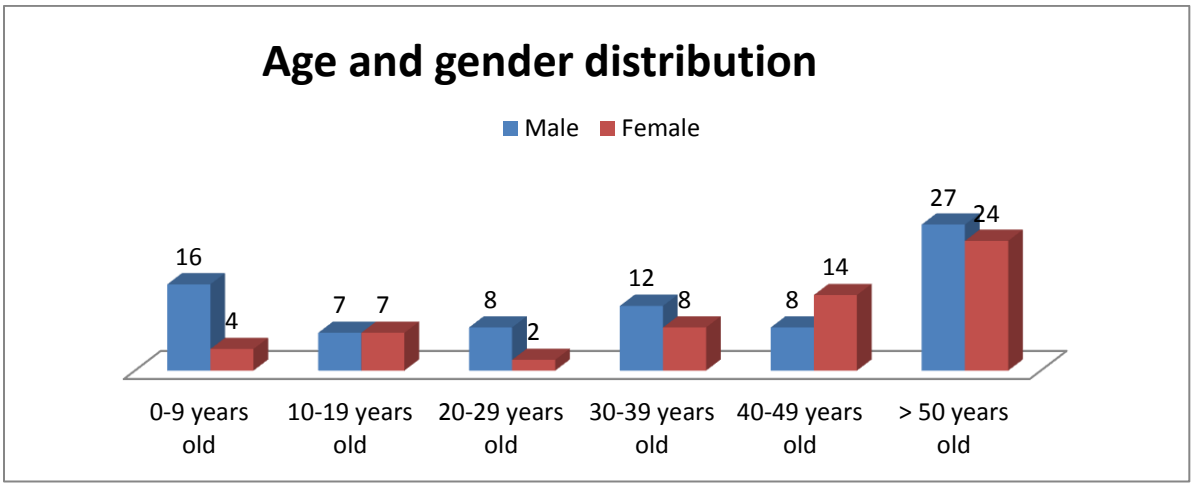


Figure 4 Age and gender distribution

I.3 Marital status

The marital status among the burn patients is shown in Figure 5. Approximately 84.7% of the patients are single and the 15.3% married patients were adults.

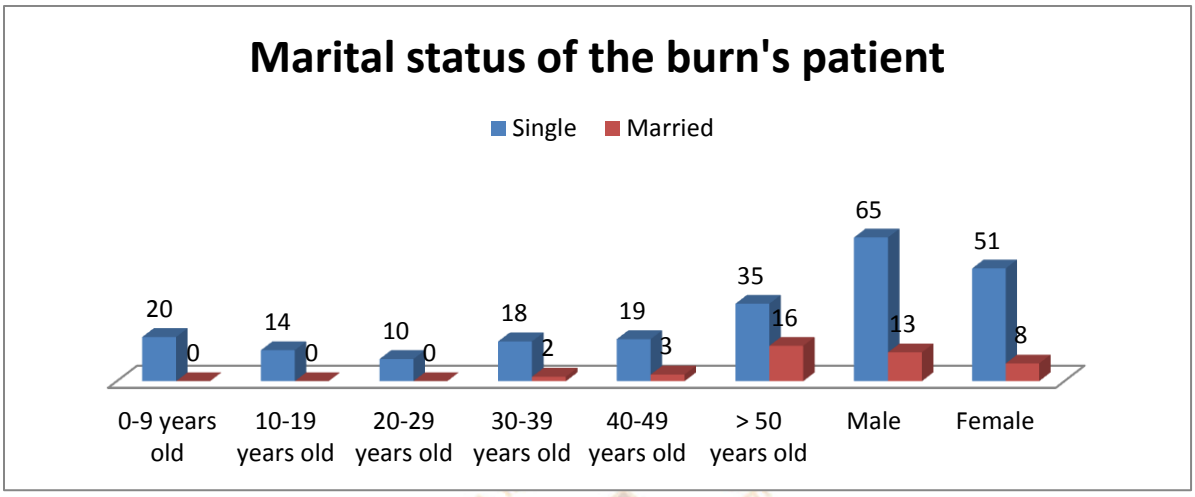


Figure 5 Marital statuses among the burned patients

Part 2 Location of the burned patients

The location of the burned patients in the subject medical center was 59.9% in the ward and 40.1% in the burn unit (BU). (Table 4 & Figure 6)

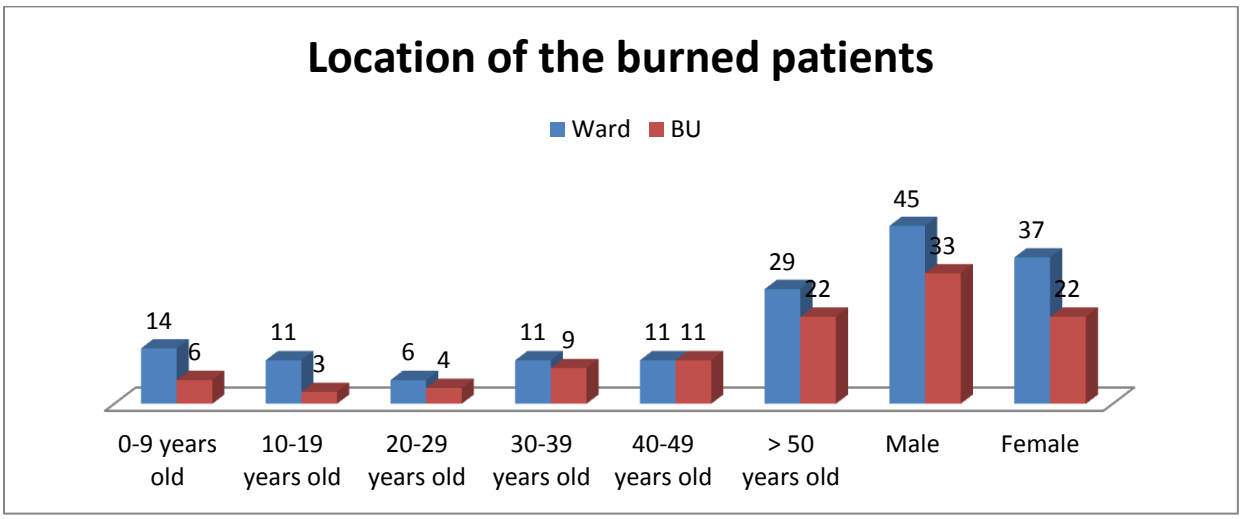


Figure 6 Location in WFMC of the burn's patient

Part 3 Distributions of burns

III.1 Yearly distribution

There is a trend to have most of the burn injuries in year 2007 with 57 admission (40% of cases) followed by year 2008 (21%), year 2010 (15%), year 2009 (13%) and year 2006 (11%). Figure 7

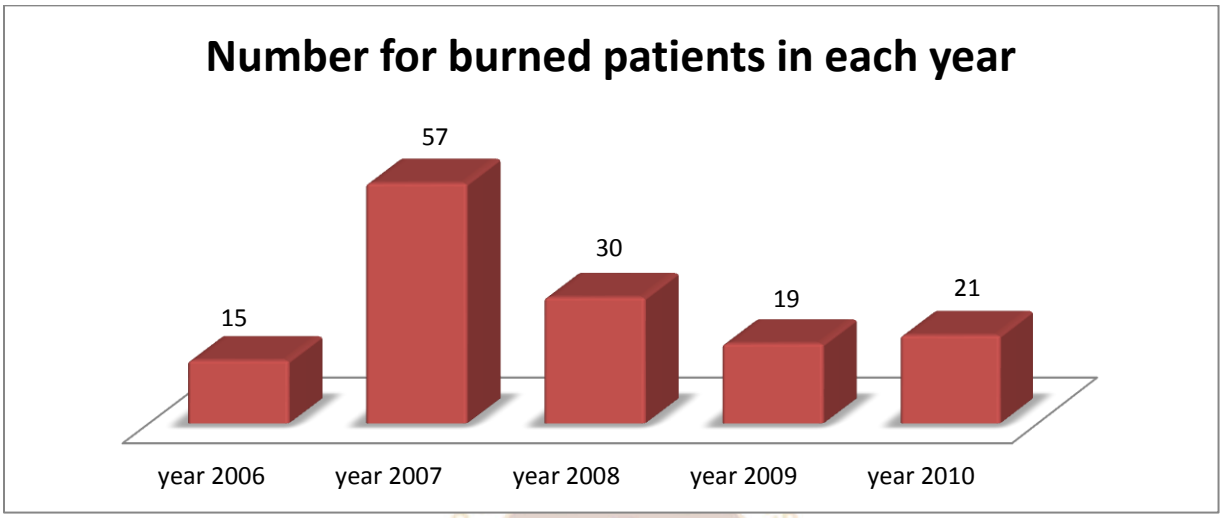


Figure 7 Yearly distributions of the burns

III.2 Monthly distribution

Burns were more common during summer between June and August with 42 admissions (31% of cases) followed by spring (26%), winter (25%) and autumn (18%). The highest number of admissions occurred during the month of July. Figure 8

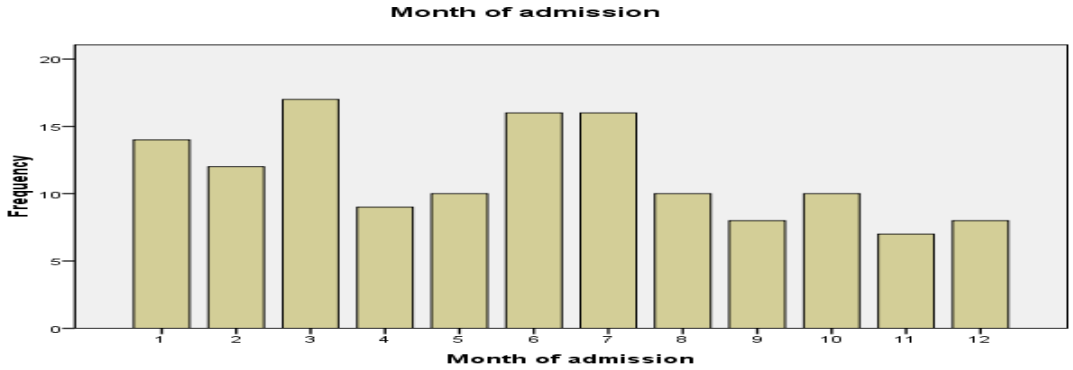


Figure 8 Monthly distribution of burn

Part 4 Severity of burns

IV.1 Burn extent

The mean burn size was 0.51, with 68.6% of total body surface area was between 0-9%, 19% between 10-19%, 7.3 % patients suffered from extent more than 30% TBSA and 5.1% between 20-29% TBSA. (Table 4 & Figure 9).

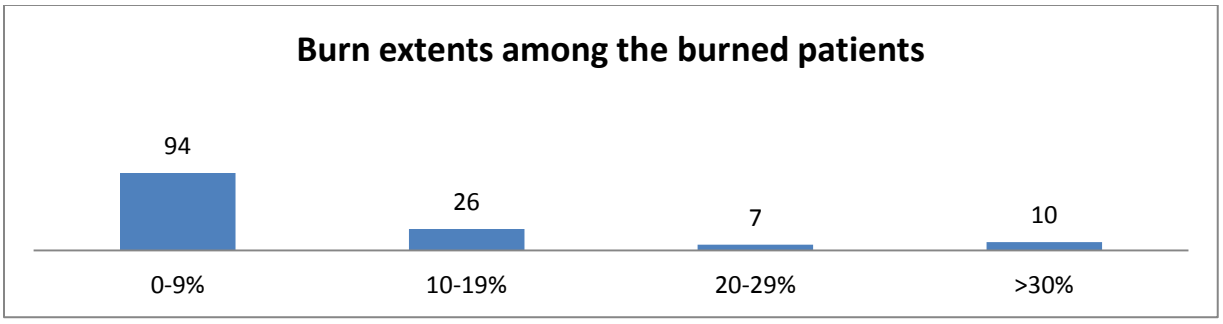


Figure 9 Distribution of burn extents among the burned patients

IV.2 Degree of burn

The mean degree of burn was 2.09 with 53.3% of the degree of burn was for patients with 2-3 degree of burn, followed by 43.1% of patients with a 2 degree of burn. 2.9% and 0.7% was the percentage of patients who suffered respectively from 3 degree and 1 degree of burn. (Table 4)

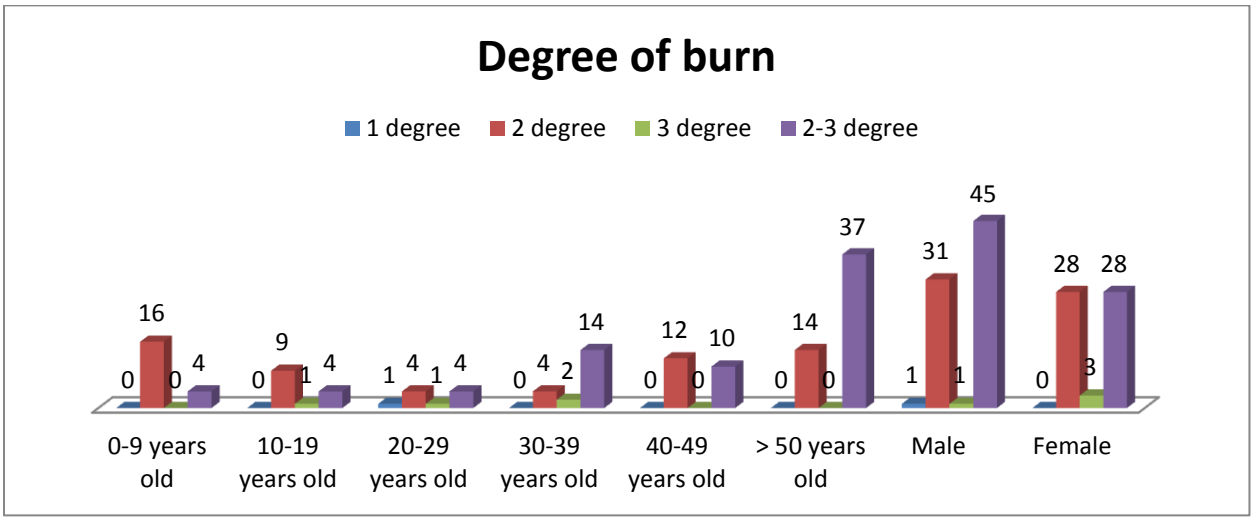


Figure 10 Degree of burn among the burned patients

Part 5 Types of burn

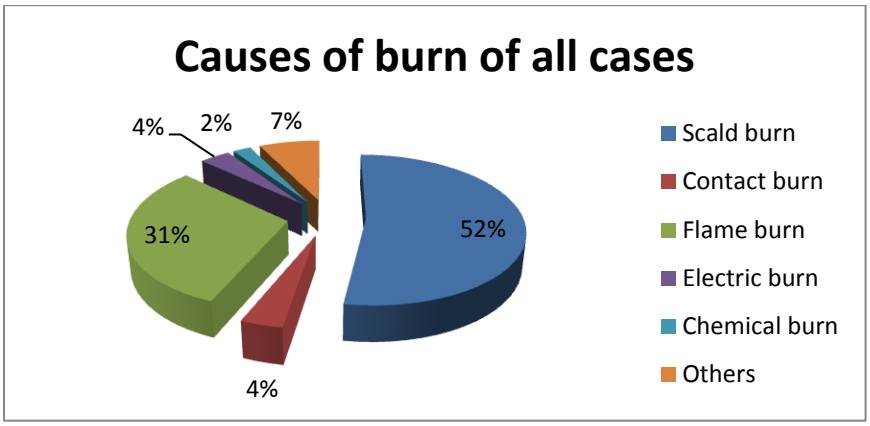


Figure 11 Causes of burn

Scalds were the most common type of burns, 52.6% of the cases. The causing agent couldn't be identified in the medical record. In second position with 30.7% the flame burn, 3.6% for both contact and electric burn finally 2.2% for chemical burn. The unspecified or unclassified burn represented 7.3%. (Table 4 and Figure 11)

Part 6 Treatment

VI. 1 Surgical procedures and number

76.6% of the burn's patient admitted didn't have any surgical procedures and 23.4% of them had at least one surgical procedure as a treatment for their burn injury. (Table 4 and Figure 12)

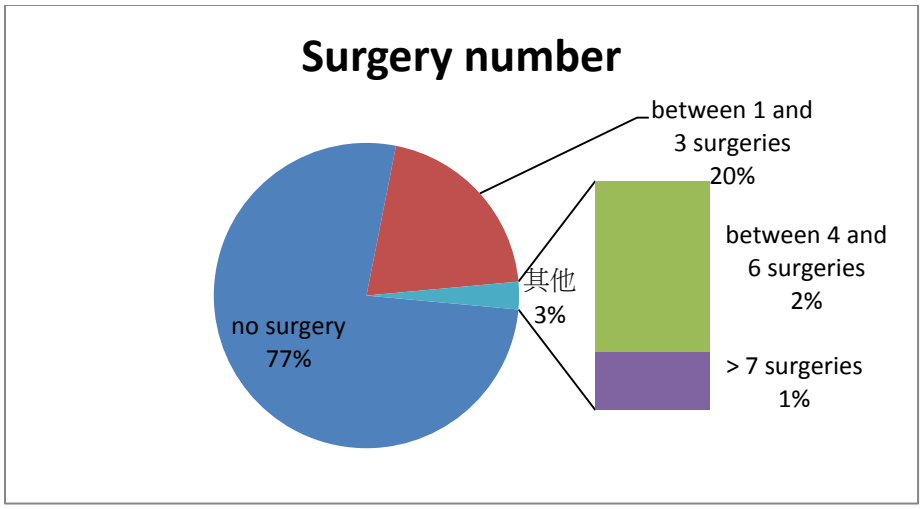


Figure 12 Surgery number

VI. 2 Infection report

The mean of the infection report among the burn's patient was 0.32. 79.6% of the burn's patient didn't present any signs of infection, 11.7% had a positive culture after the hospital have been running some laboratories exams and 8.8% did have a culture without any growth of bacteria's. (Table 4)

Part 7 Length of hospital stay

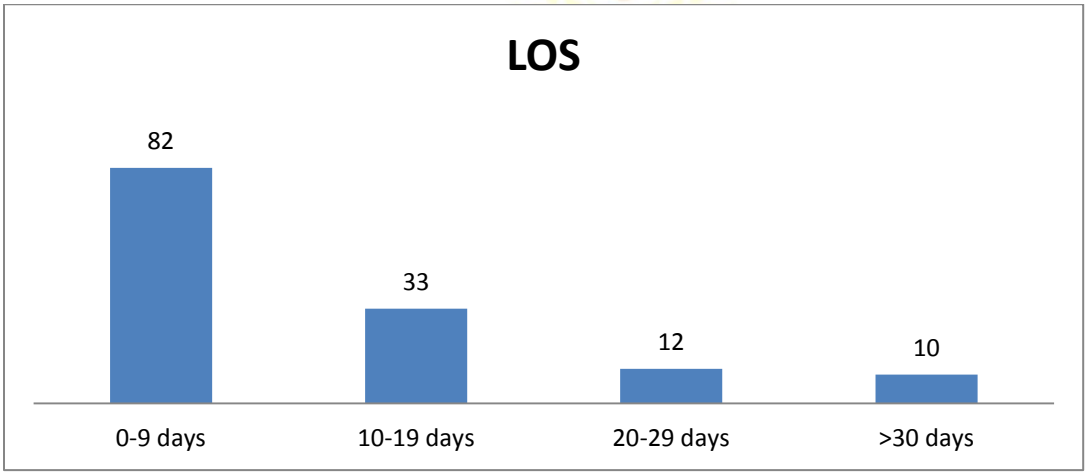


Figure 13 LOS among the burned patients

The median of the hospital stay was 0.00 and the mean 0.64 days. 59.9% of the patients stayed in the hospital for 0 to 9 days, 24.1% for 10 to 19 days, 8.8% for 20 to 29 days and 7.3% for more than 30 days. The average length of stays in different burn extent group can be seen in Table 4

Part 8 Complications

94.9% of the patients didn't develop any complications during their admission for their burn treatment and 5.1% did have a complication. (Table 4)

Part 9 Medical resources utilization

41.6% and 76.6% of the patient has the therapeutic procedure fees and surgery payment between 0-100000NT. 21.2% and 8% have 100000 to 200000NT for the therapeutic procedure fees and surgery payment; 8% have pay more than 500000NT for the surgery. (Table 4)

57.7% of the patients pay between 0-100000NT, 16.8% between 200000 to 300000NT, 11.7% between 300000 to 400000NT, 10.9% between 100000 to 200000NT and 2.9% more than 500000%. There are no patients who pay between 400000 to 500000NT for the MRU (Figure 4)

Part 10 Independent-Samples T Test and One-Way ANOVA for LOS

In this dependent variable "Length of hospital stay (LOS)", there was no statistical significance for different variables such as the gender, the age, the marital status and the location of the burned patients admitted to the subject medical center from January 2006 to December 2010. The gender of the burned patients has showed no statistical significance, p value for the male patients (0.413), with (mean 13.56, SD 14.68) and p value for female patients (0.403) with (mean 11.58, SD 12.72). There's no statistical significance for the age range groups p value (0.009); from 0-9 years (mean 5.4, SD 2.33), 10-19 years (mean 7.2, SD 3.72), 20-29 years (mean 17.1, SD 26.09), 30-39 years (mean 20, SD 19.5), 40-49 years (mean 14.68, SD 16.75), and >50 years (mean 12.61, SD 8.48). For the marital status for the burned patients there was no relative statistical significance p value (0.725) for the single patients with (mean 12.92, SD 14.60) and p value (0.61) for the married patients with (mean 11.76, SD 8.41). The location of the burned patient in the subject medical center didn't show any statistical significance p value (0.003) for the patients in the ward with (mean 9.93, SD 11.54) and p value (0.006) for the patients in the burn unit with (mean 16.92, SD 15.84). The different months of admission of the burned patients didn't show any relative statistical significance p value (0.42) with January (mean 11.07, SD 5.4), February (mean 18.08, SD 14.32), March (mean 13, SD 16.2), April (mean 10.44, SD 8.8), May (mean 10.3, SD 8.96), June (mean 11.18, SD 9.15), July (mean 9.25, SD 7.54), August (mean 8.7, SD 6.75), September (mean 12.62, SD 19.65), October (mean 11.3, SD 7.24), November (mean 20.86, SD 27.79), and December (mean 22.75, SD 27.46).

For the different variables: type of burn, degree f burn, %TBSA, surgical number and procedures of the burned patients admitted to the subject medical center from January 2006 to December

2010, we found for those variables statistical significance p value (<0.001). First the type of burn we identified that patients who had suffered from flame burn injury have a (mean 20.14, SD 20.63), than patients who suffered for others type of burn have a (mean 16.3, SD 11.7), than the chemical burned patients with (mean 9.33, SD 6.11), the scald burned patients with (mean 9.03, SD 6.64), the electric burned patients with (mean 6.6, SD 4.93) and the contact burned patients with (mean 5.2, SD 3.11). For the patients who had suffered from 2-3 degree of burn the (mean 17.43, SD 16.45), followed by the patients suffered from 3 degree of burn (mean 9.25, SD 8.34), the patients with 1 degree of burn (mean 8, SD 0) and the patients with 2 degree of burn (mean 7.25, SD 6.94). For the patients with more than 30% TBSA (mean 41.1, SD 26.7), 10-19% TBSA (mean 17.85, SD 13.19), 20-29% TBSA (mean 15.14, SD 9.8) and 0-9% TBSA (mean 8.14, SD 6.45). For the patients who have a surgical procedures (mean 26.5, SD 20.35) and for the patients with any surgical procedures (mean 8.55, SD 7.08). For the patients who have a surgical procedures, the number of surgery: for the patients who had more than 7 surgeries (mean 89, SD 0), between 4 and 6 surgeries (mean 53.8, SD 22.69), between 1 and 3 surgeries (mean 16.62, SD 8.2). These variables have a relationship with the LOS in the Taiwanese subject medical center for the burned patients admitted from January 2006 to December 2010. (Table 18)

Table 5 Independent-Samples T Test and One-Way Anova for LOS among the burned patients

Independent-Samples *t*-test and One-Way ANOVA for LOS among burned patients

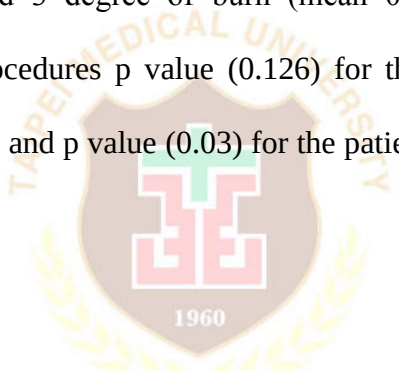
Variables	*Mean*	*SD*	*t/f*	*p*	*Scheffe methods*
Gender					
Male	13.5641	14.68066	0.822	0.413	
Female	11.5862	12.72108	0.839	0.403	
Age					
			3.21	0.009**	
0-9 years old	5.4	2.33			
10-19 years old	7.21	3.72			
20-29 years old	17.1	26.09			
30-39 years old	20	19.5			
40-49 years old	14.68	16.75			
> 50 years old	12.61	8.48			
Marital status					
single	12.9224	14.60206	0.353	0.725	
married	11.7619	8.41371	0.508	0.614	
Location in subject medical center					
ward	9.939	11.54524	-2.985	0.003**	
burn unit (BU)	16.9273	15.84398	-2.809	0.006**	
Month of admission					
			1.037	0.42	
January	11.07	5.4			
February	18.08	14.32			
March	13	16.2			
April	10.44	8.8			
May	10.3	8.96			
June	11.18	9.15			
July	9.25	7.54			
August	8.7	6.75			
September	12.62	19.65			
October	11.3	7.24			
November	20.86	27.79			
December	22.75	27.46			

Table 5 Independent-Samples T Test and One-Way Anova for LOS among the burned patients

Independent-Samples *t*-test and One-Way ANOVA for LOS among burned patients					
Variables	***Mean***	***Std deviation***	***t/f***	***p***	***Scheffe methods***
Type of burn					
			4.67	0.001***	0<2
Scald burn	9.03	6.64			
Contact burn	5.2	3.11			
Flame burn	20.14	20.63			
Electric burn	6.6	4.93			
Chemical burn	9.33	6.11			
Others	16.3	11.7			
Degree					
			6.81	0.001***	
1 degree	8	0			
2 degree	7.25	6.94			
3 degree	9.25	8.34			
2-3 degree	17.43	16.45			
TBSA					
			31.31	0.001***	0<1,0<3,1<3,2<3
0-9%	8.14	6.45			
10-19%	17.85	13.19			
20-29%	15.14	9.8			
>30%	41.1	26.7			
Surgical procedures					
No surgical procedures	8.55	7.08	-7.68	0.001***	
Have a surgical procedures	26.5	20.35	-4.9	0.001***	
Surgical number					
			83.28	0.001***	
no surgery	7.94	6.94			
between 1 and 3 surgeries	16.62	8.2			
between 4 and 6 surgeries	53.8	22.69			
> 7 surgeries	89	0			

Part 11 Independent-Samples T Test and One-Way ANOVA for Complications among the burned patients

In this dependent variable "complications", there was no statistical significance for different variables such as the age, the degree of burn and the surgical procedures of the burned patients admitted to the subject medical center from January 2006 to December 2010. The age of the burned patients has showed no statistical significance, p value (0.15), from 30-39 years (mean 0.15, SD 0.366), from 20-29 years (means 0.1, SD 0.316), from 40-49 years (mean 0.09, SD 0.294), more than 50 years (mean 0.02, SD 0.14), from 0-19 years (mean 0, SD 0). For the patients who had suffered from 2-3 degree of burn the (mean 0.1, SD 0.296), followed by the patients suffered from 1, 2 and 3 degree of burn (mean 0, SD 0). There's no statistical significance for the surgical procedures p value (0.126) for the patients who have a surgical procedures (mean 0.12, SD 0.33) and p value (0.03) for the patients with any surgical procedures (mean 0.03, SD 0.16).



For the different variables: type of burn, %TBSA and infection report of the burned patients admitted to the subject medical center from January 2005 to December 2010, we found for those variables statistical significance . First the type of burn with p value (p,0.05) we identified that patients who had suffered from flame burn injury have a (mean 0.14, SD 0.35), than patients who suffered for others type of burn have a (mean 0.1, SD 0.31), than the scald, contact, electric and chemical burned patients with (mean 0, SD 0). The p value (<0.001) was significant for % TBSA and the infection report. For the patients with more than 30% TBSA (mean 0.5, SD 0.53), 0-9% TBSA (mean 0.02, SD 0.14), 10-29% TBSA (mean 0, SD 0). For the infection report of burned patients, the culture is positive (mean 0.31, SD 0.47), the culture is negative (mean 0.02, SD 0.13)

and the culture with no growth (mean 0, SD 0). These variables have a relationship with the complications in the Taiwanese subject medical center for the burned patients admitted from January 2006 to December 2010. (Table 6)

Table 6 Independent-Samples T Test and One-Way Anova for the complications among the burned patients

Independent-Samples *t*-test and One-Way ANOVA for complication among burned patients					
Variables	***Mean***	***SD***	***t/f***	***p***	***Scheffe methods***
Age			1.65	0.15	
0-9 years old	0	0			
10-19 years old	0	0			
20-29 years old	0.1	0.316			
30-39 years old	0.15	0.366			
40-49 years old	0.09	0.294			
> 50 years old	0.02	0.14			
Type of burn					
			2.6	0.03	0<2
Scald burn	0	0			
Contact burn	0	0			
Flame burn	0.14	0.35			
Electric burn	0	0			
Chemical burn	0	0			
Others	0.1	0.31			
Degree					
			2.2	0.9	
1 degree	0	0			
2 degree	0	0			
3 degree	0	0			
2-3 degree	0.1	0.296			
TBSA					
			21.73	0.000	0<3,1<3,2<3
0-9%	0.02	0.14			
10-19%	0	0			
20-29%	0	0			
>30%	0.5	0.53			
Surgical procedures					
No surgical procedures	0.03	0.167	-2.191	0.03*	
Have a surgical procedures	0.12	0.336	-1.565	0.126	
Infection report					
			15.4	0.001	0<2, 1<2
culture: no	0.02	0.135			
culture, no growth	0	0			
culture positive	0.31	0.479			

Part 12 Independent-Samples T Test and One-Way ANOVA for MRU

In this dependent variable "medical resources utilization", there was no statistical significance for different variables such as the type of burn, the degree of burn and the surgical procedures of the burned patients admitted to the subject medical center from January 2006 to December 2010. The type of burn of the burned patients has showed no statistical significance, p value (0.29), the patients who had suffered from chemical burn injury have a (mean 6.66, SD 50275.03), than patients who suffered for scald burn injury (mean 5.95, SD 92845.5), than the flame burned patients with (mean 4.22, SD 1.36), the contact burned patients (mean 1.95, SD 10956.4), the others type of burn (mean 1.83, SD 3.54) and the electric burned patients (mean 1.23, SD 2.36). There's no statistical significance for the degree of burn p value (0.3), for the patients who had suffered from 2 degree of burn the (mean 4.74, SD 1.19), followed by the patients suffered from 3 degree of burn (mean 3.17, SD 20701.47), the patients with 1 degree of burn (mean 3, SD 0) and the patients with 2-3 degree of burn (mean 2.98, SD 1.04). For the surgical procedures for the burned patients there was no relative statistical significance, p value (0.002) for the patients with any surgical procedures (mean 8.55, SD 7.08) and p value (0.084) the patients who have a surgical procedures (mean 5.52, SD 1.53)

For the different variables: %TBSA, infection report and surgical number o of the burned patients admitted to the subject medical center from January 2005 to December 2010, we found for those variables statistical significance p value (<0.001). First the %TBSA of burn we identified that patients with 0-9% TBSA (mean 4.62, SD 1.23), 10-19% TBSA (mean 1.68, SD 1.53), 20-29% TBSA (mean 1.6, SD 1.29) and for patients with more than 30% TBSA (mean 1.49, SD 2.58). For the infection report of burned patients, the culture is positive (mean 8.77, SD

8.77), the culture is negative (mean 7.13, SD 1.44) and the culture with no growth (mean 2.46, SD 2.89). For the patients who have a surgical procedures, the number of surgery: for the patients between 4 and 6 surgeries (mean 2.33, SD 3.63), between 1 and 3 surgeries (mean 1.64, SD 1.64) and who had more than 7 surgeries (mean 1.1, SD 0). These variables have a relationship with the medical resources utilization in the Taiwanese subject medical center for the burned patients admitted from January 2006 to December 2010. (Table 7)

Table 7 Independent-Samples T Test and One-Way Anova for MRU among the burned patients

Independent-Samples *t*-test and One-Way ANOVA for MRU among burned patients					
Variables	***Mean***	***SD***	***t/f***	***p***	***Scheffe methods***
Type of burn					
			1.25	0.29	
Scald burn	5.95	92845.5			
Contact burn	1.95	10956.4			
Flame burn	4.22	1.36			
Electric burn	1.23	2.36			
Chemical burn	6.66	50275.03			
Others	1.83	3.54			
Degree					
			1.22	0.3	
1 degree	3	0			
2 degree	4.74	1.19			
3 degree	3.17	20701.47			
2-3 degree	2.98	1.04			
TBSA					
			13.44	0.001***	0<3, 1<3, 2<3
0-9%	4.62	1.23			
10-19%	1.68	1.53			
20-29%	1.6	1.29			
>30%	1.49	2.58			
Surgical procedures					
No surgical procedures	6.76	1.55	-3.207	0.002***	
Have a surgical procedures	5.52	1.53	-1.782	0.084	
Infection report					
			8.47	0.001***	0<2
culture: no	7.13	1.44			
culture, no growth	2.46	2.89			
culture positive	8.77	8.77			
Surgical number					
			20.14	0.001***	
no surgery	5.94	1.53			
between 1 and 3 surgeries	1.64	1.64			
between 4 and 6 surgeries	2.33	3.63			
> 7 surgeries	1.1	0			

Part 13 Regression analysis of LOS

The regression analysis will synthesized all the independents variables to determine their impact on the LOS. In our study, the R square is 0.875 means that approximately 87% of the variability of the LOS of the burned patients in the subject Taiwanese medical center is accounted by the independent variables. The adjusted R square indicates that 75% of the variability of the LOS of the burned patients in the subject Taiwanese medical center is accounted by the independent variables. The statistical significance was showed for: patients who were electrically burned (p value $p<0.05$, beta -4.80), the patients with their therapeutic procedures fees between 20000-29000NT ($p<0.001$, beta 6.12) and more than 50000NT ($p<0.001$, beta 6.93). For the patients with more than 30% for the degree of burn there was a statistical significance proven ($p<0.001$, beta 15.50). (Table 8)

Table 8 Regression analysis of the LOS among the burned patients

Regression analysis of LOS among the burned patients

Predicts variables	*B*	*S.E*	*β*	*t*	*p*
No infection report	4.514	1.692	.171	2.668	0.009***
Therapeutic procedures fees: 10000-19000 NT	3.475	1.120	.188	3.103	0.003***
20000-29000 NT	6.123	1.743	.249	3.512	0.001***
30000-39000 NT	7.190	2.303	.227	3.121	0.003***
40000-49000 NT	9.314	3.961	.151	2.351	0.021*
> 50000 NT	6.939	1.969	.273	3.524	0.001***
TBSA >30%	15.500	3.130	.352	4.953	0.001***

P<0.05 *
P<0.01 **
P< 0.001 ***

R Square=0.875
Adjusted R square= 0.756

Part 14 Regression analysis of MRU

The regression analysis will synthesized all the independents variables to determine their impact on the medical resources utilization. In our study, the R square is 0.865 means that approximately 86% of the variability of the MRU of the burned patients in the subject Taiwanese medical center is accounted by the independent variables. The adjusted R square indicates that 78% of the variability of the MRU of the burned patients in the subject Taiwanese medical center is accounted by the independent variables. The statistical significance was showed for: patients with their surgery payment therapeutic procedures fees between 40000-49000NT ($p<0.001$, beta 270559.131) and more than 50000NT ($p<0.05$, beta -111942.717). For the patients with their degree of burn between 10-19% TBSA ($p<0.05$, beta 54839.483) and with more than 30% for the degree of burn there was a statistical significance proven ($p<0.001$, beta 454790.360). (Table 9)

Table 9 Regression analysis of the MRU among the burned patients

Regression analysis of MRU among burned patients

Predicts variables	***B***	***S.E***	***β***	***t***	***p***
Therapeutic procedures fees: > 50000 NT	89699.385	30156.136	.218	2.974	0.004***
Surgery payment: 40000-49000 NT	270559.131	61994.661	.271	4.364	0.001***
> 50000 NT	-111942.717	51388.400	-.157	-2.178	0.033*
TBSA: 10-19%	54839.483	22780.044	.163	2.407	0.019**
>30%	454790.360	47924.988	.640	9.490	0.001***

P<0.05 *
P<0.01 **
P< 0.001 ***

R Square=0.865
Adjusted R square= 0.781

Part 15 Regression of the complications

The regression analysis will synthesized all the independents variables to determine their impact on the medical complications. The -2 log likelihood ratio (25.65) also called deviance measures unexplained variability in the data and thus lower value indicate a better fit. The Chi-square test determines the difference between the -2 Log likelihood ratio of the complications alone with each other of the independent variables. In our study, the statistical significance was showed for: the type of burn that the patients suffered ($p<0.05$, beta 1.04), % TBSA ($p<0.05$, beta 1.09) and the infection report ($p<0.05$, beta 1.22). Those three independent variables: the type of burn, %TBSA and the infection report are the one who can affect the complications among the burned patients. (Table 10)

Table 10 Logistic regression analysis of the complications among the burned patients

	B	S.E.	Wald	df	Sig.	Exp(B)
Age	-.058	.040	2.087	1	.149	.944
Type of burn	1.045	.532	3.861	1	.049*	2.843
Degree	15.325	2.576E3	.000	1	.995	4.526E6
TBSA	1.097	.485	5.122	1	.024*	2.995
Surgical procedures	-.776	1.203	.417	1	.519	.460
infection report	1.225	.642	3.641	1	.056*	3.403
Constant	-50.072	7.729E3	.000	1	.995	.000

P<0.05 *
P<0.01 **
P< 0.001 ***
-2 Log likelihood = 25.652[a]
Cox & Snell R Square = 0.194
Nagelkerke R Square = 0.586

Chapter V.

DISCUSSION AND CONCLUSION

Part 1 Discussion

This chapter will highlights some relevant findings of this study regarding the burned patient in a Taiwanese medical center with a five year epidemiology study. First of all we will discuss the findings and compared it to other similar studies in the world. Secondly, we will see if our hypotheses are verified or not; also see in which way we achieve our objectives outlined in the previous chapter 1. The last section of this chapter will be our recommendations, limitations, future research and conclusion.

The profile of the typical burn patient in our study is as follows: male and female, all ages included, single and married, covered by the National Health Insurance, burns resulting from an unintentional event and most often caused by scalding, flame or fire.

From an epidemiological perspective, many studies are available on the most important characteristics of the burn patient and also on the factors related to the length of stay. Such factors include the area and deepness of the burn, age and sex of the patient, and time from the incident to the application of treatment. (Saffle, J.R., Davis, B., Williams, P. 1995).

The epidemiologic distribution of our patients was similar to that of other environments. The mean patient age was 43 years, and the patients had a somewhat low total body surface area (TBSA) of 68.6%.

Reports from other countries indicate that children younger than 6 years are at the highest risk of burns.[34] However, their distribution will depend much on the country of residence and possibly on its level of social and economic development. Our environment demonstrated a good hospital rate which is somewhat lower than the rates presented by other US studies. (Saffle, J.R., Davis, B., Williams, P. 1995).. Therefore, our study produced a lesser risk of burns and a higher mean age, which is possibly one of the characteristics of our Taiwanese environment.

The report about the epidemiology of burn injury in the subject hospital is limited [36, 37]. In the present study, the age of the 137 burns patients showed a double-peak distribution which corresponded to the adult group aged more than 50 years old and between 40 to 49 years old, respectively. The double-peak age distribution implies different types of burns for adults. In our study and in agreement with other studies (Duggan, D., Quine, S. 1995, Ho, W.S., Ying, S.Y. 2001 and Lari, A.R., Alaghehbandan, R.., Nikui, R. 2000) males were more frequently burned than females. Some studies have, however, reported the opposite (Duggan, D., Quine, S. 1995, Ho, W.S., Ying, S.Y. 2001)

Scalding was the predominant burn type and accounted for 52.6% (72/137) of cases. The cause of the scalds couldn't be identified because it wasn't notice in the medical report of the patients.

This was followed by flame burn (30.7%), other type of burn (7.3%), contact and electrical burn (3.6%) and chemical (2.2%) burns. In general, scalding was the main type of burn seen in this population of patients, which is in agreement with some studies(National Nosocomial Infections Surveillance (NNIS) System Report, Data Summary from January 1992-June 2002, Issued August 2002, and Weber, J.M. 1998) but differs from others where naked flame burn was predominant (McManus, A.T., Kim, S.H., McManus, W.F., et al. 1987. McManus, A.T., McManus, W.F., Mason, A.D. Jr., et al. 1985). Burns due to explosion and from chemical substances occurred more frequently in the workplace such as factories were more serious. The highest risk for burn injury requiring admission in the burn population of WFMC was mainly due to scalding. This pattern was similar to many developed countries.

The majority of burn injuries reported here occurred at home but we couldn't know for sure the most common location. This result corresponds to findings reported in recent studies (Panjeshahin, M.R., Lari, A.R., Talei, A., Shamsnia, J., Alaghehbandan, R. 2001). Higher frequencies of burns resulted from hot water, hot soup, hot oil, and hot food and stove fires, corresponding to high occurrence of burns before or during lunch and dinner time. This may be related to the Chinese culture that cooked food and hot food are more favorable and acceptable, and suggests the need for prevention programs to reduce the risks of burns associated with cooking and eating.

Most studies where such an analysis has been done report that winter is the most frequent season for burn injuries (Carroll, S.M., Gough, M., Eadie, P.A., McHugh, M., Edwards, G., Lawlor, D. 1995, Lari, A.R., Alaghehbandan, R.., Nikui, R. 2000). There is no tendency for the burn injuries

to occur in winter season. Another study reported that summer was the higher season (Panjeshahin, M.R., Lari, A.R., Talei, A., Shamsnia, J., Alaghehbandan, R. 2001). On the contrary, there is a trend to have the injuries in summer season. On a month-by-month basis, July was the highest month for recorded burn injuries, which may be related to the summer vacation for students or due to accidents with fires due to the hot weather. In our study, summer was the more common season for burns which is in agreement with one other study (Panjeshahin, M.R., Lari, A.R., Talei, A., Shamsnia, J., Alaghehbandan, R. 2001). A possible explanation might be that during summer vacation in July and August, most of the people stayed at home and this can make home more crowded and it further makes summer home a dangerous zone for the accident to take place.

The overall value of the lengths of stay is between 0 to 9 days. Roughly, there was about 1 day of stay for every percent of burn area.

In comparison with the study by Ho and Ying 2001, our study found that a higher proportion of patients don't have any surgical procedures (operations) (76.6%), but that the average number of operations per patient was 19.6% for 1 to 3 surgeries.

In the present study, the overall complication mortality rate of hospitalized burns patients was 5.1%. No infection amount the burn patient was 79.6%. This implies that the quality of care for burns victims in this Taiwanese subject hospital is acceptable compared to other developed countries.

Regarding the costs and methods of our study, many of the cost distributions show evidence of substantial skew, so statistically it would not be accurate to study mean costs. Despite this, we preferred to use the mean rather than the median because we were evaluating total costs. 57.7% of the patients spent between 0-10000NT for their total cost while they were admitted to Wan Fang Medical Center. However, this apparently high cost was less than half of the daily cost of patients treated in an intensive care unit, as pointed out by Chassin 1982.

In a study by Eldad et al published in 1993, hospitalization costs of a severely burned patient, in 1991, were higher than ours. In the work by Eldad and colleagues, the costs of treating a severely burned patient were distributed as follows: salaries, 37.5%; medical and surgical materials, 22%; medicines, 7%; nutrition, 3.5%; laboratory, 14%; blood and derived products, 15%; and laundry, 1%. In our research, the total cost was represented by the therapeutic fees and the surgery payment.

Obviously, with this diversity of values in costs, various factors may influence health care cost. Wheeler et al found a direct relationship between the severity of burns and health care costs. In another study, the cost per patient with severe burns amounted to US $46 069 in 1991.
In our study, those patients incurred a cost more than 50000 NT but this amount does not take into account the labor and social costs to make the costs comparable.

Therapeutic actions may also influence costs. The treatment of a burn patient consists of covering the skin of the patient, although the conditions and the way of doing so depend on the type and extent of the injury. When the TBSA is less than 30%, autograft skin can be used in a

single operation. However, in full-thickness burns with TBSAs of more than 30%, it is necessary to cover the burns with some kind of skin and undertake various operations; in burns with TBSAs of 20% to 30%, the wound should be treated with cerium nitrate and sulfadiazine until the patient can be operated on. For a long time, expanded meshed autografts and, more recently, cultured epidermal autografts have been used on massive burns. With these autografts, the variability in costs may depend on various factors.

As indicated by numerous authors, early surgical treatment tends to shorten the hospital stay and reduce sepsis incidence. A suitable diet is also useful in reducing the hospitalization costs of burn patients, as pointed out by Weinsier et al. There may also be differences attributable to different techniques. Hence, a modified technique of postage stamp autografting compared with the modified Meek technique produces a reduction in costs and other advantages, mainly in patients with extensive burns,31 although there is still much discussion regarding the optimal dermal substitute.

Other factors that could influence costs are the introduction of cultures in the first 24 hours after burn injuries as a means of reducing the hospital stay and expenses of the burn patient (Lee, S.S., Tsai, C.C., Lai, C.S., Lin, S.D. 2000) and the use of topical treatment, such as topical silver sulfadiazine combined with cerium nitrate, which according to some studies produces a reduction of 8 days in reepithelialization and shortens the hospital stay by 7 days. Which therapeutic techniques should be used is also a cause for confusion. One study (De Gracia, C.G. 2001. Kirn, D.S., Luce, E.A. 1998) questions the utility of early excision in the first 4 days after the injury and concludes that it produces a higher mortality rate compared with spontaneous scar

separation and late skin grafting, although it was undertaken with elderly patients approaching 80 years old. That study also concludes that cultured epidermal autografts cause an increase in length of stay and therefore hospital costs.

Another interesting US study concluded that "routine cultures during the first 24 hours after admission to the hospital [are] not cost-effective"35(p300) and even estimated that their elimination could reduce the expenditures of that center by $14,000 a year. However, studies unanimously agree that burn patients should be administered antibiotics and that positive culture results show signs of clinical sepsis. (Gillespie, R., Carroll, W., Dimick, A.R., et al. 1987)

The highest costs in medication consumption classified by therapeutic groups were blood and hematopoietic and dermatological products. Other factors that may influence costs are the size of the burn center or the fact that the center may not be specialized in the treatment of burn patients.

Finally, another factor that strongly influences cost differences and in turn is the result of another series of factors is length of stay. In 1987, Gillespie et al [54] indicated that in the most advanced burn centers the mean length of stay per burn patient must not be more than 1 day per percentage of the TBSA. According to that study, this goal should be achieved by means of early aggressive surgical treatment, a suitable diet, physiotherapy and occupational therapies, nursing care, and psychological support. (Bezuhly, M., Gomez, M., Fish, J.S. 2001)

In our study, the mean length of stay was practically equal to 1% of the TBSA, although it was not equal in all the therapeutic options, especially when the treatment was undertaken with debridement plus grafting.

Hypothesis 1: Demographics variables (age, gender, marital status), type and severity of burn can influence LOS

Only the age can influence LOS. Severity of the burn (type, degree and TBSA) has a big influence on LOS. Hypothesis was verified

Hypothesis 2: Severity of burn (degree and the TBSA) has an effect of the MRU

Only TBSA have an effect on MRU. Hypothesis was verified

Hypothesis 3: Severity of burn (degree and TBSA) and type of burn can predict complications

Type of burn and TBSA can predict complications. Hypothesis was verified

Hypothesis 4: Demographics variables, treatment and severity can influence LOS and MRU

More LOS more MRU, there's a close relationship between them. TBSA have an impact on LOS and MRU. Therapeutic procedures fees influence LOS and surgery payment the MRU. Hypothesis was verified

Hypothesis 5: 1 or several independent variables that can affect simultaneously LOS, MRU and complications

Only TBSA affects simultaneously LOS, MRU and complications. Hypothesis was verified.

Part 2 Conclusion

Better and adequate care of the burned patients is the most effective way to improve the life of a patient after he had suffered from a burn injury. This concept is really important because it will reduce hospital complications; shorten LOS, decreases MRU and at the same time will have an impact by improving the quality of life and enhancing survival.

This study realized in a Taiwanese medical center showed a unique distribution that reflected the social, economic and cultural background of Taiwan. If the same study has been realize in other countries, what will be the resemblance and the differences with Taiwan? Will we be surprised by the results?

Part 3 Limitations

The few data related to burned patients for the five years can be explained by the subject medical center didn't have a lot of cases of burn injury from January 2005 to December 2010.The sample size of this study is reasonable (N=137) but may not fully respect the experience at other medical center in Taiwan. The sample size that had been using for this study is too small to say that it is the situation in all the Taiwanese hospital. The graph is showing the difference more in one side.

Most of the cases found were not severe in this study so the results cannot be generalized to all the population.

The study population corresponds to children and adult burned patients admitted only to a subject Taiwanese medical center. Taiwan has a unique health care system which is not similar to other countries. Despite this uniqueness, the result of this study can be used for burned patients from other populations by comparing patients with similar characteristics.

Language barrier: mandarin Chinese versus English.

Most of the recent articles were in mandarin Chinese and without some financial and human resources (employment of a translator), it was really difficult for the author do read those articles.

Part 4 Future research

It may be appropriate to conduct this similar study for burned patients from other countries with different health care systems than the Taiwanese system. In addition, further exploration of adding other independent variables such as mortality, smoke inhalation or multiple organ failure.

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