FACTORS PREDICTING LENGTH OF HOSPITAL STAY OF OLDER PATIENTS IN MEDICAL WARDS OF RAMATHIBODI HOSPITAL

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ABSTRACT

Length of hospital stay has been used as an indicator of the quality of care in the acute care setting. Prolonged length of hospital stay may result in patients' complications, a low rate of bed utilization, and high cost to both patients and the hospital. The aim of this descriptive correlational study was to investigate the relationship and the power of the selected patients' factors including age, functional ability, severity of illness, serum albumin level, acute confusional state, and the number of medications used to mutually predict length of hospital stay of older patients with medical problems in Ramathibodi Hospital. Purposive sampling was used to recruit 211 patients aged 60 years and older who were admitted in medical wards during May to August 2005. Data collection procedures were conducted after the approval of the Ethics Committee of Ramathibodi Hospital. The seven instruments used in the study were the record forms (demographic data, the number of medications used, serum albumin level, and length of hospital stay) and the assessment forms (Yamvong's Modified Barthel Activities of Daily Living Index, the Acute Physiologic and Chronic Health Evaluation II, and the Thai version of the Confusional Assessment Method). The data were analyzed using descriptive statistics, Spearman rank order correlation, and multiple regression with the Enter method.

The analysis revealed that the length of hospital stay ranged from 2 to 64 days with a mean of 10 days. Functional ability at admission and serum albumin level were significantly negatively correlated with length of hospital stay, whereas acute confusional state was significantly positively correlated with length of hospital stay. The findings indicated that a higher level of functional ability at admission and serum albumin level including no acute confusional state were correlated to a shorter length of hospital stay. However, age, severity of illness, and the number of medications used were not significantly correlated with the length of hospital stay. All variables could jointly explain 15% of the variance in length of hospital. Functional ability at admission emerged as the strongest predictor of length of hospital stay of medical older patients followed by acute confusional state.

The results suggest that to shorten the length of hospital stay of older patients, improvement of nutritional status before hospitalization, early ambulation to improve functional ability of older patients, and prevention of acute confusional state during hospitalization should be promoted.

KEY WORDS: FUNCTIONAL ABILITY/ ACUTE CONFUSIONAL STATE/ SERUM ALBUMIN LEVEL/ LENGTH OF HOSPITAL STAY/ MEDICAL OLDER PATIENTS

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ปัจจัยทำนายจำนวนวันนอนโรงพยาบาลของผู้ป่วยสูงอายุที่เข้ารับการรักษาในแผนกอายุรกรรมโรงพยาบาลรามาธิบดี (FACTORS PREDICTING LENGTH OF HOSPITAL STAY OF OLDER PATIENTS IN MEDICAL WARDS OF RAMATHIBODI HOSPITAL)

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บทคัดย่อ

จำนวนวันนอนโรงพยาบาลเป็นดัชนีชี้วัดคุณภาพทางการรักษาพยาบาลที่สำคัญตัวหนึ่ง เนื่องจากการพักรักษาตัวอยู่ในโรงพยาบาลนาน อาจส่งผลกระทบทางด้านลบต่อผู้ป่วยและโรงพยาบาล ทำให้เกิดปัญหาภาวะแทรกซ้อนเพิ่มขึ้น อัตราการหมุนเวียนเตียงต่ำ และเสียค่าใช้จ่ายมากขึ้น ดังนั้นการศึกษาเชิงบรรยายแบบศึกษาความสัมพันธ์ครั้งนี้ มีวัตถุประสงค์เพื่อศึกษาความสัมพันธ์และความสามารถของตัวแปรคัดสรร (อายุ ความสามารถในการทำหน้าที่ ความรุนแรงของความเจ็บป่วย ระดับอัลบูมินในเลือด ภาวะสับสนเฉียบพลัน และจำนวนชนิดของยาที่ใช้) ในการร่วมกันทำนายจำนวนวันนอนโรงพยาบาลของผู้ป่วยสูงอายุ กลุ่มตัวอย่างเป็นผู้ป่วยที่มีอายุ 60 ปีขึ้นไปที่เข้ารับการรักษาในแผนกอายุรกรรม โรงพยาบาลรามาธิบดี ระหว่างเดือนพฤษภาคมถึงเดือนสิงหาคม พ.ศ. 2548 จำนวน 211 ราย โดยเลือกกลุ่มตัวอย่างแบบเจาะจงตามคุณสมบัติที่กำหนด และยึดหลักการพิทักษ์สิทธิผู้เข้าร่วมวิจัย เก็บรวบรวมข้อมูลโดยใช้แบบบันทึกข้อมูลส่วนบุคคล จำนวนชนิดของยาที่ใช้ ค่าอัลบูมินในเลือด จำนวนวันนอนโรงพยาบาล และแบบประเมินความสามารถในการทำหน้าที่ ความรุนแรงของความเจ็บป่วย และภาวะสับสนเฉียบพลัน วิเคราะห์ข้อมูลโดยใช้สถิติบรรยาย สัมประสิทธิ์สหสัมพันธ์อันดับของสเปียร์แมน และการวิเคราะห์ถดถอยพหุแบบ Enter

ผลการศึกษาพบว่า ผู้ป่วยสูงอายุนอนโรงพยาบาลนาน 2 ถึง 64 วัน จำนวนวันนอนโรงพยาบาลเฉลี่ย 10 วัน ความสามารถในการทำหน้าที่ ณ แรกรับและระดับอัลบูมินในเลือด มีความสัมพันธ์ทางลบกับจำนวนวันนอนโรงพยาบาล ส่วนภาวะสับสนเฉียบพลันมีความสัมพันธ์ทางบวกกับจำนวนวันนอนโรงพยาบาล อย่างมีนัยสำคัญทางสถิติ แสดงว่าผู้ป่วยที่มีความสามารถในการทำหน้าที่ระดับสูง ณ แรกรับ ผู้ป่วยที่มีระดับอัลบูมินในเลือดอยู่ในเกณฑ์ปกติ และการไม่เกิดภาวะสับสนเฉียบพลันมีแนวโน้มที่จะมีจำนวนวันนอนโรงพยาบาลสั้น อย่างไรก็ตามอายุ ความรุนแรงของความเจ็บป่วย และจำนวนชนิดของยาที่ใช้ ไม่มีความสัมพันธ์กับจำนวนวันนอนโรงพยาบาลอย่างมีนัยสำคัญทางสถิติ แต่ตัวแปรทั้งหมดในการวิจัยครั้งนี้สามารถร่วมกันอธิบายความแปรปรวนของจำนวนวันนอนโรงพยาบาลได้ร้อยละ 15 โดยความสามารถในการทำหน้าที่อธิบายความแปรปรวนมากที่สุด รองลงมาคือภาวะสับสนเฉียบพลัน

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CHAPTER I
INTRODUCTION

Background and Rationale

Nowadays, the birth rate and death rate of Thai population have decreased. As a result, the population aged 60 and older has been increasing in number and proportion. The National Economic and Social Development Board (B. E. 2545) reported that the number of the old Thai people in 2020 will be approximately 10,780,000. Also, the proportion of the old Thai population, 7.36% in 1990, is expected to rise to 10.7% in 2010 and 15.28% in 2020 (Suthichai Jittapunkul, B. E. 2543a; Jitapunkul & Bunnag, 1998). Most of the aged population have chronic illness and disability (Suthichai Jittapunkul, B. E. 2543b). According to the survey by Naphaporn Chayowon and colleagues (B. E. 2535), it indicated that 28% of beds in all public hospitals within Thailand were used for admission of older patients. Therefore, it is clear that the aged population is expected to be a large group of healthcare service users and there will be a continuing increase in the number of this admission following the population change.

Illness in older people is always associated with aging changes in physical, mental, and social problems (Prakong Intarasombat, B. E. 2539). As a result, elder adults usually have the specific characteristics of health problems, which differ from other age groups such as decrease in the ability of body balance, decrease in immune function, no specific signs and symptoms of illness, quickly worse condition in case of delayed treatment (Ebersole & Besdine, 1992; Ham, 1992), and higher risk of complications rate such as infection, acute confusional state, and fall (Brady et al., 1993; Gross & Levine, 1993). Moreover, the older patients usually spend more time with rehabilitation to recovery (Talbot, 1994). For these reasons, some older patients are admitted to hospital more often and stayed longer than patients in younger age groups. Also, a small number of patients who stay in hospital for a long time

referred as "bed blockers" were sometimes in this group (Andrews & Brocklehurst, 1985).

Prolonged hospitalization has had some adverse effects on the patient's health and the hospital service providers. Especially, some older patients have more health problems caused by the effect of long-term hospitalization. According to Palmer (1995), 25% to 60% of older patients in hospital for an acute illness risk some loss of independent physical functioning. In addition, older patients are at increased risk of cognitive dysfunction, mood disorders, and malnutrition. These losses can lead to prolonged hospital stay and if there is a failure to restore independence prior to discharge, then patients are at increased risk of death, or placement in a nursing home (Palmer & Bolla, 1997; Palmer, Landefeld, Kresevic, & Kowal, 1994; Potts, Feinglass, Lefevere, Kadah, Branson, & Webster, 1993; Rudberg, Sager, & Zhang, 1996). For the other detrimental effect of long-stay patients, there are inadequate beds for other patients in need of admission because some patients are not well-recovered enough to discharge from hospital earlier. This phenomenon causes patients and hospitals to spend too much cost for the prolonged length of hospital stay. This makes health care providers take much effort to effectively provide healthcare resources. Therefore, a reduction in length of hospital stay is important for the quality and standard of nursing care.

The surveys and studies in the United States found that the length of hospital stay is different in each state. It depends on the severity of illness, medical treatment, and the government policy to provide cost in each admission (Mark & Chassin, 1983). The different points of these issues bring about the research studies that have been done on the topic " Factors related to length of hospital stay in the United States." From these studies, there are many factors in relation to prolonged hospitalization such as age (Maguire, Taylor, & Stout, 1986), gender (Pearson et al., 1992), economy (Epstein et al., 1988), disease and severity of illness (Pompei, Charlson, Ayles, Mackenzie, & Norton, 1991), functional ability (Winograd et al., 1991), acute confusional state during admission (Lusis, Hydo, & Clark, 1993), relative or social support (Shapiro et al., 1980 as cited in Jackson, 1989) and insufficient medical service system (Jackson, 1989).

In Thailand, the length of hospital stay, one of nursing outcome indicators, has been used in some nursing studies such as the experimental research about development of nursing care system like patients' and families' participation based on the concept of Orem's self-care theory (Suwanee Mahakayanun, B. E. 2538; Chavalee Yamvong, B. E. 2538). According to some parts of their studies, nursing care system results in a reduction in the mean length of stay of older patients. In addition, there was a descriptive study published in Thai journals regarding the outcome between patients' factors such as acute confusional state and length of hospital stay (Busara Oearsakul, B. E. 2545). This study revealed that patients with acute confusional state stayed in a hospital longer than patients without acute confusional state.

Increase in patient's length of hospital stay can lead to negative health impact including higher health-care costs. To shorten the length of hospital stay, the studies regarding factors related to length of stay in the literature has been developed in terms of predictive research design. In Thailand, the literature about factors predicting length of hospital stay has not been found. In a different health care delivery system, factors influencing length of hospital stay might be less generalizable. Therefore, there are not enough knowledge to understand what influencing factors are used to predict the length of hospital stay in Thai older patients. This study aims to fill this gap by choosing the independent variables shown in the literature. The reason for the specific selection of these variables is that most of them can be modified for health promotion programs.

This study used only one hospital as a case study because factors predicting length of hospital stay in each place are context-bound that might be different from place to place in several factors. Furthermore, this study aimed at focusing only patients'factors. To control the variation of the service system, the data collection was conducted in one hospital. In this study, Ramathibodi Hospital was chosen for the data collection. Ramathibodi Hospital is a university and tertiary care hospital that the number of the hospitalized older patients has been increasing from 16% in 1984 to 28% in 2003 (Ramathibodi Statistics, B. E. 2547). Most of this population were admitted with chronic health problems, acute exacerbation on top chronic illness, and had complicated health problems in many organic systems. These incidences had caused some older patients to stay in a hospital for several days. The top five principal

diseases were ischemic heart disease (7%), cerebral infarction (4.3%), chronic obstructive pulmonary disease (3.6%), septicemia (3.3%), and acute myocardial infarction (3.2%). Most of them had underlying diseases of hypertension (40.5%), diabetes mellitus (14%), chronic obstructive pulmonary disease (3.4%), respiratory tuberculosis (2.7%), and chronic renal failure (2.1%). According to the statistics of Ramathibodi Hospital in 2004, medical older patients were hospitalized about 12 days at average. Twelve percent of medical older patients were admitted in the hospital longer than mean length of hospital stay (= 12 days) at that time (Ramathibodi Statistics, B. E. 2547). Patients with septicemia stayed the longest in the hospital (mean length of hospital stay = 16 days). This is an interesting point to clarify what patient's characteristics including age, functional ability, severity of illness, serum albumin level, acute confusional state, and the number of medications used associated with the length of hospital stay. Also, this study would determine whether these selected factors could predict the length of hospital stay of older patients in medical wards of Ramathibodi Hospital. The result of this study may be useful to guide health-promoting interventions to shorten length of hospital stay of medical older patients.

Conceptual Framework

The conceptual framework of this study is synthesized from a literature review related to theoretical knowledge of aging and factors related to length of hospital stay. The literature is a guide for the variable selection as a factor to predict length of hospital stay of older patients in medical wards of Ramathibodi Hospital.

Factors related to length of hospital stay in each place are different because they are context-bound. The literature indicated that there are many factors related to prolonged lengths of hospital stay, for example, demographic factors such as age (Maguire et al., 1986; Narain, Rubinstein, & Weiland, 1988), and gender (Dunstan, Amar, Watt, & Seymour, 1996); aspects of diagnosis such as co-morbidity (Bertozzi, Barbisoni, Franzoni, Rozzini, Frisoni, & Trabucchi, 1996; Di Iorio et al., 1999), poly-pharmacy (Narain et al., 1988), and diagnosis or presenting illness (Dunstan et al., 1996; Findlay, Gibbons, Primrose, & Seymour, 2000; Maguire et al., 1986; Narain et al., 1988; Perlado, Midon, & Mesa, 1999); illness severity (Di Iorio et al., 1999);

nutrition (Bertozzi et al., 1996); cognition (Bertozzi et al., 1996; Di Iorio et al., 1999; Dunstan et al., 1996; Findlay et al., 2000; Maguire et al., 1986; Narain et al., 1988; Perlado et al., 1999); function (Alarcon, Barcena, Gonzalez-Montalvo, Penalosa, & Salgado, 1999; Bertozzi et al., 1996; Di Iorio et al., 1998; Di Iorio et al., 1999; Dunstan et al., 1996; Findlay et al., 2000; Perlado et al., 1999; Rock et al., 1996) and system such as nurses'discharge planning (Cable & Mayers, 1988), delays in hospital procedures (Zimmer, 1974), the number of physicians affiliated with the hospital and the number of beds in the hospital (Devine & Cook, 1983; Mumford, Schlesinger, & Glass, 1982).

This study focused only on patients' factors and was designed to conduct in one hospital, thus, a service system was not included as a predictive variable because it was provided with the same criteria in the hospital. In this study, age, functional ability, severity of illness, serum albumin level, acute confusional state, and the number of medications used were selected to predict the length of hospital stay because of two reasons. First, most of the selected variable can be modified for health promotion for older adults. Second, some factors affecting length of hospital stay were related to one another such as co-morbidity and severity of illness. Therefore, there were some tools included co-morbidity into the severity of illness assessment. To untangle these effects, only six factors were selected from other variables to determine which factors have greater impact on length of hospital stay. The rationales for using each variable related to the length of hospital stay are described as follows.

Age

It is difficult to identify when the process of getting older starts. However, age is the period of time that a person has been alive. It may be reflecting on aging process. This aging process tends to affect health status. When human beings become old, both body structure and capability will gradually deteriorate (Timiras & Hudson, 1993). These changes are just sufficient to normal status living, but not enough during illness. As a result, aging people, especially very old ones, are commonly vulnerable to have complications and require longer periods for recovery. Therefore, there is a tendency for the aged to stay for a long time in a hospital. Although age is an unchanged variable, it provides us understanding in planning management for older patients.

Functional Ability

Functional ability can be a useful indicator of health status and well-being in older persons because it is a combination with physiological, psychological, and social functions (Prakong Intarasombat, B. E. 2539). When functional abilities suddenly deteriorate, it means that older persons have some health problems. Hamilton and Lyon (1995) found that 75% of older patients admitted in the hospital became dependent on others in performing activities of daily living, resulting from illness. Factors related to functional decline include injuries, acute illness, side effects of medication, depression, malnutrition, a decrease in energy and ability of physical and mental activities, self-care deficit, decreased mobility, the use of physical restraints, iatrogenic complications, and a reduction in adaptation to hospital environments (Creditor, 1993). Moreover, according to the studies, authors (Narain et al., 1988; Reiley & Howard, 1995; Rubenstein et al., 1984) found that functional ability was negatively related to length of hospital stay. They explained that the patients with functional dependence usually stay in hospital longer than those with independence. Thus, these studies support that functional ability might influence older patients' health and time spent in hospitalization.

Severity of Illness

Older patients with severe illness usually have complications from diseases and treatments because of the aging process and a specific characteristic of illness (Isaacs, 1964). First, the aged patients usually have reactions with diseases and treatments. For example, the side effect of drugs sometimes is not shown and it can induce the older patient more sickness. Second, older patients usually have chronic illness. It causes the older patients to be admitted with acute illness or exacerbation in chronic disease with more than one health problem. Some patients with a high degree of a severity of illness need several interventions and invasive treatments, which need a period of time to recover. Therefore, patients with a high degree of a severity of illness need to spend more time for hospitalization. Maguire et al. (1986) and Pompei et al. (1991) found that the mean of length of hospital stay of older patients is high following the degree of a severity of illness.

Serum Albumin Level

Albumin has an effect on the strength of human's body (Rudman & Cohan, 1992). Serum albumin is synthesized in the liver. Basically, it is synthesized during periods of adequate nutrition but its synthesis is curtailed during periods of inadequate nutrition (Rothschild, 1988). When human's body has a low level of albumin, it is called hypoalbuminemia. It occurs when the body is stimulated by endotoxin to secrete Tumor Necrosis Factor (TNF), Interleukin-1 (IL-1), and Interleukin-6 (IL-6) to inhibit liver to reduce albumin production (Li, Li, & Gu, 1997). Hypoalbuminemia occurs in a variety of disease states such as malnutrition, severe hepatic dysfunction, acute infection, malignancy, renal disease, and burns (Sacher & McPherson, 1991). In addition, it is associated with an increased rate of complications during hospitalization such as low immune function, which increases the opportunity of infection rate in human body (Anderson & Wochos, 1982; Anderson, Moxness, Meister, & Burritt, 1984). In addition, there are several drugs to be free in plasma, when serum albumin level is low. The effect of free medical substances will be strong and harmful to patients especially the older patients (Carruthers, 1986). Some studies showed that patients with hypoalbuminemia have a high tendency of death rate and prolonged hospitalization (Anderson et al., 1985; Burness, Horne, & Purdi, 1996; Giner et al., 1996; Herrmann et al., 1992).

Acute Confusional State

Acute confusional state or delirium is a transient organic brain syndrome of acute onset characterized by the occurrence of disordered attention and changes in cognition, memory, orientation, perception, psychomotor behavior, and the sleep-wake cycle (Pompei et al., 1994). Acute confusional state is not difficult to diagnose if the patients have signs and symptoms clearly such as change into aggressive or drowsy behaviors and alteration of communication. In contrast, the patients with unclear signs and symptoms of delirium usually become the problem because doctors and nurses may delay an initial diagnosis and a particular treatment. The associated problems of the patients with delirium are severe sickness, functional deterioration (Francis & Kapoor, 1992; Francis, 1997), high risk of complication (Eden & Foreman, 1996; Kelley, 1996) and prolonged hospitalization (Busara Oearsakul, B. E. 2545).

Therefore, a contributing factor of prolonged hospitalization may be an acute confusional state.

The Number of Medications Used

Older people often have more than one chronic illness, which results in multiple medications use. Moreover, the physiologic process of aging makes older patients more susceptible to adverse outcomes with medications, especially in advanced age, resulting in functional dependence (Jitapunkul, Lertkupinit, Jongsitimahakul, & Suteparuk, 1997). Therefore, multiple drug therapy can lead to increasing risks of adverse drug reactions, drug-drug interactions, and drug-disease interactions. These are sometime major causes of hospital admission (Williamson & Chopin, 1980). Patients who use multiple drugs before admission may reflect the number of health problems or complications from their diseases leading to the higher risk of severe illness or death (Castleden & Pickles, 1988). Especially, older patients with adverse drug reactions tend to prolong hospitalization (Hurwitz, 1969). Therefore, this study included the number of medications used before admission as a predictive variable of length of hospital stay of older patients.

In this study, patients' factors chosen to predict the length of hospital stay in Ramathibodi Hospital include age, functional ability, severity of illness, serum albumin level, acute confusional state, and the number of medications used. The relationship among these factors is shown in Figure 1.

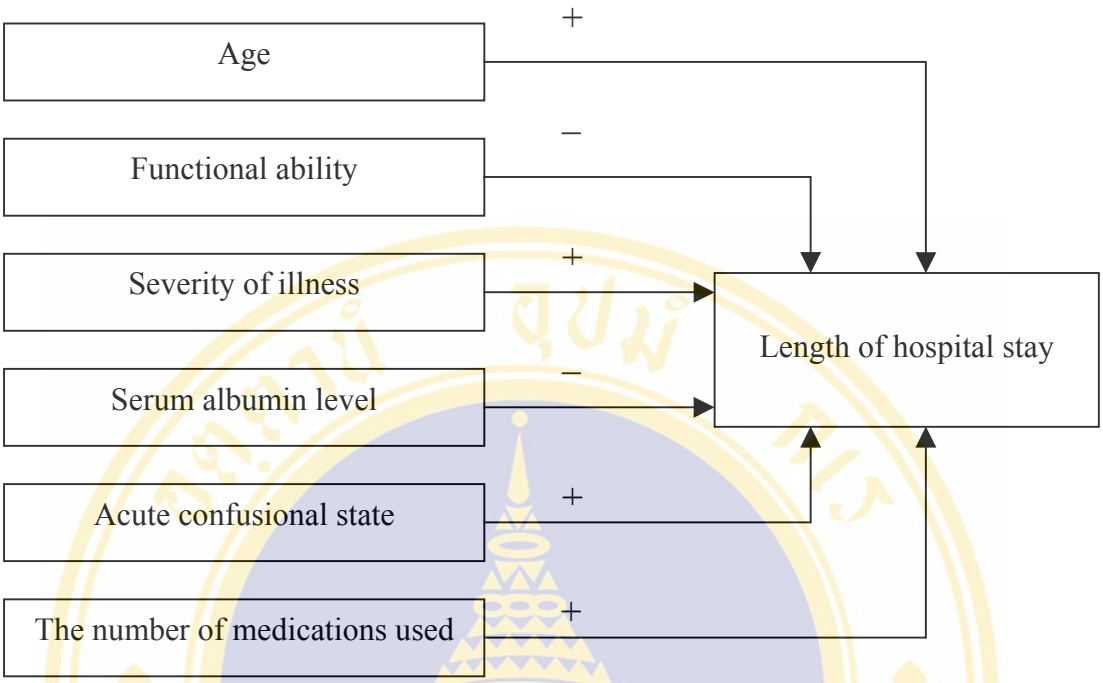


Figure 1 Conceptual framework of factors predicting length of hospital stay of older patients

Objectives of the Study

1. To examine the relationship of age, functional ability, severity of illness, serum albumin level, acute confusional state, and the number of medications used to length of hospital stay of older patients.

2. To determine whether the selected factors (age, functional ability, severity of illness, serum albumin level, acute confusional state, and the number of medications used) could mutually predict the length of hospital stay of older patients.

Research Hypotheses

1. There is a positive association of age, severity of illness, acute confusional state, and the number of medications used with the length of hospital stay of older patients.

2. There is a negative association of functional ability and serum albumin level with the length of hospital stay of older patients.

3. Selected factors (age, functional ability, severity of illness, serum albumin level, acute confusional state, and the number of medications used) can mutually predict the length of hospital stay of older patients.

Scope of the Study

This study aimed to determine whether the selected variables (age, functional ability, severity of illness, serum albumin level, acute confusional state, and the number of medications used) could predict the length of hospital stay of older patients admitted in six medical wards: three general medical wards, one intermediate ward, and two critical care units at Ramathibodi Hospital, Bangkok, Thailand, from May to August 2005.

Significance of the Study

Prolonged length of hospital stay can lead to high cost of care, functional decline, and possible complications (Lamont, Sampson, Matthias, & Kane, 1983). In order to shorten the length of hospital stay, its predictive factors should be identified. The findings of this study may provide health care providers to develop intervention programs that aim at reducing the length of hospital stay. For example, there should be intervention programs for maintenance of functional ability or prevention of functional decline during hospitalization, promotion of nutritional status of older patients before admission, prevention and precaution of any complications associated with hospitalization e.g., acute confusion. In addition, the length of hospital stay has been used as an indicator of organization-focused outcomes (Jennings, Staggers, & Brosch, 1999), thus, the administrator may use this finding as basic information to improve the quality of care.

Definition of Variables

Length of hospital stay is defined as the number of days that an older patient stays in the hospital counting from the day of admission to the day of discharge from the hospital. Counting the length of hospital stay is based on the graphic sheet in the medical record.

Age is defined as the full-year age of an older patient.

Functional ability is defined as the levels of abilities of an older patient to perform basic activities of daily living as follows: eating, bathing, grooming, dressing, bowel control, bladder control, toilet use, transferring, and mobility (Chavalee Yamvong, B. E. 2538). In this study, the functional abilities were measured by Yamvong's Modified Barthel Activities of Daily Living Index, which was translated and adjusted from the Barthel ADL Index developed by Mahony and Barthel (1965). The possible score ranges from 0 to 36. The higher score refers to greater independence. In this study, functional ability on admission was used to predict the length of hospital stay.

Severity of illness is defined as the severity of disease of an older patient that can be measured by quantifying the degree of abnormality of multiple physiologic variables. The score is based upon initial values of 12 physiologic measurements (temperature, mean arterial pressure, heart rate, respiratory rate, oxygenation, arterial pH, serum sodium (Na^+), serum potassium (K^+), serum creatinine, hematocrit, white blood cell, and the Glasgow-coma score) and previous health status to provide a general measure of the severity of disease (Knaus et al., 1985). In this study, the severity of illness was measured by using the Acute Physiology and Chronic Health Evaluation II (APACHE II), which was developed by Knaus and colleagues (1985). The possible score ranges from 0 to 65, with higher scores indicating the high degree of severity of illness. Severity of illness in this study was measured on admission.

Serum albumin level refers to serum albumin level of an older patient measured by laboratory of Ramathibodi Hospital using an automated application of the Bromcresol Green Dye method. Serum albumin level used in this study was measured in the first week of hospitalization. If there were several values of serum albumin level

in the first week, the first value was used to predict the length of hospital stay. The normal range of serum albumin level is 42-52 g/l (Emma, Stacey, & George, 1995).

Acute confusional state is defined as transient organic brain syndrome of acute onset characterized by the occurrence of disordered attention and changes in cognition, orientation, perception, psychomotor behavior, and the sleep-wake cycle (Pompei et al., 1994). In this study, acute confusional state was measured by the Thai Version of the Confusional Assessment Method originally developed by Inouye and colleagues (1990). It was then translated into Thai by Prakong Intarasombat (B. E. 2547) for clinical use to determine whether the acute confusional state develops in an older patient or not. Then, the researcher adjusted its language for this study. In this study, acute confusional state in the first week of hospitalization was used to predict the length of hospital stay. The score of 0 refers to absence of acute confusion and 1 refers to presence of acute confusion.

The number of medications used refers to the number of types of all medications prescribed by a physician that an older adult used regularly during the period of one month before admission.

CHAPTER II
LITERATURE REVIEW

This study aimed to examine the power of the selected variables that could predict length of hospital stay of medical older patients in Ramathibodi Hospital. Corresponding to the purpose of this study, the literature is reviewed in this chapter including four aspects:

1. Concept of aging
2. Health status changes and common health problems in older adults
3. Length of hospital stay
4. Literature regarding patients' factors related to length of hospital stay

Concept of Aging

The elderly is a group of persons having lived for many years. Getting older is the continuously changing process of life that is inevitable. The physical and mental changes cause this age group different from other age groups. With these changes, people usually have different attitudes towards them. People with negative feeling will think that the aging process causes a person to have a gradually continuing deterioration in many parts of structure and organic systems function. On the contrary, people with a positive idea view that the process of getting older helps older people to be more mature with knowledge and intelligence from their experienced life. Perhaps, it is difficult to identify when the deterioration of human body starts because a person's body deterioration depends on molecules, cells, tissues, organs, persons and population groups. Some societies respect seniority following a role or qualification in society. In western countries, the age of 65 is used as aging because people in those countries live a long life and can generally work well (Schrier, 1990). However, older Thai people tend to be referred as persons at the age of 60, following the retirement criteria (Peerasit Kumnounsilp et al., B. E. 2523). Nevertheless, it is clearly seen that

each person of the old age group is different in physical and functional ability. Therefore, the aged is divided into three small groups: young-old aged 60-74 years, middle-old aged 75-84 years, and old-old aged 85 years and over. Considering separation of the elderly into groups, it is clearly seen that each small group is different in the number and a health care service requirement (Schrier, 1990).

Health Status Changes and Common Health Problems in Older adults

Health status changes in the elderly consist of normal aging changes and illness changes, which are described below.

Normal Aging Changes in Older Adults

Aging is natural process of gradually continuous changes in all-living organisms. When impairment of several organs occurs, older people are vulnerable, have more complications, and usually require longer periods for recovery. These changes are different in each person depending on genetics, alternative lifestyle, personality, society, environment, socioeconomic factors, stress and illnesses through each life (Tagliareni & Water, 1995; Talbot, 1994). Therefore, there are very different changes in the old age group. At the same age, some are healthy, physically independent, and physically fit, whereas, others are unhealthy, disabled, and physically dependent. The facts regarding the aging process are concluded below (Tagliareni & Water, 1995).

1. The older adults from the same group are rather different than similar.
2. Aging changes have differently occurred in each person.
3. Getting older is not a disease or pathology.
4. Getting older usually causes both positive and negative responses.
5. Most of older adults are adaptable to getting older.

The normal aging process including physiological, psychological, and social changes (Eliopoulos, 1993; Timiras & Hudson, 1993) is described as follows:

1. Physiological changes. Organ and system changes can be traced from changes at the basic celled level. When human body deteriorates, it will show the signs of getting older such as gray hair, hunchback, wrinkled skin, forgetfulness, decrease in metabolic rate and so on. Changes in the structure of organs and tissues do not affect some functions until aged 80 to 90 years such as maintaining blood sugar level in plasma and balancing of acid-base in a human body. However, some human body functions in the old age group do not work as good as the young age group such as a musculoskeletal system, a integumentary system, a neurological system, a cardiovascular system, a respiratory system, gastrointestinal system, genitourinary system, and endocrine system.

Many older people have a degree of muscle weakness particularly in the lower limb because muscle fibers atrophy and decrease in number and fibrous tissue gradually replace muscle tissue. Overall muscle mass, muscle strength, and muscle movements are decreased. Therefore, it has significant effects on stability and walking. Also, the changes run an important risk for falls and fractures in older persons.

Older adults' skin becomes irritated and breaks down more easily because the skin becomes less elastic, loses subcutaneous fat, drier, and more fragile which cause a pressure sore problem and risk to infection especially a bedridden elderly.

With advanced age, there is a reduction in nerve cells, cerebral blood flow, and metabolism. The nerve conduction velocity is lower. These changes are manifested by slower reflex and delayed response to multiple stimuli. Moreover, the sense of vision, hearing, smell, taste, and tactile sensation become less efficient, interfering in varying degrees of safety, normal activities of daily life, and general well-being.

Heart is less functional pursuit to advanced age. Heart muscle loses its efficiency and contractile strength, resulting in reduced cardiac output. Heart valves become thick and rigid as a result of sclerosis and fibrosis, compounding the dysfunction associated with any cardiac disease that may be presented. The vessels lose their elasticity and accumulate calcium deposits, which cause a narrowing of their lumen size. The increased rigidity of vessel walls and their narrow lumen cause more force to pump blood through the vessels; that is, systolic and diastolic pressures are

risen. These changes are possibly progressive of heart failure in older adults, when they face with the situations cause their heart to work harder. However, the older adults' heart rate and the stroke volume may not increase to compensate for this situation as high as the younger age's.

A variety of structural changes in the chest reduces respiratory activities. The calcification of costal cartilage makes the rib cage more rigid; the anterior-posterior chest diameter increases and is often demonstrated by kyphosis; the thoracic inspiratory and expiratory muscles are weaker. Alveoli are reduced in number and stretched due to a loss of elasticity. These changes cause less lung expansion, insufficient basilar inflation, and decreased ability to expel foreign or accumulated matter. The lungs exhale less effectively. Thereby, there is an increase in a residual volume. As residual volume increases, vital capacity and a maximum breathing capacity are reduced. With less effective gas exchange and reduced cough response, older adults are at a high risk of developing respiratory infections.

Teeth are in poor conditions: having flatter surfaces, stains, and varying degrees of erosion and abrasion of the crown and root structure. Taste sensations are less and due to an atrophy of the taste buds. Salivary ptyalin is decreased, which interferes with the breakdown of starches. Esophageal motility is decreased and the esophagus tends to become slightly dilated. Esophageal emptying is slow, causing discomfort as food remains in the esophagus for a longer time. Relaxation of the lower esophageal sphincter may occur. When combined with the weakness of gag reflex and delayed esophageal emptying of the elderly, aspiration is a major risk. The stomach tends to have less mobility and decreased amounts of hydrochloric acid, pepsin, lipase, and pancreatic enzyme production, which lead to indigestion problems in older adults. Constipation is another problem promoted by decreased colonic peristalsis. Moreover, the liver becomes smaller with advanced age and consequently has less storage capacity. In addition, the incidence of gallstones increases due to less efficient cholesterol stabilization and absorption.

The renal mass becomes smaller, which is attributable to the loss of nephron units. There is an approximate of 50% decrease in renal blood flow and the glomerular filtration rate between the ages of 20 and 90. Tubular function and reabsorption of glucose from the filtrate decreased causing a weakening of the bladder

muscles and a decreased bladder capacity. Emptying of the bladder is more difficult. Retention of large volumes of urine may result in frequent urination, urgency, and nocturia. Prostatic enlargement is presented in most elderly men, which causes problems with urinary frequency. The female genitalia demonstrates many changes with age, including atrophy of the vulva, cervix, uterus, ovaries, etc. The vaginal environment is more alkaline in older females, accompanied by a change in the type of flora and reduction in secretion. Urinary tract infection occurs from these changes in older adults.

The pituitary gland decreases in cell mass and weight because of atrophy, fibrosis, and decreased vascularity. There are alterations of hormone secretion. The thyroid gland becomes fibrosis, cellular infiltration, and increased nodularity. The result of decreased thyroid gland activity causes a lower basal metabolic rate. The secretion of glucocorticoids, progesterone, androgen, and estrogen is also reduced by an influence of the adrenal gland. The pancreas has delayed and insufficiently released of insulin by the beta cells, which is believed to cause decreased sensitivity of insulin circulation. Therefore, the ability of older adults to metabolize glucose is reduce. It is not unusual to detect higher blood glucose levels in non-diabetic older persons.

2. Psychological changes. During the aging process, psychological changes are related to physical and social changes such as general health status, genetic factors, educational achievement, and community activity. The common psychological changes in the elderly include personality, memory, intelligence, learning ability, and attention span.

Personality is the basic psychological characteristics resulting in diversity in psychological status in advanced age because it will remain with the elders throughout their life. Changes in personality traits may occur in response to events that alter self-attitude such as retirement, death of spouse, loss of independence, income reduction, and disability. Certain personality type of older adults may be changed. However, morale, attitude, and self-esteem tend to be stable throughout the life span.

Retrieving of information from long-term memory can be slowed if the information is not daily used or regularly needed. Healthy older women have been found to have a greater ability to recall nouns presented in a list than their male counterparts. Some age-related forgetfulness can be improved by the use of memory

aids such as making notes or lists, associating a name with an image, and placing objects in fixed locations.

The basic intelligence is maintained. The abilities for verbal comprehension and arithmetic operations are unchanged. There are two types of ability to postulation: crystallized intelligence and fluid intelligence (Meier-Ruge, 1987). Crystallized intelligence, which arises from the dominant hemisphere of the brain, is the ability to judge based on experience in order to solve problems, which is maintained through the adult years. This form of intelligence enables the individual to use past learning and experiences for problem-solving. The other ability, fluid intelligence, is directly related to function of the nervous system and relative freedom of education and experience, emanating from the non-dominant hemisphere. It controls emotions, retention of nonintellectual information, spatial perceptions, creative capacities, and aesthetic appreciation. This is believed to decline in older age.

Factors interfering with the older person's ability to learn include motivation, perceptual deficits, attention span, delayed transmission of information to the brain, and illness. Older persons may display less readiness to learn, which depends on previous experience in problem-solving rather than finding new problem-solving techniques. Older adults demonstrate a decrease in the ability to retain attention longer than 45 minutes. They are more easily distracted by irrelevant information, stimuli and less able to perform tasks that are complicated or require simultaneous performance.

3. Sociological changes. When older adults get older, they usually have sociological changes. The present changes in society affect the older adults such as the change in social status, being abandoned, and lack of self-confidence (Surakul Jenobrom, B. E. 2534).

First, the physical deterioration causes the older adults to change their role from family leaders to dependent members. The loss of their power and role makes them feel unimportant and being a burden to others.

Second, the social change from the agricultural to industrial society has created the migration of labor force to urban areas and also the abandonment of the older adults in their hometown. The trend of becoming nuclear families together with the economic crisis causes families unable to afford taking care of the older adults.

Third, most older adults were found to lack self-confidence because they felt unvalued and unrespected after retirement.

Health Status Changes from Illnesses

Health status changes of older adults have an important effects on physical disability which leads to less functional ability and functional roles including a process of a well-balanced body and a responsive process of stress-related illness. Therefore, illnesses in older adults are specific characteristics and different from other age groups that they are described below (Ebersole & Besdine, 1992; Ham, 1992).

1. Older adults usually have at least one chronic illness. It was found that 80% of people aged 65 or older had one chronic disease and 50-70% had more than two (Miller, 1995; Walker, 1997). As a result, most of the older patients are admitted with acute illness or acute exacerbation on top chronic diseases. The common chronic diseases in older adults include arthritis, hypertension, cardiovascular disease, and hearing or vision impairments (Krach, DeVaney, DeTurk, & Zink, 1996).

2. Illness with multipathology tends to occur in older adult by having chronic disease combined with changes from aging process. This characteristic makes illnesses in older adults severe by interreaction between disease and disease, disease and age, and disease and treatment. For example, as an illness progresses, the older adult is incontinent from urinary tract infection but this problem leaves untreated because it is understood as elderly nature.

3. Patients with chronic illness have to take usual medications to control their diseases. Multipathology in chronic diseases causes patients to receive multiple drugs. Multiple medications use is common among the elderly, and there is at risk of drug interactions and adverse drug reactions (Jitapunkul, Lertkupinit, Jongsitimahakul, & Suteparuk, 1997).

4. Older patients are affected by treatments easily. Drugs are the first one and other effects are hazards from hospitalization and procedures of treatment. For example, there are developing delirium, falling, and nausea from changing a new environment, or occurring complications of nosocromial infection, pressure sore, stiffness of joints, faecal impaction, and muscular dystrophy from limited body movement (Creditor, 1993).

5. An illness in older adults is usually atypical presentation. That is not apparent signs and symptoms of diseases as same as other age groups. For instance, specific characteristics of diseases are not suddenly present themselves or not occur. Sometimes it seems to get a minor ill or the specific signs of clinical appearances become different from an actually medical condition such as having peritonitis without fever or abdominal pain, which in turn, presenting with tachypnea, pneumonia, confusion, or incontinence (Burston & Moore-Smith, 1979). Another example, patients have an ischemic heart disease with no chest pain or diseases progressed to congestive heart failure without dyspnea, breath form tiredness, and cough (Pathy, 1967). These changes usually occur to older adults because aging changes in a nervous system cause them to decrease perception of physical senses.

6. Illnesses in the elderly are related to functional decline (Creditor, 1993). It means that an older adult's reserved energy to recover from an illness is decreased. With this reason, it increases the risk of death, especially older adults with impairment of cognition, mobilization, urinary, and bowel control before admission. Also, functional ability is deteriorated by treatments such as receiving sedative drugs or restrained to limit activity. In addition, older adults can become dependent because of unfamiliar environment.

7. When older adults suffer from an acute illness, they usually spend more time in hospitalization because they are potential for complications, delayed and uncompleted recovery.

8. Sometimes older patients receive delayed treatment because they are misunderstood between the nature of the aged and signs of an acute illness. Abnormal signs are neglected from both patients and their families. Also, fear of older patients to become burden of other persons and to stay in a hospital is the reasons of this problem.

In summary, illnesses in older people have specific characteristics and are different from other age groups. It is complex in every stage beginning with diagnosis, treatment, and recovery.

Common Health Problems in Older Adults

Diseases are the cause of death in older adults per year more than other reasons. The common health problems in older adults are described below (Schrier, 1990; Timiras & Hudson, 1993).

1. Brain syndrome is divided in two groups: acute brain syndrome and chronic brain syndrome.

Acute brain syndrome occurs under pressure of mental status, emotion, and society, for instance, a feeling of being excited or confused. Physical status is another cause of this problem such as congestive heart failure, infection, hypokalemia, and dehydration. Acute brain syndrome is treatable with effective treatments.

Chronic brain syndrome is developed by the blood vessels that supply the blood to the brain getting stenosis or be blocked to become brain infarction. Patients with chronic brain syndrome sometimes become dependent and need a constantly good care because they are risky to get more complications such as pressure sore, aspiration pneumonia, urinary tract infection, and feelings of depression.

2. Heart and blood vessel diseases are the important cause of deaths in developed countries. In developing countries, deaths with these causes become large in amounts and also expected to be the important cause of deaths in the future. Common diseases are atherosclerosis, coronary heart disease, cerebrovascular accident, and hypertension. Heart and blood vessel diseases are related to lifestyle especially modernistic lifestyle. Adjustment of lifestyle can reduce death rates from these diseases such as stopping smoking and alcohol drinking, avoiding high cholesterol food, and taking more exercise.

3. Abnormal gastrointestinal system is usually found in older adults with impairment of physical status and inappropriate health behavior. The poor condition of teeth, less taste and smell sensation, and ineffective digestion and absorption are partly classical causes of discomfort symptoms or diseases such as flatulence, constipation, diarrhea, relaxation of the lower esophageal sphincter, esophageal reflux, gastritis, diverticulosis, peptic ulcer, and cancer.

4. Bone and joint diseases are important health problems, which usually occur in the elderly. Common bone and joint diseases are degenerative joint disease, osteoporosis, spondylosis, rheumatoid arthritis, and gout. These clinical entities may

result from natural degeneration combined with inappropriate health behavior such as consumption of food with less calcium and vitamin D, inadequate exercise, and excess body weight. Furthermore, these patients may not receive appropriate treatment early in the course of disease or even do not have regular follow up.

5. Genitourinary system is commonly problematic in older adults. Older men may be unable to urinate because of the enlarged prostate gland while women may be incontinent because of weakness of bladder muscle and urethral sphincter.

6. Endocrine system tends to secret less hormone in advanced age. This change affects physical and mental status. For instance, decreased insulin secretion may lead to diabetes mellitus and a reduction in sex hormone, thyroid hormone, and parathyroid hormone may lead to osteoporosis.

7. Sense organs that usually have problems in older adults are eyes and ears. They become abnormal because of degenerative changes or complications of chronic illnesses such as diabetes mellitus, hypertension, or adverse effects of drugs. Cataract, glaucoma, presbyopia, dry eyes, and macular disorder are common eye problems. Regarding ear problems, hearing loss is mostly caused by accumulation of cerumen in the middle ear or occurs as a result of aging or drugs.

Moreover, there are other problems such as integumentary system, respiratory system, and so on. These problems may lead to limitation of physical activities among older adults. They can also affect emotion, mind, and life satisfaction. Therefore, specific health problems of older adults, combined with aging changes and illnesses, may affect the length of hospital stay because these characteristics are difficult to diagnose, treat, and recover.

Length of Hospital Stay

Length of hospital stay is the duration that patients are admitted to a hospital, counting from the day of admission to the day of discharge from the hospital. Length of hospital stay is an indicator of nursing outcome that is used to measure quality of service system in an organization and cost effectiveness in patient's expenses of medical treatment per each admission (Sleet et al., 1991).

Prolonged hospital stay has negative effects to patients in that it may increase risk of developing complications. The study of Palmer (1995) showed that 25-60% of older patients admitted with an acute illness were at risk of having functional ability deterioration, cognitive impairment, emotional disorder, and malnutrition. Furthermore, they will have a higher chance of death. Some patients may be referred to a nursing home if these problems are not cured. (Palmer & Bolla, 1997; Palmer et al., 1994; Rudberg, Sager, & Zhang, 1996). Prolonged hospitalization may directly result in a low rate of bed utilization and high cost of treatment for both patients and the hospital (Potts et al., 1993).

It is good when patients are quickly discharged from a hospital with a good health condition. In fact, it is difficult to discharge every patients quickly because of mass factors such as diagnosis of the disease, severity of illness, service and stages of treatment (Sleet et al., 1991), functional status, cognitive function, nutritional status, comorbidity, polypharmacy, and age (Susan et al., 2004). However, quickly discharging patients from the hospital is desirable whenever their health status allows a physician to do so.

Reducing length of hospital stay is good for patients and the health care service system. One way to reduce length of hospital stay is having a good health service system both effective treatment and speedy recovery in a short time. For example, the study of Marchettc and Holloman (1986) revealed that discharge planning could be contributed to increases and decreases in length of hospital stay in the community hospitals. Another way, the relationship between patient variables and length of hospital stay should be determined. This knowledge is a useful guideline for health care providers to improve their health care management. For example, if they know what factors associated with length of hospital stay are, it is useful to develop the specific health promotion programs to maintain and improve patient's health in the direct way. It is understood that patients who early recover from an acute illness will spend less time in a hospital and be discharged with a good health again. Therefore, length of hospital stay is a nursing outcome indicator that should be concerned.

Literature regarding Patients' Factors Related to Length of Hospital Stay

Length of hospital stay is related to many factors. In previous research studies, factors associated with length of hospital stay were included structural factors, administrative factors, and patients' factors. In this study, the factors related to length of hospital stay focused only patients' factors because most of them can be modified for health promotion programs. These factors are discussed below.

Age

Advanced age has an effect on body structures and may be associated with declining functions. These changes cause older persons to be less physically and mentally active. Therefore, when older adults experience an acute illness or change into an unfamiliar environment, their health status may be easily worsen. Moreover, older patients easily have more complications from hospitalization and a slow recovery. Older people need time in a hospital longer than younger age groups (Andrews & Brocklehurst, 1985).

In some countries, the relationship between age and length of hospital stay has widely been explored. For example, Maguire et al. (1986) studied regarding factors associated with prolonged stay in a hospital. A prospective study of 419 patients aged 70 and over admitted to acute medical wards was carried out. Data including presenting problem, housing, social support, mental state, continence, and degree of independence before and after admission were recorded. This study showed that of the 419 patients, 143 and 65 patients stayed in the hospital for longer than 14 and 28 days, respectively ($p < .02$). In this study, advanced age is one of the major factors associated with prolonged hospitalization. This was consistent with the study of Vik (1993), which analyzed all 633,987 periods of patient's admission to Norwegian general hospitals in 1991. It is found that the length of stay increases considerably with the patient's age; 80-year-old patients stay three times as long in hospital as five-year old patients do. For patients with medical illness, the mean length of stay was 6.8 days.

Patients in the age group 70-79 years require almost twice as more resources as the youngest patients.

In Thailand, Thamprechavai et al. (1992) investigated the number and reasons for continued hospital stay of all patients, classified by age (less than 60, and 60 years and older), in Chulalongkorn Hospital. This study found that of 191 medical inpatients surveyed, 34 percent were 60 years and older. Durations of hospital stay were longer for older patients: median stay 8 and 11 days respectively for those less than 60 and those 60 years and older.

These studies suggested that advanced age influences length of hospital stay. However, advanced age is, at the same time, associated with other factors that can increase length of hospital stay. Age is related to length of hospital stay because it is possible that illness in older adults is complicated health problems. Also, patients in this group spent more time to recover from their sickness than the other age groups. These conditions often lead to increase lengths of hospital stay. Therefore, it is very interesting to include age as a variable to predict length of hospital stay in this study.

Functional Ability

Functional ability, which is a combination of physical, mental and social functions, is an indicator for measuring health status and well-being in older persons. Functional ability should be concerned because disability limits the autonomy of older people, introduces dependence, reduces the quality of life, increases the risk of nursing home admission, and premature death. Old age disability is usually defined in terms of difficulties in one or more basic self-care tasks, often called basic activities of daily living or BADLs (bathing, dressing, toileting, continence, feeding, transferring from bed to chair, walking, and climbing up and down stairs) or in one or more instrumental activities of daily living or IADLs (using the phone, shopping, preparing meals, housekeeping, laundry, public transportation, taking medication, and handling finances) (Becker & Cohen, 1984; Brown, 1988; Lekan-Rutledge, 1988; Suthichai Jittapunkul, B. E. 2544). In a hospital and a community, evaluation of functional status is useful information to identify problems and to monitor health and illnesses of older people. To understand the functional pattern in older people, functional ability should

be assessed at least three times: before admission, on admission, and before discharge from a hospital (Prakong Intrasombat, B. E. 2539).

Declining functions of each organic system result from the changes of genetics, diet, environment, and personal habits. In natural status, human's bodies are adaptable with these factors. But, whenever the body's ability to withstand stress or challenges (i.e. illness, anxiety, over exercise, etc.) decreases, the frailty in some older adults can be seen (Tagliareni & Water, 1995). For example, it is observed that many older people who have sudden changes in physical activities of daily living usually have something wrong about their health. Physical disability has many consequences. Loss of independence in basic activities of daily living is strongly associated with institutionalization, caregiver burden, higher resource use, and death (Covinsky et al., 1997; Covinsky et al., 1999; Fortinsky et al., 1999; Inouye et al., 1998). Therefore, a principle goal of the care of older patients is maintaining the ability to perform basic self-care activities without assistance (Covinsky et al., 1998; Palmer et al., 1994). These activities, known as BADLs and IADLs, are a practical assessment and popular use in geriatric wards help nurses to manage nursing care plans for daily routines and discharge planning.

The prevalence of various disabilities increases with advancing age. Also, diseases, particularly multiple chronic illnesses when a new condition develops, are the main cause of old age disability (Guralnik et al., 1993). Prior studies have described functional changes in hospitalized older people to support the view that before hospitalization, patients can remain either be stable or decline in function because of their acute illness. After hospital admission, patients who were stable before admission can remain stable or decline, whereas patients who declined before admission can recover, not recover, or decline further (Chavalee Yamvong, B. E. 2538; Hirsch et al., 1990; Viriya sumprathanugul, B. E. 2542). The functional trajectories of hospitalized older people in these evidences are concluded that many hospitalized older people are more likely to be discharged with worse-than-baseline ADL function. Particularly, the study of Covinsky and colleagues (2003) showed the effect of increasing age on the pattern and frequency of functional changes in hospitalized older people in that the oldest patients are at higher risk of poor functional

outcomes because they are less likely to recover the ADL function to the level before admission and more likely to develop new functional deficits during hospitalization.

Functional ability, especially in older patients, is related to acute illnesses. This was consistent with the study of Reiley and Howard (1995). They studied variables that were available at the time of admission among older patients with congestive heart failure and were associated with length of hospitalization. Two-hundreds and thirty-one patients who stay in hospital for prolonged periods had higher severity of illness scores and lower functional status scores. In addition, multiple regression analysis showed that functional status and severity of illness were significant predictors of length of hospital stay. They could explain 9.5% of the variance in length of hospital stay. Not surprising, the finding that the model only explained 9.5% because the diagnosis-related groups (DRG) grouping provides some homogeneity. These variables may more explain the variance in length of hospital stay in hospitals where are not under the DRG system. Diagnosis-related groups (DRGs) are categories of clinically meaningful patient's conditions which require similar levels of hospital resources for their treatment (Baker, 2002).

Moreover, previous studies demonstrated that functional status was a significant predictor of patient outcomes. For example, a cohort of 604 patients was studied in the study of Pompei and colleagues (1991). To determine whether physician estimates of illness severity, comorbidity, functional status and stability, were predictive of morbidity, mortality, length of stay, and average daily ancillary charges. It is found that functional status was predictive of in-hospital morbidity and mortality, 1 year mortality, length of stay, and hospital charges ($p < .01$). Besides, Narain et al. (1988) examined variables available at hospital admission that were associated with the following outcomes: nursing home admission, hospital readmission, mortality, and length of stay. They found that functional status was the strongest predictor of length of stay, mortality, and nursing home placement. Only functional status and major admitting diagnosis explained 17% of the variance in length of hospital stay. In a related study, the strongest predictors of length of stay on a geriatric unit were functional status on admission, living location, and living with spouse, which explained 22% of the variance in length of hospital stay (Rubenstein et al., 1984).

The literature review supported that functional status of hospitalized patients is increasingly recognized as an important predictor of patient outcomes such as length of hospital stay. In this study, functional ability on admission was proposed as a predictor variable to predict the length of hospital stay of medical older patients.

Severity of Illness

Severity of illness is an important clinical construct usually used by physicians to classify patients. The assessment of illness severity takes into accounts both disease specific and patient specific attributes. The etiology, natural history, and scope and intensity of manifestations of the disease are important considerations. In addition, physicians take into account the patient's overall condition, burden of comorbid illness and ability to withstand the physiologic, psychologic and social perturbations of an acute illness (Matteson, McConnell, & Linton, 1997). Also, severity of illness is an important construct for clinical epidemiologists and health service researchers (Pompei et al., 1991). Several instruments for measuring severity of illness were developed based on information extracted from the medical record for different reasons. For example, the original purposes of the Computerized Severity Index developed by Horn and Horn (1986) included insuring fairness of the hospital prospective payment system, appropriately adjusting outcome data for quality assessment, and helping hospitals manage in an era of cost containment (Iezzoni, 1989). While the Index includes a measure of the severity of the clinical problem or principal diagnosis, which brought the person to the hospital, it also incorporates complications incurred and the results of diagnostic procedures performed during the hospitalization. It is implied that high hospital charges are one outcome of high level of severity of illness.

In contrast, the Acute Physiology and Chronic Health Evaluation (APACHE) index was designed to classify groups of patients on the basis of severity of illness as standardized information to assess patients on admission, treatment, and to assess the risk of mortality in intensive care units (Knaus et al., 1985). Scores predictive of a high mortality rate result largely from abnormalities in vital signs and laboratory values early after admission to the intensive care unit (Knaus et al., 1981).

Besides mortality rate and charges, other studies have identified other outcomes that are related to severity of illness. For instance, Pompei et al. (1991) used physicians' estimates of illness severity, comorbidity, functional status, and stability to predict morbidity, mortality, length of stay, and average daily ancillary charges with a cohort of 604 patients. They found that severity of illness was a significant predictor of in-hospital morbidity, mortality, length of stay, and charges ($p < .001$).

When patients were admitted to a hospital for an acute problem, most of them, especially older patients, had coexisting medical conditions. These comorbid conditions might be expected to alter an individual's ability to recover from acute illness and influence the number of days in hospital and type of resources required for evaluation and treatment. Patients with limited physiologic reserve in several organ systems are less likely to be able to compensate for the stress of an acute illness and may be less likely to tolerate invasive testing and rigorous treatment regimens. Therefore, those patients usually took time in a hospital for treatment and recovery. Moreover, patients who spent much time in a hospital usually had increased risk of many iatrogenic complications or other complications unrelated to the reason of developing admission; that is hazards of hospitalization, such as functional decline in muscle strength and aerobic capacity, vasomotor instability, reduced bone density, diminished pulmonary ventilation, altered sensory continence, appetite, and thirst, and a tendency toward urinary incontinence (Creditor, 1993). With these reasons, patients with a high degree of severity of illness might be associated positively with the length of hospital stay.

Serum Albumin Level

Albumin is synthesized in the liver. The average adult human liver produces approximately 15 grams of albumin daily, which is rapidly secreted into the plasma (within 30 minutes) and has a serum half life of approximately 21 days (Sacher & McPherson, 1991). The two main functions of albumin are maintenance of osmotic pressure and transport of various ligands in the bloodstream including hormones, fatty acids, bilirubin, and drugs. The serum albumin level is the result of hepatic albumin synthesis, body distribution, and degradation. The liver does not store excess albumin, and as a result, when hepatic production ceases, serum albumin levels decline

(Rothschild, Oratz, & Schreiber, 1988). Therefore, measurement of serum albumin has been widely used as a marker of malnutrition in hospitalized patients. However, many potential factors may contribute to hypoalbuminemia including malnutrition, severe hepatic dysfunction, acute infection, malignancy, renal disease, and burns (Sacher & McPherson, 1991). As a result, hypoalbuminemia may serve as a marker of underlying systemic disease and not always reflect inadequate oral intake. Albumin is not an essential protein for immediate survival; hence, when mulnutrition or an acutely stressful event or illness occurs, hepatic production of albumin decreases, resulting in a decline of the serum level. The stress of various illness such as infection, malignancy, trauma, and surgery enhances the release of the cytokines interleukin-1 and tumor necrosis factor, which in turn, decreases hepatic albumin production in favor of acute phase proteins (Grimble, 1990; Rothschild, Oratz, & Schreiber, 1988). Albumin may also be lost in the urine with renal disease and the integument in patients with burns (Finestone et al.,1996). Thus, hypoalbuminemia often results from an interaction between malnutrition and various illnesses. With this phenomenon, cessation of hepatic albumin, hospitalized older persons usually have a dropped level of serum albumin after the first day of admission.

Regardless of the cause, hypoalbuminemia is associated with decreased immunologic function (Herrmann et al, 1992; Sganga et al., 1985), increased susceptibility to normal infection, and increased mortality rates (Giner et al., 1996; Herrmann et al, 1992; Marinella, Pierson, & Chenoweth, 1997; Phillips, Shaper, & Whincup, 1989; Rich et al., 1989), increased hospital readmission rates (Herrmann et al, 1992), development of postoperative complications (Rich et al., 1989), and prolonged duration of hospitalization (Anderson et al., 1985; Chima et al., 1997; Herrmann et al, 1992; Rich et al., 1989). Moreover, with a low serum albumin level, the concentration of unbound drugs in the circulation is increased, particularly in the elderly, who often have diminished drug clearance mechanisms. The increased level of free drugs may pose adverse effects (Carruthers, 1986).

Herrmann and colleagues (1992) explored the serum albumin level within 48 hours of hospitalization for acute illness and in-hospital death, length of hospital stay, and readmission in 15,511 patients who were older than 40 years. Low serum albumin level (< 34 g/l) was a strong predictor of all three outcomes. Serum albumin level was

inversely related to length of stay ($p < .00001$) and it was the most important variable for predicting length of stay, followed by age, serum sodium level, and sex. This model explained 7% of the total variance of length of stay while serum albumin level and age explained 6.5% (R^2) of the total variance in length of stay among all adult patients.

In another study, including 144 patients aged 60 years and older, Marinella and Markert (1998) determined whether older patients with a serum albumin level less than 3.4 g/dL on admission to community hospitals had a longer duration of hospitalization than those with an admission serum albumin level equal to or more than 3.4 g/dL. They found that a serum albumin level less than 3.4 g/dL obtained within 4 hours of hospital admission was a reliable predictor of prolonged hospital stay and death in patients 60 years of age or older. The mean length of hospitalization was 3.85 days (SD = 2.55) for patients with an admission serum albumin level equal to or more than 3.4 g/dL and 6.74 days (SD = 4.79) for those with an admission serum albumin level less than 3.4 g/dL. Like the former study, length of hospital stay was inversely related to admission serum albumin level ($r = -.38$; $p < .01$).

Also, malnutrition has been linked to a poorer outcome, and this may also account for the increased duration of hospitalization in hypoalbuminemic elderly patients. It is seen clearly in the study of Ferguson and colleagues (1993). They investigated the prevalence of hypoalbuminemia and hypoprealbuminemia in 146 medical and surgical in-patients aged 65 and older, and to correlate these findings with length of hospitalization and mortality. Serum albumin and prealbumin were measured at admission, mid-week, 1 week, and 1 month. This study indicated that severe hypoalbuminemia at mid-week ($\leq$ 20 g/l) was a stronger predictor than hypoprealbuminemia for 90-day mortality (RR = 4.1, 95% CI = 2.0-8.5 vs not significant) and extended length of stay (RR = 5.2, 95% CI = 2.8-9.8 vs RR = 3.2, 95% CI = 1.5-6.7). Serum albumin on admission was not as a strong predictor of outcomes as serum albumin at mid-week. This point was contrary to the above studies. They presumed that admission albumin levels might be misleadingly elevated by a combination of hydration status, hospital interventions, continuing illness, and poor nutrition. In addition, this study showed that both albumin and prealbumin tend to decrease in the first few days after admission.

In previous studies, timing of blood sampling for determination of serum albumin was different. However, most time frames were not fluctuated from early hospitalization. Studies mentioned above supported that serum albumin level should be routinely obtained on admission studies since it may serve as a simple, useful predictor of elderly patients with prolonged hospitalization. However, in practical, serum albumin blood sample was not examined in all patients at admission. Therefore, serum albumin level within the first week of admission was selected as a predictor in this study. Serum albumin level may be a marker of a body's reserved energy before admission to use in the recovery phase. If hypoalbuminemia is associated with length of hospital stay, health factors that were associated with hypoalbuminemia such as low socioeconomic status, tobacco-related illness, dental health, and some gastrointestinal symptoms (Reuben et al., 1997) should also be studied in community-based population.

Acute Confusional State

Acute confusional state or delirium is defined as a transient organic brain syndrome without specific etiology, characterized by the simultaneous presence of disturbances related to consciousness and attention that are acute in onset and have a fluctuating course. It generally involves disturbances in orientation, perception, thinking, memory, psychomotor behavior, emotions and sleep-wake cycle (American Psychiatric Association, 1994; Lipowski, 1989). Among medically ill older patients, reported incidence (developing after hospital admission) varies from 5% to 38% (Foreman, 1989), and prevalence (present on admission) is reported at approximately 20% (Francis, Martin, & Kapoor, 1990; Jitapunkul, Pillay, & Ebrahim, 1992). Typical symptoms of delirium include reduced ability to focus and maintain attention, memory deficits, disorientation, language difficulties, illusions, hallucinations, and many other behavioral abnormalities (Lipowski, 1990). Based on the state of arousal, Three types of delirium are described. Firstly, the hyperactive type (15%-29%) is observed in patients in a state of alcohol withdrawal or intoxication with to phencyclidine (PCP), amphetamine, and lysergic acid diethylamide (LSD). Secondly, the hypoactive type (19%-43%) is observed in-patients in states of hepatic encephalopathy and hypercapnia. Lastly, in the mixed type (43%-52%), individuals display daytime

sedation with nocturnal agitation and behavioral problems (Liptzin & Levkoff, 1992). There are numerous factors that are associated with the development of delirium in medically ill elderly. These factors include older age, prior cognitive impairment, severe illness or multiple co-morbidities, electrolyte imbalance, dehydration, changes in vital signs, psychotropic medication use, alcoholism (Francis et al, 1990), impaired sensory status (i.e. vision impairment), fractures, decreased mobility/functional status (Williams et al., 1985), poor sleep quality (Lipowski, 1990), presence of infection (Jitapunkul et al, 1992), and decreased interaction with significant others (Foreman, 1989). In fact, more than one factors often contribute to an individual who becomes acutely confused (Francis et al, 1990; Lipowski, 1990). However, delirium is often reversible if the underlying cause is identified and treated (Inouye et al., 1999).

The presence of a delirium leads to poorer hospital outcomes: prolonged hospitalization, and increase in the resources used (Francis et al., 1990; Inouye, Rushing, Foreman, Palmer, & Pompei, 1998; Pompei, Foreman, Cassel, Alessi, & Cox, 1995; Stevens, de Moore, & Simpson, 1998). Studies looking at the longed-term prognosis show an increase in the rate of hospital readmission, the need for nursing home placement and increase in mortality and morbidity, as well as clear decline in function (Curyto, Johnson, TenHave, Mossey, Knott, & Katz, 2001; George, Bleasdale, & Singleton, 1997; Inouye et al., 1998; Rahkonen, Makela, Paanila, Halonen, Sivenius, & Sulkava, 2000; Rockwood, Cosway, Carver, Jarrett, Stadnyk, & Fisk, 1999). Delirium causes individual patients and their families distress and hardship, but beyond that there is a marked economic cost to every nation's healthcare system (Franco, Litaker, Locala, & Bronson, 2001). However, there are still marked hidden costs, such as further morbidity, increased care needs (especially care needs provided by unpaid carers), nursing home placements and readmissions to acute hospital that go unaccounted for in considering the economic burden of delirium. The study of Thomas, Cameron, and Fahs (1988) delirium was diagnosed in 15% of a cohort of 133 hospitalized patients by using explicit criteria. Each patient's discharge or death was followed and the length of stay was compared with the diagnosis related group-predicted length of hospitalization. Delirious patients stayed longer than predicted duration by an average of 13 days, while nondelirious patients did so by 3.3 days. The mean (± SD) length of hospitalization for patients with delirium was

significantly longer than for their nondelirious counterparts (21.6 ± 23.7 days vs 10.6 ± 10.1 days, respectively). Similarly, Levkoff and colleagues (1992) evaluated the occurrence and persistence of delirium in 325 elderly patients admitted to a teaching hospital from either a defined community or a long-term care facility. Delirium was associated with a prolonged hospital stay and an increased risk of institutional placement among community-dwelling elderly. Similarly, Foreman et al. (1995) determined the prevalence of undiagnosed delirium in hospitalized elderly patients. They found that the prevalence of diagnosed delirium was 2%. Thirty-six percent of the patients were suspected of having unrecognized delirium. The mean length of hospital stay and the rate of mortality were significantly higher for patients with suspected delirium than for non-delirious patients.

The acute confusional state (delirium) is a common presentation for a wide variety of medical conditions in the elderly. The evidence shows that delirium is adversely affected length of hospital stay. Therefore, delirium was entered into this study as an independent variable.

The Number of Medications Used

Older people often have more than one chronic illness, which results in multiple medications use. On the other hand, several medications use is not necessarily related to the number of diseases. Increasing use of health services may also be one reason for the increase of multiple drugs (Jitapunkul et al., 1997) Not surprisingly, some older adults take many prescribed and nonprescribed drugs while others do not take any.

Common illnesses occur in older people include heart disease, high blood pressure, diabetes, arthritis, cancer, and psychoactive disorders (Thailand Health Research Institute, 1996). Two or more of these diseases may occur simultaneously. Thus, it is necessary to use many different medications. The most common drugs prescribed for this age group include cardiovascular drugs, antihypertensives, analgesics, antiarthritics, laxatives, antacids, sedatives, and tranquilizers. Older adults may encounter problems with drugs because of aging. The physiologic process of aging makes older patients more susceptible to adverse outcomes with medications. Older adults handle drugs differently than younger people. They have decreased total

body water, decreased lean body mass, increased body fat, decreased serum albumin levels and altered protein binding, decreased hepatic perfusion and phase I metabolism, reduced renal plasma flow, reduced glomerular filtration rate, decreased tubular secretion function, and various alteration in determinants of tissue sensitivity (Christensen, Andreasen, & Jansen, 1982; Forbes & Reina, 1970; Klotz et al., 1975). These common characteristics have been shown to increase the risk of medication-related problems in older adults. Therefore, multiple drug therapy can lead to increased risks of adverse drug reactions, drug-drug interactions, and drug-disease interactions. These are sometime major causes of hospital admission (Williamson & Chopin, 1980). When older adults with multiple drugs are admitted to a hospital, they may require long-term medical treatment and lead to significant morbidity and mortality. Smythe, Melendy, Jahns, and Dmuchowski (1993), who studied patterns of medication use in a medical intensive care unit (ICU) and explored relationships between drug use, patient age, admitting diagnosis, Acute Physiology and Chronic Health Evaluation (APACHE II) scores, length of stay, and survival with combination prospective and retrospective study, indicated that there was a positive linear relationship between total medication use and long length of stay (R^2 = .62). Therefore, in this study, the number of medications was chosen as a predictive variable for length of hospital stay.

Summary of Literature Review

The purpose of this chapter was to review the available literature regarding the concept of aging, health status changes, and common health problems in older adults, length of hospital stay, and patients' factors related to length of hospital stay including age, functional ability, severity of illness, serum albumin level, acute confusional state, and the number of medications used. Older adults normally encounter natural aging changes and diseases, which cause poor health status. They are frequently sent to a hospital with acute illness. Some older patients can recover from their illness in a short time while others need prolonged hospitalization. Prolonged length of stay may result in patients' complications, a low rate of bed utilization, and high cost of both patients and hospitals. Therefore, length of hospital stay has been used as an indicator of the

quality of care in the acute care setting. To shorten length of hospital stay of older patients, several studies had been conducted to understand what factors were related to prolonged hospitalization and strongest result in length of hospital stay prediction. Patients with advanced age, low score of functional ability, high degree of severity of illness, low level of serum albumin, acute confusional state, and multiple drugs use have relationship with prolonged hospitalization. The strongest variables that influence the length of hospital stay are different among studies. The majority of studies were conducted in other countries. Therefore, the researcher proposes to explore further knowledge on patients' factors that influence the length of hospital stay in Thai older patients with medical problems. Finally, the aim of this study was to identify whether these factors such as age, functional ability, severity of illness, serum albumin level, acute confusional state and the number of medications used that could predict the length of hospital stay of medical older patients.

CHAPTER III
MATERIALS AND METHODS

The study was a prospective, descriptive, correlational research design to determine whether the selected factors (age, functional ability, severity of illness, serum albumin level, acute confusional state, and the number of medications used) could jointly predict the length of hospital stay of medical older patients.

Population and Sample

The target population was older adults who were 60 years old or older admitted to medical wards in Ramathibodi Hospital. The sample was purposively selected from older adults aged 60 years or older who were admitted to medical wards in Ramathibodi Hospital during May to August 2005.

The Inclusion Criteria were as Follows:

1. being male and female patients aged 60 years and older who were newly admitted to six medical wards, including three general wards, one intermediate ward, and two medical intensive care units of Ramathibodi Hospital;
2. not being referred from other hospitals;
3. never been recruited in this study before;
4. not being admitted for a specific treatment (e.g., chemotherapy or antibiotics) or for investigation (e.g., cardiac catheterization, lung or liver biopsy, bronchoscope, etc.); and
5. being examined by the physician for the following laboratories: complete blood count, electrolyte, serum creatinine at admission, and serum albumin level within the first week of admission.

The Exclusion Criteria were as Follows:

1. being transferred to the private wards during hospitalization;

2. being referred to another hospital when the condition was not readily discharged;

3. unable to be discharged with any reasons (e.g., the family delay) although the condition was readily discharged; and

4. death during hospitalization

Sample Size

A sample size of the study was calculated based on power analysis of Cohen (1988: 444-465) that determined the sample size following selected variables. In this study, a power of .80, alpha of .05, and a medium effect size (f^2) of 0.15 were used for a correlational study. With six independent variables (age, functional ability, severity of illness, serum albumin level, acute confusional state, and the number of medications used) in multiple regression analysis, the sample size of the study should be at least 90. The calculation is shown as follows:

$$N = \lambda / f^2$$

λ (effect size) = 13.6: see Table α = .05 (Cohen, 1988: 452)
at u (independent variable) = 6,
v (degrees of freedom) = ∞, and power = .80

f^2 (medium effect size) = 0.15

$$N = 13.6 / 0.15$$
$$= 90$$

However, after the pilot study conducted by the researcher, the scores of severity of illness of older patients were rather homogeneous in general medical wards. To increase the variance of severity of illness, older patients in medical critical care units were included in this study, according to the proportion of the number of beds in the general wards and the critical care units. Therefore, the sample size was increased to 211.

Setting

This study was conducted at the Department of Internal Medicine, of Ramathibodi Hospital, a university and tertiary care hospital, Bangkok. Most older patients were admitted to this setting with acute illnesses on top multiple chronic diseases and complex health problems. The inpatient medical department consists of seven wards: three general wards, one intermediate ward, two medical intensive wards, and one private ward. Criteria to discharge patients from the hospital in each ward are the same. However, in a private ward, the criteria for discharge might be tailored according to the family's reasons. Therefore, the settings of this study, which excluded the private ward, contained six medical wards as follows:

1. Male Medical Ward (7SW), a general medical ward with 30 beds;
2. Female Medical Ward (7SE), a general medical ward with 30 beds;
3. Male and Female Medical Ward I (9SW), a general medical ward with 21 beds;
4. Male and Female Medical Ward II (7NW), an intermediate medical ward with 20 beds;
5. A medical intensive care unit (9IC) with 8 beds; and
6. A coronary care unit (9CC) with 6 beds.

Instrumentation

The instruments used in this study consisted of four record forms: 1) demographic data, 2) the number of medications used, 3) serum albumin level, and 4)

length of hospital stay, and three assessment forms: 1) Yamvong's Modified Barthel Activities of Daily Living (MBAI); 2) the Acute Physiology and Chronic Health Evaluaion II (APACHE II); and 3) the Thai version of the Confusional Assessment Method. The description of the instruments was as follows.

The four record forms used in this study were:

1. The Demographic Data Form (see Appendix C): the information collected was the older patients' characteristics including gender, age, nationality, religion, habitation, marital status, education level, occupation, source of income, sufficiency of income, methods of payment, living situation, and other health information;

2. The Number of Medications Record Form (see Appendix D): the information recorded was total types of medications prescribed by a physician that an older patient has continuously taken for one month before this admission;

3. The Serum Albumin Level Record Form (see Appendix E): the information recorded was the first value of serum albumin level, which was ordered by a physician within the first week of hospitalization; and

4. The Length of Hospital Stay Record Form (see Appendix F): the information recorded was the number of days that an older patient was hospitalized for this admission by counting from the day of admission to that of discharge from the hospital, which follows the number of admitted days recorded in the vital signs graphic sheet.

The three assessment forms used in this study were:

1. Yamvong's Modified Barthel Activities of Daily Living Index (see Appendix G), which was translated and adjusted by Chavalee Yamvong (B. E. 2538) from the Barthel ADL Index developed by Mahoney and Barthel (1965). The Barthel ADL Index has been used for measuring the functional status and rating self-care abilities in the areas of personal hygiene, bathing, dressing, feeding, bowel and bladder control, toilet use, transferring from bed to chair, walking, and walking up and down stairs, which are the basic activities of daily livings (ADLs). For each item, the individual is scored based on an ability to perform the task independently or with help. The higher score indicates the higher independence, with a range from 0 to 100 or from total dependence to total independence.

Chavalee Yamvong (B. E. 2538) translated and adjusted the Barthel ADL Index into Thai for her research. She categorized the levels of score from two (0, 1) to three levels (0, 1, 2) of personal hygiene and bathing activities, but other activities remained at the same levels as the original. Therefore, the adjusted total score was changed from 0-100 to 0-40.

In Yamvong's Modified Barthel ADL Index, walking up and down stairs was excluded from this study because older patients did not perform this activity in the hospital. Then, the total score was adapted from 0-40 to 0-36. The score of each item was as follows:

The activities of bathing and personal hygiene (brushing teeth, combing hair, shaving, and making up) were scored on three levels (2 = independent, 1 = required some assistance, and 0 = completely dependent).

The activities of transferring and walking were scored on four levels (6 = independent, 4 = required less assistance, 2 = required some assistance, and 0 = completely dependent).

The activities of feeding oneself, dressing, and toilet use were scored on three levels (4 = independent, 2 = required some assistance, and 0 = completely dependent).

The activities of bowel and bladder control were scored on three levels (4 = completely continent, 2 = mostly continent, and 0 = completely incontinent).

In this study, the higher score indicates the higher independence, with a range from 0 to 36 or from total dependence to total independence.

Psychometric Properties of this Instrument

The Barthel Activities of Daily Living Index is an empirically obtained scale with validated inter-rater and test-retest reliability, and validity, which measured the patient's functional ability without family social functioning distorting the outcome (Shah, Vanclay, & Cooper, 1989: 703-704). Therefore, it is an uncomplicated instrument, which can be used by either an experienced or inexperienced person. The Kendall's coefficient of concordance was highly significant ($p < .001$) among all four raters with overall reliability of .93 showing a high degree of agreement (Collin et al., 1987 as cited in Shah et al., 1989: 704). The Cronbach's coefficient alpha of internal consistency of the BAI was .87 (Shah et al., 1989: 706).

Chavalee Yamvong (B. E. 2538: 31) evaluated the Thai version of the BAI for its content validity with three nursing instructors in the Faculty of Medicine Ramathibodi Hospital, Mahidol University and tested its internal consistency using Cronbach's alpha coefficient in 60 elderly patients with a result of .93. It was tested for inter-rater reliability between the research and assistant with a result of .97. Additionally, Suwanee Mahakayanun (B. E. 2538) used the Thai modified version to measure ten elderly patients in her pilot study and 60 elderly patients in her main study. The Cronbach's alpha coefficients of reliability were .91 and .95 respectively. The inter-rater reliability in the pilot study was .97. Then, Jom Suwanno (B. E. 2540) has tested the internal consistency of the Cronbach's alpha coefficient with 10 and 30 patients with stroke. The Cronbach's alpha coefficients were .94 and .93 respectively. Later, Sumana Sanmanoch (B. E. 2541) used the Thai modified BAI with 10 elderly patients in the pilot study and 40 elderly patients with fracture. The Cronbach's alpha coefficients of reliability were .92 and .95 respectively, and the inter-rater reliability in the pilot study was .92. Furthermore, Viriya sumprathanugul (B. E. 2542) used the Thai modified version to measure 60 elderly patients before admission, the first 2-day of admission, and before patients discharged in her study. The Cronbach's alpha coefficients were .91, .90, and .90 respectively.

For this study, the research tested the inter-rater reliability of 10 medical older patients, which had similar characteristics to the sample, with two assistants to ensure its clarity. The reliability of agreement was .80 for all activities.

2. The Acute Physiology and Chronic Health Evaluation (APACHE II) (see Appendix H), which was developed by Knaus and colleagues in 1985 to measure the severity of illness. The original APACHE II used a pointed score, ranging from 0 to 71, based upon initial values of 12 routine physiologic measurements, age, and chronic health status to provide a general measure of severity of disease.

In this study, age was separated to a predictive variable, so the APACHE II was used only two parts, which are described as follows:

2.1. The Acute physiologic factors score was determined from the worst initial 24-hour values of 12 routine physiologic measurements at admission. The data was collected by quantifying the degree of abnormality of multiple physiologic variables including: 1) temperature via rectum (°C) is approximately 0.5 degree celsius

higher than oral temperature and one degree celsius higher than axilla temperature. If the temperature was measured by oral or axilla, the score was plused 0.5 or 1 respectively, before scoring; 2) mean arterial pressure (calculated before scoring by [(systolic blood pressure) + (2 x diastolic pressure)]/3); 3) heart rate; 4) respiratory rate; 5) oxygenation (mainly collected from arterial blood gas (PaO_2) or oxymeter (SpO_2). However, when SpO_2 was used, it was changed to PaO_2 before scoring by using the program of oxyhemoglobin dissociation curve on computer online (Kelman, 1966); 6) arterial pH or serum HCO_3; 7) serum sodium; 8) serum potassium; 9) serum creatinine (in patients with acute renal failure, the score was double); 10) hematocrit; 11) white blood count; and 12) the Glasgow-coma score (score = 15 minus actual score). The score of this part ranges from 0 to 60.

2.2. Chronic health score, in this study, was adjusted from 2 and 5 to 0 and 5 because the research setting was taken in medical wards where the score of 2 points for elective postoperative patients was not met at admission. Therefore, the score would be 5 points for the patient with a history of severe organic system insufficiency or immuno-compromised host following the criteria (see Appendix H, Part II) or with emergency post operation, and 0 point for the patient without those criteria.

The possible score of the APACHE II in this study ranged from 0 to 65, with higher score indicating the high degree of severity of illness.

Psychometric Properties of this Instrument

Mortality is an objective and reasonable starting point for evaluation of APACHE II. Therefore, the most specific standard for judging the validity of APACHE II, a severity of disease classification system, is hospital mortality. Knaus and colleagues (1985: 819-821) evaluated the validity of APACHE II by testing its association with hospital mortality in a large number of unselected, but carefully described ICU admissions from 13 hospitals. All data were checked for transcription errors, completeness, and internal consistency. Interobserver reliability testing by others revealed 96% agreement for all physiologic data. The result of validation, all 12 physiologic measurements, was available for 87% of the 5815 ICU admissions. They found that medical patients had widely distributed scores because those were all emergency admissions with a greater variety of acute illness. With regard to the direct relationship between APACHE II scores and observed hospital death rates, there was a

significant increase in death rate for each five-point increase in the APACHE II. A five-point increase in APACHE II also significantly ($p < .0001$) increased death rate in the intermediate ranges of severity. Even though, the end-point of this study is not hospital mortality, the developer suggested that the researcher could use only the points of 12 physiologic variables and/or severe chronic disease to present the severity of illness because advanced age and a chronic disease are risk factors for death from an acute illness (Knus et al., 1985: 827).

In this study, the research tested the inter-rater reliability of 12 physiologic derangement points and severe chronic health status points, with two assistants, to ensure its clarity. The reliability was 1 and .90 respectively.

3. The Thai Version of Confusional Assessment Method (see Appendix G), a diagnostic assessment instrument for delirium developed by Inouye and colleague (1990), was then translated from the Confusional Assessment Method (CAM) by Prakong Intarasombat (B. E. 2547). The CAM is a structured interview of delirium symptoms based on the Diagnostic and Statistical Manual of Mental Disorders Criteria (DSM-III-R) that can distinguish between delirium and other kinds of cognitive impairment. The CAM consists of 9 sections assessing rate of onset, attention, thinking, level of consciousness, orientation, memory, sensory perception, psychomotor activity, and sleep-wake cycle. The diagnosis of delirium by the CAM requires the presence of: 1) acute onset/fluctuating course (the disturbance develops over a short period and tends to fluctuate during the day); and 2) inattention (reduced ability to focus or shift attention); and 3) disorganized thinking (or incoherent such as rambling or irrelevant conversation, unclear or illogical flow of ideas, or unpredictable switching from subject to subject); or 4) altered level of consciousness, which is shown by any answer other than “alert” such as vigilant (hyperalert), lethargic (drowsy, easily aroused), stupor (difficult to arouse), or coma (unarousable). The other five sections, which are disorientation, memory impairment, sensory perceptual disturbances, psychomotor agitation/retardation, and altered sleep-wake cycle, are used to screen for overall cognitive impairment.

For this study, the researcher adjusted the language of the Thai version of the Confusional Assessment Method, which was translated by Prakong Intarasombat for clinical use to determine whether the acute confusional state develops in an older

patient or not. The acute confusional state was set as a nominal scale, so the score was assigned as follows: 1 referred to older patients who developed acute confusion during a hospitalization and 0 referred to those without acute confusion.

Psychometric Properties of this Instrument

The CAM was developed with the aim at helping non-psychiatrists identifying cases of acute confusion. The scale has been used widely, particularly among medical practitioner because it is reliable and has a friendly format (Inouye & Charpentier, 1996; Pompei et al., 1995). The concurrent validity was established with psychiatric diagnosis revealing good sensitivity of 94-100% and specificity of 90-95% and inter-observer reliability rates are high (Kappa = 0.81 to 1.00). This tool can be administered in less than 5 minutes. It is closely correlated with DSM-IV criteria for acute confusion. However, this tool is limited to identify the presence or absence of acute confusion, but not assessable for the severity of the condition, making it less useful to detect clinical improvement or deterioration (Inouye et al., 1990).

Fabbri, Moreira, Garrido, and Almeida (2001) translated the CAM into the Portuguese version and have tested the validity and reliability of the Portuguese version of the Confusional Assessment Method. The scale showed high levels of sensitivity (94.1%) and specificity (96.4%) with 100 elderly patients. The inter-rater reliability was tested in a sample of 24 patients with a Kappa coefficient of .70. The summary of their study suggested that the CAM is a valid and reliable instrument for the assessment of acute confusion among older adults.

For this study, Three experts (a geriatric physician and two nurse instructors with expertise in gerontology) (see Appendix A) evaluated the Thai version of the Confusional Assessment Method for its content clarity and language appropriateness. After the researcher and two assistants tested the Thai Version of Confusional Assessment Method in the group of ten older patients, which had similar characteristics to the sample, they found that the inter-rater reliability was .90.

Protection of Human Subjects

The protection of human subjects in the study was carried out by seeking approval of the Ethics Clearance Committee on Human Rights Related to Research Involving Human Subject of Mahidol University. Prior to data collection, permission for collecting data is obtained from the dean of Faculty of Medicine, Ramathibodi Hospital to the Director of Nursing and the Head-Nurse of the inpatient medical wards. Next, the researcher obtained a verbal agreement or signed consent form indicating that the subjects clearly understood the objectives of the study, the data collection procedures, duration, and the right to agree or refuse for their information to be disclosed. Their participation or non-participation does not affect the service rendered to them. The subjects were assured that the data would be treated as strict confidence and reported as group data.

Data Collection

The approval of the Ethical Clearance Committee on Human Rights Related to Research Involving Human Subject was obtained from the Faculty of Graduate Studies, Mahidol University and the permission from the dean of Faculty of Medicine, Ramathibodi Hospital before starting the procedures below:

1. After the permission was granted, the researcher contacted the head nurses of six inpatient medical wards, Ramathibodi Hospital, to explain the objectives, procedures, and data collection process.

2. Two research assistants were prepared for data collection. The researcher described the objectives, protection of human subjects, the sampling method, and data collection process to the research assistants who were tested for the inter-rater reliability in the pilot study.

3. Screening for eligible subjects based on the inclusion criteria everyday.

4. To protect the rights of human subjects, the researcher/research assistants contacted all the subjects and/or their relatives to seek their approval for participation. An explanation was presented to the subjects and/or their relatives before they agreed

to participate. When the subjects clearly understood the procedure, they were asked to sign the informed consent form; or if uncomfortable to sign the consent, the verbal agreement was obtained (Appendix B).

5. Upon confirmation to participate in the study, the procedures on data collection were started at admission until subjects discharged from the hospital as follows:

5.1 The data must be completely collected following the time frame of data collection indicated below.

- The Acute Physiologic and Chronic Health Evaluation II was used to record the worst values of physiologic derangement and poor chronic health status at the first 24-hour of admission. The data were obtained from patients' chart.
- Yamvong's Modified Barthel ADL Index score, the subjects' performance in activities of daily living, was collected three times: one month before admission, at admission, and at discharge for understanding the pattern of functional ability when hospitalized. The scores were measured by observing or asking the subject and/or their relatives how they performed their ADL, with the answers providing the score indicators.
- The Serum Albumin Level Record Form was used for collecting subjects' serum albumin level from medical records or computerized data. If there were several values of serum albumin level in the first week, the first value was recorded.
- The Thai Version of the Confusional Assessment Method was used to find out whether the subjects had acute confusion or not. The state of acute confusion was assessed everyday in hospitalization by observing or asking from their closest relatives or nurses.

5.2 The data were completely recorded before subjects discharged pointed out below.

- The Demographic Data Form
- The Number of Medications Record Form was used to record total types of all medications prescribed by a physician that a subject had continuously taken before this admission.

• The Length of Hospital Stay Record Form was planned to record the number of days that a subject stayed in the hospital counting from the day of admission to the day one discharged from the hospital, which followed counting on the vital signs graphic sheet.

6. During data collection, subjects who met the exclusion criteria were kept out from the study.

Data Analysis

All analyses were conducted using The Statistical Package of Social Science for Windows Program (SPSS/FW version 11.5) as follows:

1. Descriptive statistics: frequency, percentage, mean, standard deviation, and range were performed to describe the demographic characteristics of the subjects and the major variables of the study.

2. Inferential statistics:

2.1 Spearman rank order correlation was used to analyze the relationship of age, functional ability, severity of illness, serum albumin level, acute confusional state, the number of medications used, and length of hospital stay of older patients because functional ability, acute confusional state, and length of hospital stay were not normally distributed. Criteria for interpretation of correlation coefficient (Munro, 1997: 235) are presented as follows:

$\pm$ 0.70 - $\pm$ 1	high
$\pm$ 0.50 - $\pm$ 0.69	moderate
$\pm$ 0.00 - $\pm$ 0.49	low

2.2 Multiple regression was used to identify the predictive power of age, functional ability, severity of illness, serum albumin level, acute confusional state, and the number of medications used to predict length of hospial stay of older patients. The significance level of this study was set at .05

The assumptions for appropriate use of multiple regression analysis were tested (i.e. assumptions of regression analysis: normality, linearity, homoscedasticity,

multicollinearity, and autocorrelation). For inferential statistics analysis, variables, which were not in interval or ratio scale of measurement, were recoded as follows:

Acute confusional state: hospitalized patients who met the criteria of acute confusion were recoded to “presence” group (code = 1), while others without acute confusion were classified into “absence” group (code = 0).

CHAPTER IV
RESULTS

This study was a prospective correlational research design aimed at examining the possibility of the selected variables (age, functional ability, severity of illness, serum albumin level, acute confusional state, and the number of medications used) to mutually predict length of hospital stay of medical older patients in Ramathibodi Hospital. The results of this study are presented in two parts as follows: 1) descriptions of the sample which include demographic characteristics and major study variables; and 2) hypotheses testing, which consists of relationships between the selected variables and length of hospital stay and factors predicting length of hospital stay of medical older patients.

Data Management

For this study, 230 older patients were approached for data collection. During hospitalization, 19 of them were excluded from analysis according to the exclusion criteria. Three patients were transferred to private wards; one patient needed to move to another hospital before the physician allowed; five patients did not have the result of serum albumin level within first week of admission; and 10 patients died of the following problems: septic shock (n = 3), respiratory failure (n = 2), cardiac arrhythmia (n = 2), cancer (n = 2), and brain anoxia (n = 1) during hospitalization. Thus, 211 older patients were included in the study. Before analysis, data were cleaned and checked.

Part I. Descriptive Data of the Study Sample

Demographic Characteristics

The sample of this study consisted of 211 older patients with 94 females (44.5%) and 117 males (55.5%). Fifty-three (25.1%) of them were admitted to critical care

unit and 158 (74.9%) was admitted to the general care unit. The age range of the subjects was 60 to 102 years with the mean age of 72.64 (SD = 7.70) years. Patients aged 73 were the most admitted. The majority of the sample were Thai nationality (94.8%), Buddhist (98.1%), up-country residents (62.1%), primary school graduation (68.3%), married (66.4%), and lived with their spouse and sons/daughters (58.8%). With regard to socioeconomic data, most of the subjects were unemployed (70.6%), received financial support from their children/spouse (79.6%), evaluated themselves as having sufficient income (83.9%), and could reimburse medical expenses from the government (70.1%). Almost all of the subjects (92.4%) could return to their home after discharged (see Table 1).

Table 1 Frequency of Sample's Characteristics (N = 211)

Personal Characteristics	Frequency	Percentage
Gender		
Male	117	55.5
Female	94	44.5
Age (years)		
60-74	123	58.3
75-84	77	36.5
$\geq$ 85	11	5.2
Nationality		
Thai	200	94.8
Chinese	11	5.2
Religion		
Buddhist	207	98.1
Islamic	3	1.4
Christian	1	0.5
Habitation		
Other provinces	131	62.1
Bangkok	80	37.9

Table 1 Frequency of Sample's Characteristics (N = 211) (cont.)

Personal Characteristics	Frequency	Percentage
Education		
No formal education	20	9.5
Primary school	144	68.3
Secondary school	27	12.8
Diploma	6	2.8
Bachelor's degree	12	5.7
Master's degree	2	0.9
Marital status		
Married	140	66.4
Widowed/Divorced/Separated	67	31.8
Never married	4	1.9
Occupation		
Unemployed	149	70.6
Merchant	33	15.7
Personal business	14	6.6
Wage/Salary	8	3.8
Agriculturist	7	3.3
Source of income*		
Children/spouse	168	79.6
Relief fund	31	14.7
Employed	23	11.0
Saving	19	9.0
Rent	15	7.1
Sufficiency of income		
Sufficient	177	83.9
Insufficient	34	16.1

*One subject could have more than one source.

Table 1 Frequency of Sample's Characteristics (N = 211) (cont.)

Personal Characteristics	Frequency	Percentage
Method of payment for hospital charge		
Government welfare	148	70.1
Universal coverage scheme (30 Baht)	48	22.7
Self-paid	11	5.2
Social security scheme	4	1.9
Living arrangement		
Living with spouse and children	124	58.8
Living with children and/or relatives	70	33.2
Living with spouse only	13	6.2
Living alone	4	1.9
Living placement after discharge		
Living in the same house	195	92.4
Moving to children/relatives' house	16	7.6

According to the health status, most of them had no visual and hearing impairment (74.4%, 88.2% respectively), and no history of falling (87.2%). Almost all of them (94.3%) had underlying diseases. Only 12 older patients (5.7%) reported no health problems. The number of chronic diseases ranged form 0 to 6 (Mean = 2.31, SD = 1.33). Most common diseases among the subjects were hypertension (56.4%), diabetes mellitus (38.9%), and cardiovascular disease (32.2%). One hundred and eighteen patients (55.9%) had history of admission within one year. On admission, the majority of active problems were found as follows: congestive heart failure (13.7%), followed by pneumonia (12.8%), cerebrovascular accident, and acute febrile illness (8.1% of each) as shown in Table 2.

Table 2 Frequency of Subjects Classified by Health Status and Illness (N = 211)

Health Status and Illness	Frequency	Percentage
Visual impairment		
No	157	74.4
Yes	54	25.6
Hearing impairment		
No	186	88.2
Yes	25	11.8
History of fall		
No	184	87.2
Yes	27	12.8
Previous admission within 1 year		
Yes	118	55.9
No	93	44.1
Underlying diseases		
No	12	5.7
Yes [a]	199	94.3
Hypertension	119	56.4
Diabetes Mellitus	82	38.9
Cardiovascular disease	68	32.2
Pulmonary disease	34	16.1
Chronic renal disease	34	16.1
History of stroke	29	13.7
Dyslipidemia	26	12.3
History of cancer	24	11.4
Benign prostatic hypertrophy	16	7.6
Gout	14	6.6
Liver disease	11	5.2
Parkinson's disease	7	3.3
Arthritis	6	2.8
Dementia	4	1.9

a = occurrence of more than one disease

Table 2 Frequency of Subjects Classified by Health Status and Illness (N = 211) (cont.)

Health Status and Illness	Frequency	Percentage
Underlying disease (cont.)		
Others (Osteoporosis, Spondylosis, Skin disease, Alzeimer, Myastenia gravis, Major depressive disorder, Venous thrombosis, Gall stone)	10	4.7
A number of known underlying diseases		
None	12	5.7
One	54	25.6
Two	56	26.5
Three	48	22.7
More than three	41	19.5
Active problem on admission[b]		
Congestive heart failure	29	13.7
Pneumonia	27	12.8
Cerebrovascular accident	17	8.1
Acute febrile illness	17	8.1
Anemia	15	7.1
Chronic obstructive pulmonary disease	14	6.6
Acute renal failure	14	6.6
Alteration of consciousness	13	6.2
Bronchiectasis	13	6.2
Upper GI bleeding	12	5.7
Unstable angina	12	5.7
Urinary tract infection	10	4.7
Hyponatremia	8	3.8
Hypoglycemia	8	3.8
Pleural effusion	7	3.3
Acute diarrhea	7	3.3

b = occurrence of more than one problem

Table 2 Frequency of Subjects Classified by Health Status and Illness (N = 211) (cont.)

Health Status and Illness	Frequency	Percentage
Active problem on admission[b] (cont.)		
Hypovolumic shock	6	2.8
Non Hodgkin lymphoma	4	1.9
Cellulitis	4	1.9
Pyelonephritis	4	1.9
Acute pancreatitis	3	1.4
Hyperglycemia	3	1.4
Venous thrombosis	2	0.9
Hepatic encephalopathy	2	0.9

b = occurrence of more than one problem

Descriptive Data on Major Study Variables

Descriptive statistics of major variables in this study (age, functional ability, severity of illness, serum albumin level, acute confusional state, the number of medications used, and length of hospital stay) are presented in this section. Mean, median, standard deviation, range, kurtosis, and Fisher's skewness are shown in Table 3 to describe the distribution of the study variables.

Age

The age range of the subjects was 60 to 102 years with a mean of 72.64 years (SD = 7.70, Median = 72). The skewness coefficient of age (.34) was severely positive, indicating that the mean of age was more than the median, indicating that most of the subjects were young-old aged. According to Jacobsen (1997: 42), "skewness values above 0.2 or below -0.2 indicate severe skewness." Regarding kurtosis, Jacobsen (1997) noted that if the value, produced by dividing the kurtosis statistics by the standard error, is not beyond $\pm$ 1.96, the distribution has a normal curve. In this study, the kurtosis value of age was -.04, indicating that its peakedness was close to a normal curve (see Table 3).

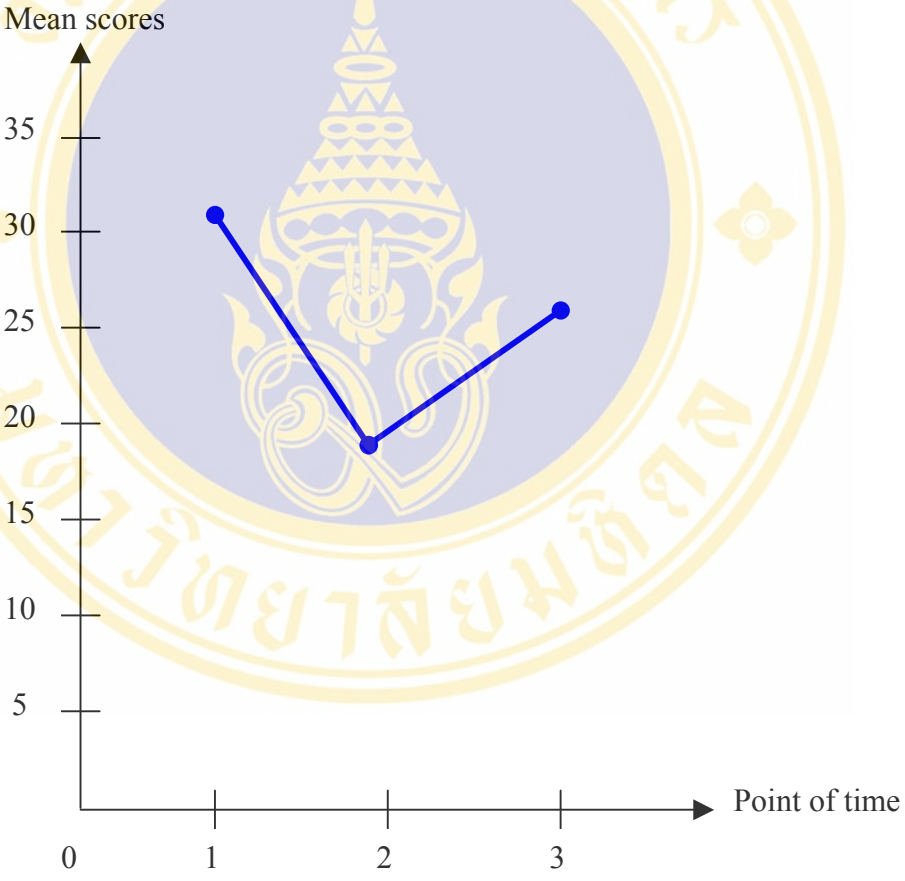
Table 3 Descriptive Statistics of Some Major Variables (N = 211)

Variables	Mean	Median	SD	Possible range	Actual range	Fisher's skewness	Kurtosis
Age (years)	72.64	72	7.70	60 to highest possible	60-102	.34	-.04
Functional ability							
Before admission	31.86	36	9.74	0-36	0-36	-2.47	4.86
On admission	19.17	22	13.43	0-36	0-36	-.32	-1.42
At discharge	27.94	36	12.51	0-36	0-36	-1.41	.42
Severity of illness (on admission)	11.71	11	5.86	0-65	1-35	.65	.56
Serum albumin level (around admission)	36.41	36.6	6.38	42-52 (normal range)	19.5-52.6	-.30	-.17
The number of medications used	4.57	5	2.85	0 to highest possible	0-13	.30	-.31
Length of hospital stay (days)	10.1	7	8.76	0 to highest possible	2-64	12.13	3.07

Functional Ability

The score on functional ability was classified into three points of time. The scores of functional ability one-month before admission, on admission, and at discharge ranged from 0 to 36 with a mean of 31.86 (SD = 9.74, Median = 36), 19.17 (SD = 13.43, Median = 22), and 27.94 (SD = 12.51, Median = 36) respectively, indicating that most of the subjects had great functional decline on admission and failed to recover to baseline at discharge (see Figure 2). On admission, the majority of the sample were dependent in activities as follows: bathing, dressing, feeding, toilet

use, transferring, and mobility. The skewness coefficients of functional ability one-month before admission (-2.47), on admission (-.32) and at discharge (-1.4) were greatly negative, indicating that the mean of these three variables were less than median, indicating that most subjects tended to have a high level in basic activities of daily living. For the kurtosis, the distribution of functional ability one-month before admission was highly leptokurtic (4.86). However, the kurtosis values of functional ability on admission (-1.42) and at discharge from the hospital (.42) were slightly above a normal distribution (see Table 3).



1 = Functional ability one-month before admission

2 = Functional ability on admission

3 = Functional ability at discharge

Figure 2 Mean of functional ability of older patients one-month before admission, on admission, and at discharge

Figure 3 showed additional functional transitions of older patients at different points of time (before admission, on admission, and at discharge) to provide understanding functional pattern in older patients hospitalized with medical illnesses. The left side of the figure depicts the functional course of patients at these three different points of time. Decline refers to loss of activities of daily living (ADL) function, defined as a lower ADL independent score. The recovery refers to return of ADL independent score to the baseline level before admission. The right side of the figure depicts the end result of these functional transitions.

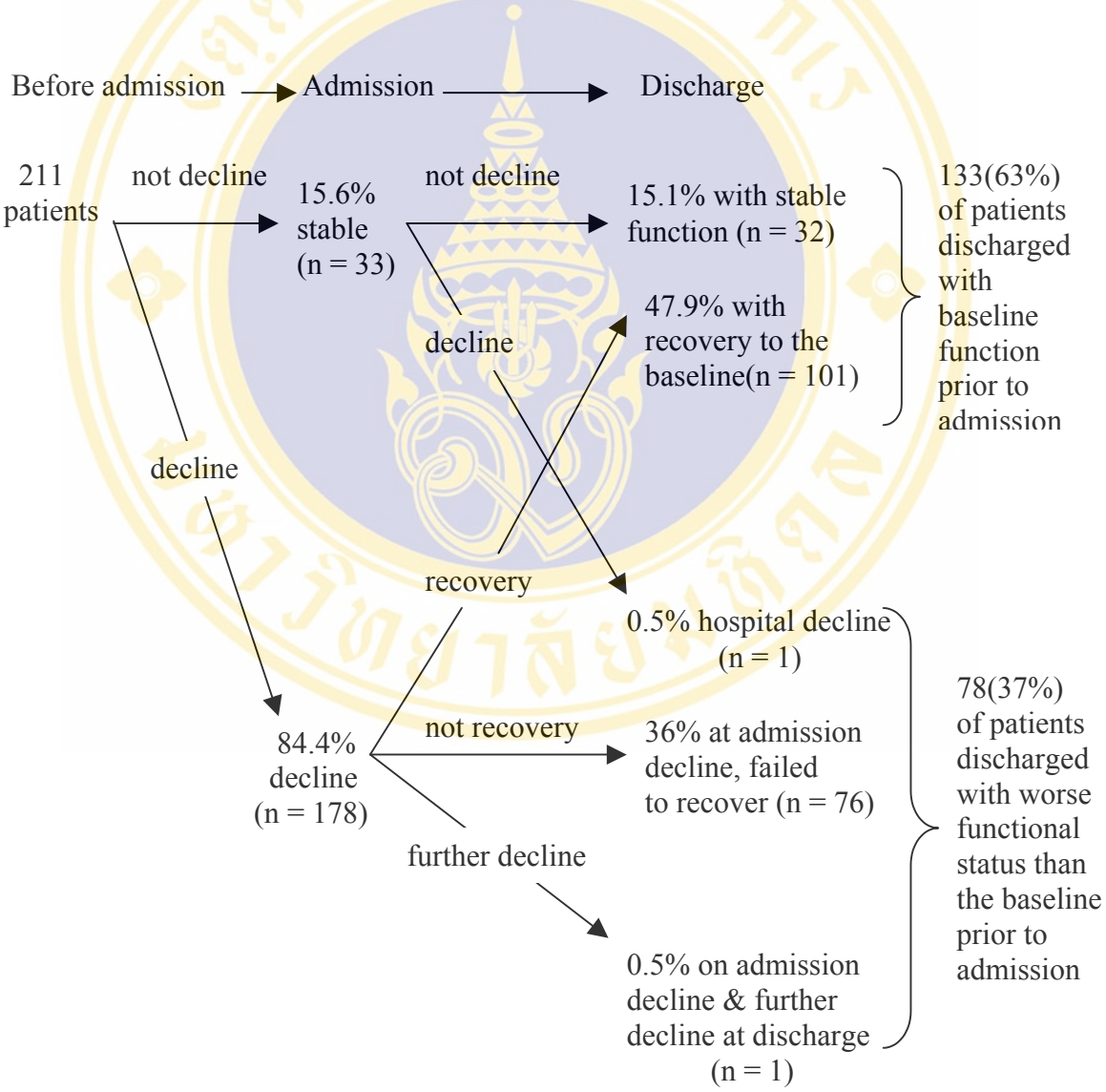


Figure 3 Functional transitions of hospitalized patients at different points of time: one-month before admission, on admission, and at discharge.

The ADL function of 84.4% of 211 older patients declined on admission, whereas the 15.6% of older patients had no decline of functional ability on admission. At discharge, most older patients (63%) were discharged with baseline function (equal to before admission). This included the 15.1% of older patients with stable function throughout their course (no decline before admission until at discharge) and the 47.9% of older patients who declined on admission, but recovered to their baseline level of function (recovery and discharged with equal to before admission). About 37% of older patients were discharged with worse functional status than before admission. This included: the 0.5% of older patients who did not decline on admission, but declined at discharge; the 36% of older patients who declined on admission and failed to recover to their baseline function at discharge; and the 0.5% of older patients who declined on admission and experienced additional decline at discharge.

Severity of Illness

The range of scores on the severity of illness measured by APACHE II was 1 to 35 with a mean of 11.71 (SD = 5.86, Median = 11). The skewness coefficient (.65) was severely positive, indicating that the illness of most subjects was not severe on admission. The kurtosis value of APACHE II scores was .56, indicating that it was close to the normal curve (see Table 3).

The mean score of severity of illness in general wards and critical wards was 10.1 and 14.8 out of 65 respectively, indicating that the sample admitted in general wards had less severity of illness than those admitted in critical wards (see Figure 4).

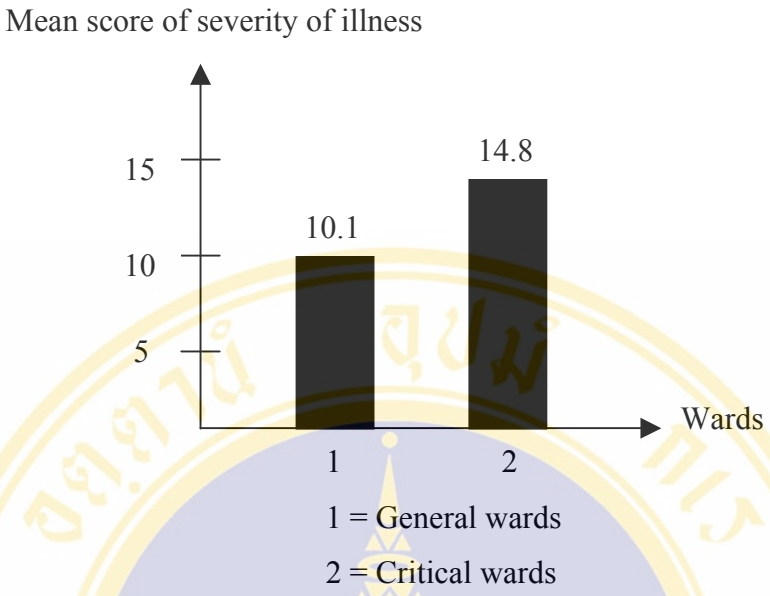


Figure 4 Mean score of severity of illness in general wards and critical wards

Serum Albumin Level

The level of serum albumin around admission of most subjects (90.5%) was measured on the first day of admission, ranging from 19.5-52.6 g/l, with a mean of 36.41 (SD = 6.38, Median = 36.6), which was lower than the normal range (42-52 g/l) of serum albumin level. The skewness value (-.30) was severely negative, indicating that most of the subjects had higher level of mean serum albumin around admission than the median (see Table 3). However, most of them (80.6%) had serum albumin level below the normal range (see Table 4). The kurtosis value of serum albumin level (-.17) was close to zero, indicating that the distribution of this variable was nearly normal (see Table 3).

Table 4 Frequency of Serum Albumin Level* (N = 211)

Serum Albumin Level	**Total number (%) of patients**
Low (<42 g/l)	170 (80.6)
Normal (42-52 g/l)	40 (19)
High (>52 g/l)	1 (0.5)
Total	211 (100)

* = The first value in the first week of admission

Acute Confusional State

This study found that 16 (7.6%) older patients developed acute confusional state. The onset ranged from 1 to 9 days and most of the sample developed acute confusional state on the first to fifth day after admission. The age of the sample with acute confusional state ranged from 60 to 90 years with a mean of 73.3 years (SD = 8.3). In addition, the findings revealed that most of the sample (87.5%) of those with acute confusion (n = 14) had one episode of acute confusional state. Each episode ranged from 2 to 7 days with a mean of 3 (SD = 1.3) days. The majority of the sample with acute confusional state had hyperactive variants (68.7%). Characteristics of these subjects were restlessness, making frequent sudden changes of position, climbing on the bed, pulling out invasive tubes (e.g., nasogastric tube, intravenous fluid catheter, and foley's catheter), disorientation, misinterpretations, inability to remember persons or events in the hospital, rambling or irrelevant conversation, being easily distracted, and excessive daytime sleepiness with insomnia at night. Some older patients were restrained. Four older patients (25%) had hypoactive variants with characteristics of drowsiness. Only one older patient developed the mixed type (see Table 5)

Table 5 Characteristics of Acute Confusional State in Hospitalized Older Patients (n = 16)

Variables	Number	Percentage	Mean	SD	Min	Max
Incidence						
Yes	16	7.6				
No	195	92.4				
Onset 1st Day	5	31.3				
2nd Day	3	18.8				
3rd Day	3	18.8				
5th Day	2	12.5				
6th Day	1	6.3				
7th Day	1	6.3				
9th Day	1	6.3				

Table 5 Characteristics of Acute Confusional State in Hospitalized Older Patients (n = 16) (cont.)

Variables	Number	Percentage	Mean	SD	Min	Max
Age (years)			73.3	8.3	60	90
Episode						
Once	14	87.5				
Twice	2	12.5				
Length of acute confusional state			3.0	1.3	2	7
Motor Behavior Pattern						
Hyperactivity variant	11	68.7				
Hypoactive variant	4	25.0				
Mixed type	1	6.3				

The Number of Medications Used

Before admission, the subjects had taken prescribed medications ranged from 0 to 13 types with a mean of 4.57 (SD = 2.85). The distribution was positively skewed (.30), indicating that the subjects had taken few types of medications (see Table 3). One-hundred and sixteen (54.9%) of the sample had taken 1 to 5 medications before admission (see Table 6). The kurtosis value of the number of medications used (-.31) was nearly zero, which indicated that the distribution kurtosis was close to a normal curve (see Table 3). In addition, 91.5% of the subjects used medications prescribed by physicians and the others (8.5%) did not take any medications (see Table 6). The ten common medications used were aspirin (29.4%), simvastatin (23.2%), atenolol (18.5%), furosemide (16.6%), amlodipine (15.2%), folic acid (14.2%), enalapril (13.7%), calcium carbonate (10%), hydrochlorothiazide (8.1%), and vitamin B1-6-12 (7.1%) respectively.

Table 6 Frequency of the Number of Medications Used before Admission (N = 211)

The Number of Medications Used	Number (Percentage)
0	18 (8.5)
1-5	116 (54.9)
6-10	70 (33.2)
> 10	7 (3.4)
Total	211 (100)

Length of Hospital Stay

The length of hospital stay of the subjects ranged from 2 to 64 days with a mean of 10.1 days (SD = 8.76). The skewness coefficient of length of hospital stay (12.13) was severely positive (see Table 3), indicating that most of the subjects (72.5%) stayed in the hospital shorter than mean length of hospital stay (see Table 7). The kurtosis value of length of hospital stay (3.07) was large positive numbers, indicating a leptokurtic shape (see Table 3).

Table 7 Frequency of Length of Hospital Stay (N = 211)

Variable	Number	Percentage
Length of hospital stay		
≤ Mean LOS (10 days)	153	72.5
> Mean LOS (10 days)	58	27.5

When the data of the sample who stayed in a hospital longer than twice of standard deviation (17 days) were explored, the major characteristics of this group (n = 26, 12.32%) were as follows; The age range of this group was 60 to 102 years old with the mean age of 72.15 (SD = 9.23). All of them could reimbursement from government welfare and universal coverage scheme (30 Baht). The majority of them had at least one underlying disease (88.5%), which was hypertension (46.2%), followed by diabetes mellitus (26.9%), cardiovascular disease (19.2%), and pulmonary disease (11.5%) respectively. About half of them (53.8%) had taken more than three types of prescribed medications before this admission. Common active problems on

admission of this group were pneumonia, congestive heart failure, urinary tract infection, and alteration of conscious respectively. On admission, most of them (88.5%) had low serum albumin level. Six subjects (23.1%) developed acute confusional state during hospitalization (see Table 8).

Table 8 Characteristics of the Sample with Prolonged Length of Hospital Stay (LOS > 2 SD, 17 days) (n = 26)

Characteristics	Number	Percentage
Age (years)		
60-74	16	61.5
75-84	9	34.6
≥ 85	1	3.8
Method of payment for hospital charge		
Government welfare	16	61.5
Universal coverage scheme (30 Baht)	10	38.5
A number of known underlying diseases		
None	3	11.5
One	11	42.3
Two	5	19.2
Three	6	23.2
More than three	1	3.8
Underlying disease[a]		
Hypertension	12	46.2
Diabetes mellitus	7	26.9
Cardiovascular disease	5	19.2
Pulmonary disease	3	11.5
Serum albumin level		
Low (<42 g/l)	23	88.5
Normal (42-52 g/l)	3	11.5

a = occurrence of more than one disease

Table 8 Characteristics of the Sample with Prolonged Length of Hospital Stay (LOS > 2 SD, 17 days) (n = 26) (cont.)

Characteristics	Number	Percentage
The number of medications used		
0	3	11.5
1-3	9	34.6
> 3	14	53.8
Active problem on admission		
Pneumonia	5	19.2
Congestive heart failure	3	11.5
Urinary tract infection	3	11.5
Alteration of conscious	2	7.7
Upper GI bleeding	2	7.7
Septicemia	2	7.7
Seizure	2	7.7
Other (Chronic obstructive pulmonary disease, Acute diarrhea, Unstable angina, Syncope, Cerebrovascular accident, Hyponatremia, Hyperglycemia)	7	26.9
Acute confusional state		
No	20	76.9
Yes	6	23.1

Part II. Hypotheses Testing

To explore the relationship of the study variables and the length of hospital stay, Pearson's product-moment correlation coefficient was planned to answer the first and the second hypotheses. However, only some selected variables (age, severity of illness on admission, the number of medications used before admission, and serum albumin level) were normally distributed, whereas some study variables (functional ability on admission, acute confusional state, and length of hospital stay) were not normally

distributed. Thus, Spearman rank order correlation was used to examine the relationship of those variables and the length of hospital stay of older patients.

Hypothesis 1 There is a positive association of age, severity of illness, acute confusional state, and the number of medications used with the length of hospital stay of older patients.

Hypothesis 2 There is a negative association of functional ability and serum albumin level with the length of hospital stay of older patients.

In using the Spearman rank order correlation**,** the correlation between length of hospital stay and independent variables was showed in Table 9. Only three variables, functional ability on admission, acute confusional state, and serum albumin level supported the hypotheses. The results showed that functional ability on admission and serum albumin level had a weakly and negatively significant relationship to length of hospital stay ($r = -.30$, $p < .001$; $r = -.19$, $p < .01$ respectively), but acute confusional state had a weakly and positively significant relationship to length of hospital stay ($r = .27$, $p < .001$). Other variables including age, severity of illness, and the number of medications used had no statistical significance in the relationship with length of hospital stay ($r = -.01, .11, -.07$, $p > .05$ respectively).

According to the results, the data showed unexpected direction and/or no significance in the relationship between length of hospital stay and some variables such as age, severity of illness, and the number of medications used. Therefore, these two hypotheses are partially supported.

Table 9 Spearman Rank Order Correlation Matrix among the Studied Variables (N = 211)

Variables	1	2	3	4	5	6	7
1. age	1						
2. functional ability at admission	-.16*	1					
3. severity of illness	.05	-.21**	1				
4. serum albumin level	-.04	.21**	-.20**	1			
5. acute confusional state[a]	.02	-.23**	.16*	.06	1		
6. the number of medications used	.06	.06	.09	.04	-.05	1	
7. length of hospital stay	-.01	-.30***	.11	-.19**	.27***	-.07	1

*p <.05 **p <.01 ***p <.001

a = dummy code: with no acute confusional state = 0
with acute confusional state = 1

Hypothesis 3 Selected factors (age, functional ability, severity of illness, serum albumin level, acute confusional state, and the number of medications used) can mutually predict the length of hospital stay of older patients.

Multiple regression was used to answer the third hypothesis. In multiple regression analysis, the assumptions related to regression analysis were examined including:

1. Assumptions concerning residuals:

1.1 Normal distribution

"If the relationship is linear and the dependent variable is normally distributed for each value of the independent variable, then the distribution of the residuals should be approximately normal. This can be assessed by using a histogram of the standardized residuals" (Munro, 2001: 270). In this analysis, histogram showed the normal curve of the standardized residuals. For this study, the residual of total length of hospital stay was not perfectly normal distribution. However, the relationship between variables was more or less linear (see Appendix J, Figure 7). A log

transformation of the length of hospital stay could make the sum of the residual be nearly linear (see Appendix K, Figure 10). However, the equation with the log of the length of hospital stay was not practical and difficult to interpret the results. Transformation of variables could be exempt for practical use in the regression equation (Norusis, 1995: 458). Also, outliers were not deleted to meet this assumption because the distribution of data after deleted outliers was unchanged. Therefore, the original data were analyzed in the multiple regression and showed in this chapter. For transformation with lnLos (Log of Length of stay), multiple regression analysis and equations to predict the lnLos of older patients were showed in appendix L (Table 10).

1.2 Homoscedasticity

Homoscedasticity was tested by plotting the residuals against the predicted values and against the independent variables. For the assumption to be supported, "when the standardized predictor values are plotted against observe value, the data would form a straight line from the lower-left corner to the upper-right corner" (Munro, 2001: 273). The plotted values fall close to the line in normal probability plot. According to the testing, the data from the study met this assumption (see Appendix J, Figure 6).

1.3 Autocorrelations

The autocorrelations were examined using Dubin-Watson Statistical testing. Dubin-Watson value approaching 2 indicated the independence between residuals (Kanlaya Vanichbuncha, B. E. 2546: 340). In this study, the regression model revealed Dubin-Watson test statistics of 1.956 which indicated no autocorrelations problem.

2. Multicollinearity

To detect for multicollinearity, the correlation matrix was used to check for large correlation coefficients greater than .80 or .90 between independent variables (Munro, 1997). Moreover, the tolerance diagnostic procedure was performed. Tolerance is "the proportion of the variance in an independent variable that is not accounted for by the other independent variables" (Munro, 1997: 268). Tolerance value of zero indicates perfect collinearity. In addition, the "variance inflation factors" (VIFs) was used to detect multicollinearity problem. The VIFs is the reciprocal of tolerance. A small value of VIFs indicates a smaller problem of collinearity. Stevens (1996) suggested

that if the VIF exceeds 10, it should be a concern. In this analysis, no correlation coefficient between independent variables was greater than .80 or .90. Also, tolerance value of independent variables ranged from .86 to .98 and VIF values ranged from 1.02 to 1.16 Therefore, multicollinearity among the predictors was not a problem for this study.

In conclusion, there were no serious violations of assumptions for regression. Therefore, the data were appropriate for regression analysis.

Multiple regression analysis by the Enter method provided the best prediction of length of hospital stay of medical older patients. All predictor variables including age, functional ability on admission, severity of illness on admission, serum albumin level in the first week of admission, acute confusional state in the first week of admission, and the number of medications used before admission could explain 15% of the variance in length of hospital stay of medical older patients ($F = 5.87$, $p < .001$) (see Table 11).

Table 11 Multiple Regression by the Enter Method in Predicting Length of Hospital Stay of Older Patients (N = 211)

Variables	**b**	**SE**	**Beta (β)**	**t**
Age	-.10	.08	-.09	-1.40
Functional ability on admission	-.18	.05	-.27	-3.91**
Severity of illness	.02	.10	.02	.22
Serum albumin level	-.003	.10	-.002	-.03
Acute confusional state[a]	6.91	2.26	.20	3.05*
The number of medications used	-.21	.20	-.07	-1.04

Constant (a) = 21.22, **Multiple R** = .38, $\mathbf{R^2}$ = .15, $\mathbf{R^2adj}$ = .12,
SEE = 8.21, $\mathbf{F_{(6,204)}}$ = 5.87**

*p <.01 **p <.001

a = in the first week of hospitalization (n = 15)

In this study, the hierarchical method used to analyze the sets of significant and non-significant variables in order to clarify the predictive power of these variables. The set of significant variables was first entered into the equation. Then, to test an indirect effect of the non-significant variables to the length of hospital stay, these variables were additionally entered to the equation. The significant variables, which were functional ability, acute confusional state, and serum albumin level, could predict 13% (12% adjusted) of the variance in length of hospital stay. The other non-significant variables, which were age, severity of illness, and the number of medications used, could account for an additional 2% of the variance in length of hospital stay. In this predictive analysis, functional ability on admission emerged as the strongest predictor followed by acute confusional state ($\beta = -.27$, $p < .001$; $\beta = .20$, $p < .01$ respectively) (see Table 12). The predictive equations were as follows:

Unstandardized Score Equations to predict length of hospital stay of older patients

Predicted Length of hospital stay = 21.22 - .18 (Functional ability on admission) + 6.91 (Acute confusional state) - .10 (Age) - .21 (The number of medications used) + .02 (Severity of illness) - .003 (Serum albumin level)

Standardized Score Equations to predict length of hospital stay of older patients

Z Predicted Length of hospital stay = - .27 Z (Functional ability on admission) + .20 Z (Acute confusional state) - .09 Z (Age) - .07 Z (The number of medications used) + .02 Z (Severity of illness) - .002 Z (Serum albumin level)

Table 12 Multiple Regression by the Hierarchical Method in Predicting Length of Hospital Stay of Older Patients (N = 211)

Model	Variables	b	R^2	R^2 change	F change	β	t
1	(constant)	13.10					3.94**
	Functional ability on admission	-.17	.13	.13	10.70**	-.26	-3.94**
	Acute confusional state[a]	6.94				.20	3.08*
	Serum albumin level	-.01				-.004	-.06
2	(constant)	21.22					3.09*
	Functional ability on admission	-.18	.15	.02	1.03	-.27	-3.91**
	Acute confusional state[a]	6.91				.20	3.05*
	Serum albumin level	-.003				-.002	-.03
	Age	-.10				-.09	-1.37
	The number of medications used	-.21				-.07	-1.04
	Severity of illness	.02				.02	.22

Constant (a) = 21.22, **Multiple R** = .38, R^2 = .15, R^2**adj** = .12, **SEE** = 8.21, **Overall F** = 5.87**

*p <.01 **p <.001

a = in the first week of hospitalization (n = 15)

Summary

Descriptive and inferential statistics were used to analyze the data. According to result of the bivariate analysis with Spearman rank order correlation, it demonstrated that functional ability on admission, acute confusional state, and serum albumin level were significantly negatively, related to length of hospital stay of medical older patients. However, other variables including age, severity of illness, and the number of medications used did not have significant relationships with the length of hospital stay.

For predicting length of hospital stay of medical older patients, multiple regression analysis by the Enter method was used to analyze the data. All independent variables as incorporated predictors of length of hospital stay could explain 15% of the variance in length of hospital stay of medical older patients. Although these factors contributed to the regression analysis, the strongest predictor of the length of hospital stay of medical older patients was functional ability on admission.

CHAPTER V
DISCUSSION

This chapter presents a discussion of the findings in three parts as follows: 1) descriptions of demographic characteristics of the sample; 2) descriptions of major variables including the relationships of major variables (age, functional ability, severity of illness, serum albumin level, acute confusional state, and the number of medications used) and length of hospital stay; and 3) explanation regarding variables that could predict length of hospital stay of medical older patients.

Characteristics of the Sample

The sample consisted of 211 medical older patients; most of the subjects were male. The age ranged between 60 and 102 years with a mean age of 72.64. The study population were categorized as followings: 60-74 years (young-old group), 58.3%; 75-84 years (middle-old group), 36.5%; and older than 85 years (old-old group), 5.2%. Most of the subjects were married (66.4%) and lived with their spouse and children (58.8%). A higher percentage of women than men in this study were widows. This finding is consistent with previous research among Thai older adults (Jitapunkul & Bunnag, 1998). Moreover, 33.2% of the study sample lived with their children and relatives, which indicates that some Thai people still had extended family. About eight percent of older adult lived with their spouse or lived alone because they lived in up-country and had children who worked in another place or their children lived in another house, but in the same area. For the educational level, 68.3% of the sample graduated from primary school. The study of the National Statistical Office (NSO) (B. E. 2543) also revealed that most older adults were in primary educational level. For occupation, 70.6% of the subjects were unemployed because of the social norm that older adults should rest, stay at home, and it is the time for the adult children to take care of their parents. Most patients (79.6%) received living stipend from their sons/daughters and/or their spouse. The majority (70.1%) of the subjects obtained

reimbursement for medical expenses from the government. With these resources, 83.9% of the subjects perceived that they had sufficient financial support because most of their living expenses were for medical services.

Regarding to health status, 94.3% of the subjects had at least one chronic disease. This is consistent with the study of Napaporn Chayowan and John Nodel (B. E. 2539) that older adults (age >65 years) would have one or more illnesses, but if the age was higher than 80 years, they would have at least 3 chronic illnesses. Most common of chronic diseases among these subjects were the same as that in the report of Ebersole and Besdine (1992) and the data from a national survey of the elderly in Thailand by Jitapunkul and Bunnag (1998). These illnesses were hypertension, diabetes mellitus, and cardiovascular disease. It is not surprising because two or more of these diseases may occur simultaneously. The finding that approximately (55.9%) were hospitalized last year suggested that they might not be able to well withstand complications associated with their underlying diseases.

In this study, the mean length of hospital stay of the sample was 10 days, which was two days fewer than that last year (Ramathibodi Statistics, B. E. 2547). Most of the sample stayed in the hospital shorter than 10 days. It indicated that they could recover from their illnesses in a short time. It was possible that most subjects in this study had not severe illness at admission and their functional ability did not greatly decline at admission

Descriptions of Major Variables including the Relationships among Major Variables and Length of Hospital Stay of Medical Older Patients

Hypothesis 1: Age, severity of illness, acute confusional state, and the number of medications used are positively related to length of hospital stay of medical older patients.

Age

The number of subjects is not equal in each group of age because data collection was not stratified by age, but was conducted in the real situation of admission at that time. The old-old age group and middle-old age group had fewer amounts than young-

old age group. Therefore, characteristics of young-old age group were representative of this sample.

It was not surprising that age was not significantly related to length of hospital stay, which did not support the hypothesis. A possible reason for this finding is that most of the sample were in young-old age group. In addition, most of them did not have severe illness, but had a little decline of functional ability at admission. When active problems were solved, these subjects tended to early recover. The study found that 153 (72.5%) out of 211 older patients were discharged within 10 days (mean of length of hospital stay = 10 days). This finding contradicts to several previous studies (Maguire et al., 1986; Marchettc & Holloman, 1986; Narain et al., 1988; Stearns, 1991; Thamprechavai et al., 1992; Vik, 1993), which stated that length of hospital stay tended to increase with patient's age. It is possible that the sample of these studies had the large number of middle-old and old-old age group more than this study. However, it is consistent with other studies (Posner & Lin, 1975; Reiley & Howard, 1995), which reported that age did not have effect on length of hospital stay. Perhaps, the relationship between age and length of hospital stay depends on the nature of the population and setting or age alone is probably not an independent factor for prolonged hospitalization.

Severity of Illness

Overall severity of illness of this sample was not severe illness when assessed by the APACHE II at admission. Subjects who had high score of the APACHE II would have abnormality of multiple physiologic variables including temperature, mean arterial pressure, heart rate, respiratory rate, oxygenation, aterial pH, serum sodium, serum potassium, serum creatinine, hematocrit, white blood cell, and the Glasgow-coma score. It is logical finding that mean score of severity of illness in critical care settings was higher than general wards. However, the score of severity of illness of both settings were not much different. Possibly, these values of the physiologic variables were not changed to abnormal scores at admission. Although, the score of the APACHE II at admission indicated that the sample had less severity of illness, there were 10 subjects excluded from this study because of death. It indicated that the score of severity of illness may be changed to higher degree during hospitalization.

This finding is guiding that severity of illness should be assessed not only at admission to provide a suitable resource of treatment, but also during hospitalization to evaluate outcomes from treatment. In addition, a low degree of severity of illness at admission may reflect good self-care of the patients as they can detect abnormal signs of presenting illness and early decide to see a physician before severely ill. Perhaps, this phenomenon is a better sign for health care services than that when patients are admitted with a high score of severity of illness at admission.

In this study, the severity of illness was not significantly related to length of hospital stay. Possibly, this study included the majority of subjects in general wards which were too homogenous of severity of illness. Therefore, the variance of severity of illness may not be enough to detect significance of this relationship. Maybe, adding more number of subjects in critical care settings may increase the variance of severity of illness. This result is not consistent with the study of Pompei and colleagues (1991) because their study included the sample with severely ill.

Acute Confusional State

The incidence of acute confusional state in this study of was 7.6% (n = 16), which was lower than that in the studies of Field et al. (1986), Foreman (1989), Francis et al. (1990), and Rockwood (1989). The incidence of acute confusional state was 20-40% in those studies. Several sample's characteristics that possibly contributed a relatively low incidence of acute confusional state in this study could explain as follows. Firstly, the sample had a small number of the old-old (over 85) age, who has been found to have a higher risk of developing acute confusional state (Levkoff et al., 1992; Williams et al., 1985). Advance age is a predictive factor of acute confusional state (Inouye & Charpentier, 1996). It results in physiological changes of normal aging process, causing older adults unable to tolerate various stresses. Host defense in advanced age has changed, causing increasing risk of infection. Changes of body compositions, function of liver and renal, as well as level of serum albumin affect change of pharmacokinetic of drugs including using multiple drugs, which increases risk of drug toxicity. Secondly, functional assessment revealed a moderate to high level of independence for most subjects while hospitalized, which is implied that cognitive function of the sample was rather intact and they did not have severe illness.

The literature supports that persons who have cognitive dysfunction and severe illness are at risk of functional decline (Kresevic & Mezey, 1997) and acute confusional state (Inouye, 1999). The cognitive dysfunction predisposing to acute confusional state is central nervous system diseases, especially dementia whereas the characteristics of severity of illness in medical patients causing acute confusional state include electrolyte abnormalities or metabolic disturbance, infection, hepatic or renal dysfunction, and pain (Inouye & Charpentier, 1996; Rummans, Evan, Krahn, & Fleming, 1995). Thirdly, sensory status was relatively good for the majority of subjects in this study: 74.4% reported no visual impairment; 88.2% reported no hearing impairment. Sensory capacity is essential to cognitive function (Kresevic & Mezey, 1997). Finally, the study was conducted in the difference of nature, environment, and lengths of data collection. Most of those studies had spent for one to two years, while this research spent for four months.

In this study, although the number of the sample who developed acute confusion was outstandingly less than those without acute confusion, they were significantly related to prolonged length of hospital stay. When the sample with acute confusional state was further explored into details, abnormal factors associated with acute confusion were found. The abnormal factors included infection, electrolyte and metabolic disturbance (e.g., hyponatremia, hypokalemia, hypercalcium, and hyperglycemia) genitourinary conditions (e.g., uremia), cardiopulmonary conditions (e.g., hypoxia), gastrointestinal conditions (e.g., hepatic encephalopathy), neurological conditions (e.g., stroke and dementia), multiple medications used, and low serum albumin level. These abnormal findings are consistent with the etiologic factors of acute confusional state in the studies of Lipowski (1989) and Rummans, Evan, Krahn, and Fleming (1995), indicating that these abnormal factors should be concerned for primary prevention, early detection, and effective management.

Acute confusional state was significantly positive correlation with length of hospital stay. This result is similar to that in the study of Francis and Kapoor (1992), Inouye et al. (1998), Levkoff et al. (1992), Pompei et al. (1995), Stevens, Moore, and Simpson (1998), and Thomas, Cameron, and Fahs (1988), which found that patients with acute confusional state had longer length of hospital stay than those without such

condition. In this study, although 31.3% of patients with acute confusional state could be early resolved and discharged, most of older patients who developed acute confusional state (68.7%) around first week of admission tended to have prolonged hospitalization. A possible explanation is that patients with acute confusional state, who take time to recover, are associated with higher rate of complications, and increased dependency rate. Existing studies (Lipowski, 1989; Rummans et al., 1995) reported that patients with acute confusion had low functional ability because of medical conditions including primary intracranial disease, systemic disease secondary affecting the brain, exogenous toxic agents, and substance withdrawal. For example, cardiopulmonary conditions such as hypoxemia and hypercapnia in older patients with congestive heart failure and chronic obstructive pulmonary disease and fever from infections cause patients fatigue, leading to a dependent person or morbidity. Patients with immobility result in many complications such as pressure sore, pulmonary complication, disuse atrophy of muscle, or contracture of joints. Additionally, causes of developing acute confusion in elder patients were complex. It is possible that patients with acute confusion may be fully recovered. However, the recovery process will take a long time, which cause the patients to stay in a hospital longer than patients without acute confusion.

The Number of Medications Used

According to this study, most of the subjects had taken at least one prescribed medication before admission, reflecting the fact that they had underlying diseases and their diseases were under control of a physician. However, some subjects did not take any medication because they had no underlying disease and never been previously hospitalized. Some of them evaluated themselves that they were really healthy. This is consistent with the report of Jitapunkul and Bunnag (1998) that Thai older adults are less likely to see a physician as long as they feel well and can work. From the interview, when the subjects felt uncomfortable from a minor illness, they would treat themselves using over-the-counter medications.

In this study, the mean length of hospital stay of patients who had been taking more than three types of medications was 8.8 days. In contrast, patients who had been taking three and less than three types of medications stayed 10.9 days on average.

Therefore, the number of medications used was not significantly related to length of hospital stay. A possible explanation is that patients who have not been taking multiple medications may actually have at least an unrecognized illness that may be associated with complications. Once they were admitted, they could have more severe illness during hospitalization. The insignificant result is not consistent with the study of Smythe et al. (1993) because they selected medication used during admission as a predictor whereas this study used the number of medication before admission. Possibly, inpatients received medication treatment both number of types and dosage more than outpatients, as a result, medications use during hospitalization causes a higher risk of adverse drug reactions, which may affects a longer length of hospital stay.

In summary, only one variable, which is acute confusional state, supports the first hypothesis that it has a positively significant relationship with length of hospital stay of medical older patients in Ramathibodi Hospital. However, other variables in this hypothesis were not significantly related to length of hospital stay and they did not support this hypothesis. In this study, age and the number of medications used have a negative correlation with length of hospital stay whereas severity of illness has a positive relationship with length of hospital stay.

Hypothesis 2: Functional ability and serum albumin level are negatively related to length of hospital stay of older patients.

Functional Ability

The majority of older patients in this study were capable of performing routine daily activities because they were relatively young. However, most of the sample were more dependent on basic activities of daily living at the time of admission such as bathing, dressing, feeding, toilet use, transferring, and mobility. These findings are consistent with previous studies (Hirch et al., 1990; McVey, Becker, Saltz, Fenssner, & Cohen, 1989; Viriya sumprathanugul, B. E. 2542) that decline in functional ability of older adults could be found in the first day of admission. In addition, hospitalization, which are bed rest, medical treatments and enforced immobilization

(e.g., intravenous line, ventilator, catheters, etc.) may result in further functional decline in these patients. When the active problems were resolved, the functional ability recovered as shown in this study that most of the subjects returned to baseline function before admission. However, some subjects were discharged with worse functional ability at discharge compared to that before admission. This finding indicated that nursing activities to maximize the physical functioning and prevent or minimize decline in ADL function should be promoted.

Functional ability at admission was the strongest variable that determined the length of hospital stay because it showed the largest coefficient of the total effect. The results indicated that older patients who had low functional ability at admission would have long lengths of hospital stay, which was consistent with findings of previous studies (Narain et al., 1988; Pompei et al., 1991; Reiley and Howard, 1995; Rubenstein et al., 1984). The literature supported that functional decline affects long lengths of hospital stay because it relates to burden of illness (Davis, Iezzoni, Phillips, Reiley, Coffman, & Safran, 1995), which results in many complications taking longer time to recover such as pressure sores, dehydration, malnutrition, pneumonia, urinary incontinence, urinary tract infection, confusion, fall, muscle weakness and joint stiffness (Creditor, 1993). Although it is difficult to avoid the functional decline in hospitalization, it is possible to reduce functional disability affecting length of hospital stay because complications unrelated their illness at admission could be prevented or minimized by effective nursing care. Therefore, treatment, rehabilitation and other strategies for improving the individual's function, and preventing progression of functional ability deterioration should be included in the model of care.

Serum Albumin Level

The study revealed that length of hospital stay was significantly inversely related to serum albumin level at early admission. This finding showed that most of the sample were hypoalbuminemia (<42 g/l) around admission. Hypoalbuminemia is a marker of malnutrition (Ferguson et al., 1993) and theoretically, albumin is normally degraded slowly with a half-life of approximately three weeks (Henderson, 1988). Thus, it is implied that most of the subjects had poor nutrition before admission. This

finding supports the report of Jitapunkul and Bunnag (1998) that malnutrition is an important problem in Thai older adults.

The older patients with low serum albumin level around admission were projected to have a slow rate of recovery. In this study, lengths of hospital stay were longer in the subjects with low serum albumin level than those with normal levels. The results of this study are consistent with that of several studies (Chima et al., 1997; Herrmann et al., 1992; Marinella & Markert, 1998; Messner et al., 1991), which reported that hypoalbuminemia is associated with prolonged length of hospital stay in medical patients. Nonetheless, this study revealed that serum albumin level was weakly related to length of hospital stay. Possibly, most of the subjects had a little decline of serum albumin level, which may slightly affect the recovery process. If the study included more subjects with severe hypoalbuminemia, the relationship between serum albumin level and length of hospital stay may be more related. In addition, albumin levels can be declined in the presence of many illnesses (Anderson et al., 1984). Thus, during admission, serum albumin levels tended to decrease further, indicating that preparation to improve nutritional status in daily life of elder adults may prevent severe hypoalbuminemia when they get ill and enhance the efficiency of a recovery process.

In summary, both the functional ability at admission and the serum albumin level support the second hypothesis that they have a statistically significant negative correlation with length of hospital stay.

In overall, the bivariate relationships among variables as hypothesized were supported, except for the relationship of age, severity of illness, and the number of medications used with length of hospital stay.

Variables that Could Predict Length of Hospital Stay of Medical Older Patients

Hypothesis 3: Age, functional ability, severity of illness, serum albumin level, acute confusional state, and the number of medications used can mutually predict the length of hospital stay of medical older patients.

According to multiple regression analysis, age, functional ability on admission, severity of illness at admission, serum albumin level within the first week of admission, acute confusional state in the first week of hospitalization, and the number of medications used before admission accounted for 15% of the variance in length of hospital stay. Functional ability at admission emerged as a significant predictor of length of hospital stay followed by acute confusional state in the first week of hospitalization. The finding revealed that functional decline at admission is an important predictor of length of hospital stay of medical older patients. Loss of independence may increase risk of developing complications (e.g., infection, muscle weakness, joint stiffness, pressure sore, etc.), which may take more time to cure and recover, leading to delayed discharge.

Patients with acute confusion also prolonged hospitalization because etiological factors are complicated and its symptoms may induce many complications, causing illness burden. The finding showed that the onset of developing acute confusion was in the first week of hospitalization. It indicated that predisposing factors inducing acute confusion were severe abnormality in this period of time. To reduce the incidence of acute confusion state during hospitalization, health care staff should not ignore and should place importance on appropriate planning and the effective intervention to prevent, reduce, and manage acute confusional state since admission.

Age, severity of illness, serum albumin level, and the number of medications used were the small extent predictors in length of hospital stay. This finding may explain that the sample included in this study may have less heterogeneous variance in each predictive variables to disentangle the complicated relationships between the variables and the length of hospital stay.

However, eighty-five percent of the variation in length of hospital stay may be predicted by variables outside of this study, indicating that there might be other variables associated with length of hospital stay of medical older patients in Ramathibodi Hospital such as number of complications, diagnosis, nurses'discharge planning, delays in hospital procedures, rate of recovery, and staffing.

CHAPTER VI
CONCLUSION

The conclusion of this study is presented as follows: summary of the study, recommendations for nursing practice, recommendations for future study, and limitations of the study.

Summary of the Study

This study was a prospective correlational research design aimed at studying the possibility that the selected variables (age, functional ability, severity of illness, serum albumin level, acute confusional state, and the number of medications used) may be able to predict the length of hospital stay of medical older patients in Ramathibodi Hospital. The subjects were older adults, aged 60 and older, who were admitted to three general wards, one intermediate ward, and two medical intensive wards of Ramathibodi Hospital. Data were collected between May and August 2005. Two hundred and thirty older patients were recruited for this study by purposive sampling. According to the excluded criteria, nineteen older patients were excluded from the study. Therefore, 211 older patients were eligible for this study. Seven instruments were used in the study: 1) The Demographic Data Form, 2) The Number of Medications Record Form, 3) The Serum Albumin Level Record Form, 4) The Length of Hospital Stay Record Form, 5) Yamvong's Modified Barthel ADL Index, 6) The Acute Physiologic and Chronic Health Evaluation II (APACHE II), and 7) The Thai Version of the Confusional Assessment Method. The inter-rater reliability was tested by the researcher and two assistants in the group of ten older patients, which had similar characteristics to the sample of this study for Yamvong's Modified Barthel ADL Index, the APACHE II, and the Thai Version of the Confusional Assessment Method with a coefficient of .80, .90, and .90 respectively. All subjects were assessed within 24 hours of admission and they would be followed up daily until hospital

discharge. The data were analyzed by the Statistical Package of Social Science for Windows Program (SPSS/FW version 11.5) in terms of frequency, percentage, range, mean, standard deviation, Spearman rank order correlation, and multiple regression analysis by the Enter method. The results could be summarized as follows.

1. Demographic Data

Data analysis were done on 211 older patients with 94 females (44.5%) and 117 males (55.5%), with the age ranging from 60 to 102 years and the mean age of 72.64 years (SD = 7.70). The majority of the subjects graduated from primary school (68.3%), were unemployed (70.6%), were married (66.4%), and lived with their spouse and sons/daughters (58.8%). In terms of income, the majority of the subjects earned income from their children and spouse (79.6%), reported sufficient income (83.9%), and could obtain reimbursement for medical expenses from the government (70.1%). Most subjects (92.4%) could return to their home after discharged. Regarding health status, almost all of them (94.3%) had underlying diseases. The number of chronic diseases ranged form 0 to 6 (Mean = 2.31, SD = 1.33). Most common diseases among the sample were hypertension (56.4%), diabetes mellitus (38.9%), and cardiovascular disease (32.2%). On admission, the majority of active problems were congestive heart failure (13.7%), followed by pneumonia (12.8%), cerebrovascular accident, and acute febrile illness (8.1% each). Of the total, 118 (55.9%) had previous admission within one year.

2. The variables of the study

2.1. The scores of functional ability at one-month before admission, on admission, and at discharge from the hospital ranged form 0 to 36 with a mean of 31.86 (SD = 9.74), 19.17 (SD = 13.43), and 27.94 (SD = 12.51) respectively. In addition, the findings revealed that 15.6% of the sample, who were independent before admission remained stable, whereas 84.4% of the sample had functional decline during hospitalization. Patients who had functional decline on admission could recover (47.9%), whereas 36% of the sample could not recover and 0.5% had further functional decline. Almost two-thirds of the sample could discharge with baseline

function prior to admission. On admission, most of the sample were dependent in activities as follows: bathing, dressing, feeding, toilet use, transfer, and mobility.

2.2. The range of scores on the severity of illness measured by the APACHE II was 1 to 35 with a mean of 11.71 (SD = 5.86). Severity of illness in general wards was less than critical wards, with a mean score of 10.1 and 14.8 respectively.

2.3. The level of serum albumin around admission, which was measured on the first day of admission, most of the sample (90.5%) ranged from 19.5-52.6 g/l, with a mean of 36.41 g/l (SD = 6.38). Of the subjects, 80.6% had serum albumin level lower than normal range (42-52 g/l).

2.4. Sixteen (7.6%) of the sample developed acute confusional state. The onset ranged from 1st to 9th days after admission. The age of the subjects with acute confusional state ranged from 60 to 90 years with a mean age of 73.3 years (SD = 8.3). Most subjects with acute confusional state (87.5%) had one episode of acute confusion. Each episode ranged from 2 to 7 days with a mean of 3 days (SD = 1.3). The majority of the subjects with acute confusional state had hyperactive variants (68.7%).

2.5. The number of medications that the sample has taken before admission ranged from 0 to 13 types with a mean of 4.57 types (SD = 2.85). Almost all of the sample (91.5%) used prescribed drugs. Most common of medications used were aspirin (29.4%), simvastatin (23.2%), atenolol (18.5%), furosemide (16.6%), and amlodipine (15.2%).

2.6. The length of hospital stay of the sample ranged from 2 to 64 days with a mean of 10.1 days (SD = 8.76). There were 26 subjects (12.32%) stayed in the hospital longer than 2SD (17 days). The major characteristics of this group were as follows. The age range of this group was 60 to 102 years old with the mean age of 72.15 (SD = 9.23). All of them could reimbursement from government welfare and Universal Coverage scheme (30 Baht). The majority of them had at least one underlying disease (88.5%), which was hypertension (46.2%) followed by diabetes mellitus (26.9%), cardiovascular disease (19.2%), and pulmonary disease (11.5%) respectively. About half of them (53.8%) had taken more than three types of prescribed medications before this admission. Common active problems on admission

of this group were pneumonia, congestive heart failure, urinary tract infection, and alteration of consciousness respectively. On admission, most of them (88.5%) had low serum albumin level. Six subjects (23.1%) developed acute confusional state during hospitalization.

3. Factors associated with length of hospital stay

3.1 The functional ability on admission and serum albumin level had a weakly significant and negative relationship to length of hospital stay ($r = -.30$, $p < .001$; $r = -.19$, $p < .01$ respectively).

3.2 Acute confusional state had a weakly significant and positive relationship to length of hospital stay ($r = .27$, $p < .001$).

3.3 Age, severity of illness, and the number of medications used were not significantly associated with length of hospital stay ($r = -.01, .11, -.07$, $p > .05$ respectively).

4. The prediction of length of hospital stay

The prediction of length of hospital stay of medical older patients was analyzed by multiple regression with the Enter method. Age, functional ability on admission, severity of illness on admission, serum albumin level within the first week of hospitalization, acute confusional state in the first week of hospitalization and the number of medications used for one month before admission could jointly explain 15% of the variance in length of hospital stay of medical older patients ($F = 5.87$, $p < .001$). Functional ability on admission emerged as the strongest predictor of length of hospital stay followed by acute confusional state ($\beta = -.27, .20$ respectively, at $p < .001$, $p < .01$ respectively).

Recommendations for Nursing Practice

The model to predict length of hospital stay of medical older patients from this study may provide information to better understand what factors might contribute to the ability to engage in shortened length of hospital stay. However, the findings reflect that loss of functional independence on admission, developing acute confusional state

in the first week of hospitalization, and low level of serum albumin were significantly associated with the prolonged length of hospital stay of medical older patients. To shorten length of hospital stay of medical older patients, the following recommendations should be considered.

1. The daily nursing assessment of ability to perform bathing, dressing, grooming, eating, toileting, continence, transferring, and ambulation during routine nursing care yielded information necessary for maintenance of function in self-care activities (Landefeld, Palmer, Kresevic, Fortinsky, & Kowal, 1995). Therefore, nurses need to assess the ability of a patient to perform activities of daily living (ADLs) in context of the patient's baseline functional status and hospitalization status. Also, function should be assessed over time to validate capacity, decline, or progress. In addition, nursing care protocol should be designed to assist bedside nurses to monitor function in individual elders such as use of a standardized functional assessment instrument to assess elders' functional status by direct observation during routine care and through information gathered from the elder, the family, and long-term caregivers. In this study, most subjects had dependent activities such as bathing, dressing, feeding, toilet use, transfer, and mobility during admission. Importantly, any decrease in functional status should prompt an immediate search for underlying causes. Then, promoting patients' and families' participation in activities of daily living should be early started (Suwanee Mahakayanun, B. E. 2538; Chavalee Yamvong, B. E. 2538) to help individuals regain baseline function after acute illnesses by using exercise, physical therapy consultation, and increasing nutrition. These activities such as routine exercise, range of motion, and ambulation to maintain activity, flexibility, and function should be included in nursing care plan to prevent or minimize decline in ADL function and to maintain and maximize the physical function of elders during acute hospitalization.

2. In this study, although only 7.6% of the sample developed acute confusion during hospitalization, older patients are at risk group of acute confusional state. Especially, the findings showed that the incidence of acute confusional state in the first week of hospitalization was associated with increased length of hospital stay. To reduce the incidence of acute confusion, the development of strategies to prevent acute confusion is the best way (Inouye et al., 1999). It should be started with the education

of nurses on how to decrease the risk of acute confusion among older patients since admission. The non-detection of delirium does lead to poorer outcomes, but can be improved with the implementation of educational programs (Rockwood et al., 1944). In addition, how to detect its early signs and symptoms combined with development of intervention protocols that emphasize the nonpharmacologic intervention for prevention and management of acute confusional state in hospitalized older patients should be initiated. For instance, nurses should increase recognition to detect the precipitating factors of acute confusion and set protocols to deal with six risk factors (Inouye, 1999): cognitive impairment, sleep deprivation, immobility, visual impairment, hearing impairment, and dehydration on admission for older patients not admitted with acute confusion. If it is possible, older patients and their families should be promoted to participate in a protocol. Moreover, the findings of this study found that most older patients with acute confusional state had infection, hypoxemia, metabolic and electrolyte imbalance, history of using prescribed medications more than three types and these medications including analgesics and histamine H_2-receptor antagonists groups, which were pharmacological agents of acute confusional state, indicating these factors should also be concerned.

3. Hypoalbuminemia is a marker of poor nutrition status and underlying systemic disease (Sacher & McPherson, 1991). Possibly, the presence of low serum albumin level of older patients at admission results from malnutrition since their homes. Therefore, nutritional status in elders should be promoted before admission. Hypoalbuminemia is associated with several easily assessed factors such as sociodemographic factors, gastrointestinal diseases and symptoms, dental problems, lifestyle factors, and specific diseases and symptoms (Reuben, Moore, Damesyn, Keeler, Harrison, & Greendale, 1997). This information might be valuable items to include in health promotion programs among community-dwelling older people to improve their nutrition status.

Recommendations for Further Research

1. It was found that age, functional ability on admission, severity of illness, serum albumin level, acute confusional state, and the number of medications used

could jointly explain 15% of the variance in length of hospital stay of older patients in medical care settings. The further study should include more variables other than patients' factors such as the structure and process factors of care delivery to predict the length of hospital stay of medical older patients. Also, the next research should design to prevent the homogeneity of variance of each variable to find significance.

2. The future study should be done to validate this model in examining the factors that contribute to the length of hospital stay of medical older patients in the different settings, but have similar characteristics to make more generalization.

Limitations of the Study

The subjects were purposively selected from medical wards of Ramathibodi Hospital. It may not be applied to older patients in other hospitals, which had different characteristics and contexts, nor in other departments such as surgical, orthopedics, and so on.

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APPENDIX

APPENDIX A

List of Experts

There were three qualified persons who examined the validity of the Thai Version of the Confusional Assessment Method.

1. Assoc. Prof. Prakong Intarasombat, R.N., M.Ed. (Nursing Administration)
   Department of Nursing, Faculty of Medicine, Ramathibodi Hospital, Mahidol University.

2. Assist. Prof. Chavalee Yamwong, R.N., M.S.N.
   Department of Nursing, Faculty of Medicine, Ramathibodi Hospital, Mahidol University.

3. Lecturer Sirintorn Chansirikarnjana, M.D., M.Sc. (Geriatric Medicine)
   Faculty of Medicine, Ramathibodi Hospital, Mahidol University.

APPENDIX B

หนังสือชี้แจงโครงการวิจัยและตอบรับเข้าร่วมการวิจัย

ชื่อโครงการ ปัจจัยทำนายจำนวนวันนอนโรงพยาบาลของผู้ป่วยสูงอายุที่เข้ารับการรักษาในแผนกอายุรกรรม โรงพยาบาลรามาธิบดี

วัตถุประสงค์

1. ศึกษาความสัมพันธ์ระหว่างอายุ ความสามารถในการทำหน้าที่ ความรุนแรงของความเจ็บป่วย ระดับอัลบูมินในเลือด ภาวะสับสนเฉียบพลัน และจำนวนชนิดของยาที่ใช้ กับจำนวนวันนอนโรงพยาบาลของผู้ป่วยสูงอายุ

2. ศึกษาความสามารถของตัวแปรคัดสรร (อายุ ความสามารถในการทำหน้าที่ ความรุนแรงของความเจ็บป่วย ระดับอัลบูมินในเลือด ภาวะสับสนเฉียบพลัน และจำนวนชนิดของยาที่ใช้) ในการร่วมกันทำนายจำนวนวันนอนโรงพยาบาลของผู้ป่วยสูงอายุ

เหตุผลที่เชิญชวนให้ท่านเข้าร่วมโครงการวิจัย

ดิฉันชื่อ นุชนาฏ แจ้งสว่าง เป็นนักศึกษาระดับปริญญาโท สาขาการพยาบาลผู้ใหญ่ คณะแพทยศาสตร์โรงพยาบาลรามาธิบดี มหาวิทยาลัยมหิดล ใคร่ขอความร่วมมือจากท่านให้ผู้วิจัย/ผู้ช่วยวิจัยบันทึกประวัติการรักษา สอบถาม สังเกต และประเมินข้อมูลเกี่ยวกับปัจจัยที่ผู้วิจัยคาดว่าจะมีอิทธิพลต่อระยะเวลาการนอนโรงพยาบาลของผู้ป่วยสูงอายุ การศึกษาครั้งนี้เป็นส่วนหนึ่งของงานวิจัยเพื่อทำวิทยานิพนธ์ระดับปริญญาโทซึ่งดิฉันกำลังศึกษาอยู่ การศึกษานี้จะทำให้ดิฉันได้เรียนรู้ปัจจัยที่มีอิทธิพลต่อจำนวนวันนอนโรงพยาบาลของผู้ป่วยสูงอายุที่เข้ารับการรักษาในแผนกอายุรกรรมของโรงพยาบาลรามาธิบดี เพื่อที่จะสามารถทำนายจำนวนวันนอนโรงพยาบาลของผู้ป่วยสูงอายุได้ และเป็นแนวทางในการคิดวิธีการที่จะลดจำนวนวันนอนโรงพยาบาลของผู้ป่วยสูงอายุที่มีแนวโน้มของการนอนโรงพยาบาลนานต่อไป ท่านเป็นผู้หนึ่งในจำนวนผู้ป่วยสูงอายุที่เข้ารับการรักษาในแผนกอายุรกรรมของโรงพยาบาลรามาธิบดี ประมาณ 230 คน ที่ได้รับการคัดเลือกแบบเฉพาะเจาะจงให้เข้าร่วมในการศึกษาครั้งนี้ เนื่องจากท่านมีอายุในเกณฑ์ 60 ปีขึ้นไป และเป็นผู้ป่วยที่รับใหม่ที่เข้ารับการรักษาในแผนกอายุรกรรมของโรงพยาบาลรามาธิบดี ด้วยอาการเจ็บป่วยเฉียบพลัน โดยไม่ได้ถูกส่งตัวมาจากโรงพยาบาลอื่นเพื่อมารักษาต่อ

วิธีวิจัย

ถ้าท่านยินดีให้ความร่วมมือในการศึกษาครั้งนี้ ดิฉันจะขอเริ่มเก็บข้อมูลของท่านตั้งแต่เริ่มเข้ารับการรักษาในโรงพยาบาล และติดตามจนกระทั่งท่านจำหน่ายออกจากโรงพยาบาล ใช้เวลาใน

การเก็บข้อมูลจากท่านวันละประมาณ 10-15 นาที ขอบข่ายของข้อมูลคือข้อมูลส่วนบุคคล ประวัติภาวะสุขภาพและการเจ็บป่วย ข้อมูลความสามารถในการทำหน้าที่ 1 เดือนก่อน แรกรับเข้ารับการรักษา และก่อนจำหน่ายออกจากโรงพยาบาล ข้อมูลผลการตรวจทางห้องปฏิบัติการ ข้อมูลติดตามประเมินการเกิดภาวะสับสนเฉียบพลัน

การยินยอมเข้าร่วมการวิจัยเกิดขึ้นเมื่อได้รับความยินยอมด้วยวาจาหรือลงนามเป็นลายลักษณ์อักษร โดยความสมัครใจของท่าน กรณีที่ท่านไม่สามารถแสดงความยินยอมได้ด้วยตนเอง ผู้วิจัย/ผู้ช่วยวิจัยจะขอความยินยอมเข้าร่วมการวิจัยจากญาติผู้เป็นตัวแทนของท่าน

ประโยชน์และผลข้างเคียงที่จะเกิดแก่ผู้เข้าร่วมการวิจัย

การศึกษาครั้งนี้จะไม่ส่งผลกระทบเสียหายในด้านใดๆ แก่ท่าน เนื่องจากผู้วิจัยไม่ได้กระทำการทดลองหรือปฏิบัติหัตถการใดๆ ที่มีการลุกล้ำร่างกาย นอกจากการเก็บข้อมูลจากแฟ้มประวัติการรักษา การสอบถาม การสังเกต และการประเมิน ถึงแม้ว่าการศึกษาครั้งนี้จะไม่เกิดประโยชน์โดยตรงกับท่าน แต่ท่านอาจได้รับประโยชน์บ้างขณะทำการศึกษาจากการได้รับการติดตามประเมินการเกิดภาวะสับสนเฉียบพลันทุกวัน

ขอบเขตการดูแลรักษาความลับของข้อมูล

ผู้วิจัยจะเก็บข้อมูลไว้เป็นความลับ และข้อมูลที่เก็บรวบรวมมาได้ทั้งหมด จะเปิดเผยเฉพาะในรูปที่เป็นผลสรุปของการวิจัยทั้งนี้ด้วยเหตุผลทางวิชาการเท่านั้น และผู้ที่จะสามารถรับรู้ข้อมูลเหล่านี้ นอกจากผู้วิจัยและอาจารย์ที่ปรึกษาแล้วต้องได้รับความยินยอมจากท่านก่อน

สิทธิในการถอนตัวออกจากโครงการวิจัย

ในการเข้าร่วมงานวิจัยครั้งนี้จะเป็นไปตามความสมัครใจของท่าน โดยที่ท่านสามารถยกเลิกการเข้าร่วมโครงการวิจัยนี้ได้ตลอดเวลา โดยจะไม่มีผลต่อการรักษาและการพยาบาลใดๆ ที่ท่านได้รับแต่อย่างใด

กรณีมีเหตุจำเป็นหรือมีปัญหา ข้อสงสัยกรุณาติดต่อผู้วิจัย

นางสาวนุชนาฏ แจ้งสว่าง

โรงพยาบาลรามาธิบดี ต. ทุ่งพญาไท อ.ราชเทวี จ. กรุงเทพฯ 10400

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ลงนาม.....ผู้ยินยอม

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Documentary Proof of Ethical Clearance Committee on Human Rights Related to Researches Involving Human Subjects Faculty of Medicine, Ramathibodi Hospital, Mahidol University

No. 0554/2005

Title of Project	Factors Predicting Length of Hospital Stay of Medical Older Patients in Ramathibodi Hospital
Protocol Number	ID 05-48-20
Principal Investigator	Miss. Nuchanad Jeangsawang
Official Address	Department of Nursing Faculty of Medicine,Ramathibodi Hospital Mahidol University

The aforementioned project has been reviewed and approved by Committee on Human Rights Related to Researches Involving Human Subjects, based on the Declaration of Helsinki.

Signature of Chairman Committee on Human Rights Related to Researches Involving Human Subjects .....
Prof. Krisada Ratana-olarn, M.D., FRCST, FICS.

Signature of Dean .....
Prof. Rajata Rajatanavin, M.D., F.A.C.E.

Date of Approval June 15, 2005

APPENDIX C

Demographic Data Form

ส่วนที่ 1 แบบบันทึกข้อมูลส่วนบุคคล

1. เพศ 1. [ ] ชาย 2. [ ] หญิง
2. อายุ .....ปี
3. เชื้อชาติ 1. [ ] ไทย 2. [ ] จีน 3. [ ] อื่นๆ (ระบุ).....
4. ศาสนา 1. [ ] พุทธ 2. [ ] คริสต์ 3. [ ] อิสลาม 4. [ ] อื่นๆ
5. ภูมิลำเนา 1. [ ] กรุงเทพมหานคร 2. [ ] อื่นๆ (ระบุ).....
6. ระดับการศึกษา
   1. [ ] ไม่ได้รับการศึกษา 4. [ ] ปวช. ปวส. อนุปริญญา
   2. [ ] ประถมศึกษา 5. [ ] ปริญญาตรี
   3. [ ] มัธยมศึกษา 6. [ ] ปริญญาโทหรือสูงกว่า
7. สถานภาพสมรส 1. [ ] โสด 2. [ ] คู่ 3. [ ] หม้าย/หย่า/แยก
8. อาชีพในปัจจุบัน
   1. [ ] ไม่ได้ประกอบอาชีพ 4. [ ] ค้าขาย
   2. [ ] รับจ้าง 5. [ ] ธุรกิจส่วนตัว
   3. [ ] เกษตรกรรม 6. [ ] อื่นๆ (ระบุ).....
9. ความเพียงพอของรายได้กับค่าใช้จ่าย
   1. [ ] เพียงพอ
   2. [ ] ไม่เพียงพอ
10. แหล่งที่มาของรายได้ (ตอบได้มากกว่า 1 ข้อ)
    1. [ ] จากบุตรหลาน/คู่สมรส 4. [ ] จากเงินบำนาญ
    2. [ ] จากการทำงานด้วยตนเอง 5. [ ] จากเงินเก็บสะสม
    3. [ ] จากค่าเช่า/ดอกเบี้ย 6. [ ] อื่นๆ (ระบุ).....
11. วิธีชำระค่ารักษาพยาบาล
    1. [ ] เสียค่ารักษาเอง 4. [ ] สิทธิประกันสุขภาพ (30 บาท)
    2. [ ] เบิกค่ารักษาได้ 5. [ ] สังคมสงเคราะห์
    3. [ ] สิทธิประกันสังคม

12. ลักษณะการพักอาศัย

1. [ ] อยู่บ้านคนเดียว 3. [ ] อยู่กับคู่สมรสและบุตรหลาน
2. [ ] อยู่กับคู่สมรสเพียงลำพัง 4. [ ] อยู่กับบุตรหลานและหรือญาติอื่นๆ

13. ความสามารถในการมองเห็น

1. [ ] มองเห็นชัดเจน
2. [ ] มองเห็นไม่ชัดเจน

14. ความสามารถในการได้ยิน

1. [ ] ได้ยินปกติ
2. [ ] หูไม่ได้ยิน

15. โรคประจำตัว

1. [ ] มี (ระบุ).....
2. [ ] ไม่มี

16. ประวัติการหกล้มในช่วง 1 ปีที่ผ่านมา

1. [ ] มี 2. [ ] ไม่มี

17. ประวัติการเข้ารับการรักษาในโรงพยาบาลในช่วง 1 ปีที่ผ่านมา

1. [ ] มี 2. [ ] ไม่มี

18. ที่พักอาศัยหลังออกจากโรงพยาบาล

1. [ ] อยู่บ้านเดิม
2. [ ] เปลี่ยนที่อยู่ใหม่
   [ ] บ้านญาติ
   [ ] สถานพยาบาล
   [ ] อื่นๆ (ระบุ).....

19. การวินิจฉัยโรคเมื่อแรกรับเข้ารับการรักษา .....

APPENDIX D

The Number of Medications Record Form

ส่วนที่ 2 แบบบันทึกจำนวนชนิดยาที่ใช้

คำชี้แจง จงบอกรายชื่อยาที่ผู้ป่วยได้รับทั้งหมดก่อนเข้ารับการรักษาในโรงพยาบาลครั้งนี้

ยาที่รับประทานตามแผนการรักษาของแพทย์
1…… 2…… 3…… . . .

APPENDIX E

The Serum Albumin Level Record Form

ส่วนที่ 3 แบบบันทึกค่าอัลบูมินในเลือด

คำชี้แจง จงบันทึกค่า Albumin จากใบบันทึกผลทางห้องปฏิบัติการตามรายละเอียดดังนี้

ค่า Albumin ค่าแรกที่ได้รับการตรวจในสัปดาห์แรกที่เข้ารับการรักษาในโรงพยาบาล

มีค่าเท่ากับ……g/l

APPENDIX F

The Length of Hospital Stay Record Form

ส่วนที่ 4 แบบบันทึกจำนวนวันนอนโรงพยาบาล

คำชี้แจง จงบันทึกข้อมูลต่อไปนี้ โดยจำนวนวันนอนโรงพยาบาลทั้งหมดให้นับตามแบบฟอร์มปรอท

ผู้ป่วยรายที่……

หอผู้ป่วยที่รับผู้ป่วยเข้ารักษา……

วันที่รับเข้ารักษาในโรงพยาบาล……..

วันที่จำหน่ายออกจากโรงพยาบาล……

รวมจำนวนวันนอนโรงพยาบาลทั้งหมด……..…..วัน

APPENDIX G

Yamvong's Modified Barthel ADL Index

ส่วนที่ 5 แบบประเมินความสามารถในการทำหน้าที่

คำชี้แจง จงประเมินความสามารถในการทำหน้าที่ของผู้ป่วยทั้งหมด 3 ครั้ง คือ ประเมิน 1 เดือนก่อนเข้าโรงพยาบาล ประเมิน 24 ชั่วโมงแรกรับเข้าโรงพยาบาล และประเมินก่อนจำหน่าย กรอกคะแนนการประเมินแต่ละครั้งตามระดับความสามารถของผู้ป่วยที่กำหนดไว้ในแต่ละข้อลงในตาราง

ความสามารถในการทำหน้าที่	1 เดือนก่อนเข้าโรงพยาบาล	24 ชั่วโมงแรกรับเข้าโรงพยาบาล	ก่อนจำหน่าย
1. การรับประทานอาหาร 0 ไม่สามารถรับประทานอาหารได้เอง ต้องป้อนอาหารให้ หรือรับอาหารทางสายยาง 2 ต้องมีผู้คอยดูแล ช่วยเหลือในการเตรียมอาหาร เช่น ช่วยตัดหรือหั่นอาหาร 4 ช่วยตัวเองได้ เมื่อวางอาหารไว้ให้			

ความสามารถในการทำหน้าที่	1 เดือน ก่อนเข้าโรงพยาบาล	24 ชั่วโมง แรกรับเข้าโรงพยาบาล	ก่อน จำหน่าย
2. การอาบน้ำ เช็ดตัว 0 ไม่สามารถอาบน้ำ หรือเช็ดตัวดูแลความสะอาดของร่างกายได้เอง ต้องการผู้ช่วยเหลือ 1 ต้องการความช่วยเหลือในบางขั้นตอน 2 สามารถอาบน้ำ หรือเช็ดตัวทำความสะอาดร่างกายได้เองโดยไม่ต้องการผู้ช่วยเหลือ 3. สุขวิทยาส่วนบุคคล 0 ต้องพึ่งพาบุคคลอื่นทั้งหมดในการล้างหน้า แปรงฟัน หวีผม หรือโกนหนวด 1 ต้องการความช่วยเหลือในบางขั้นตอน 2 สามารถล้างหน้า แปรงฟัน หวีผม โกนหนวดได้โดยไม่ต้องมีคนช่วย . . . . 9. การเดินบนพื้นราบ 0 เดินไม่ได้ 2 เดินไม่ได้ แต่สามารถใช้เก้าอี้เข็น คลาน หรือถัดได้ 4 เดินได้โดยมีคนช่วยพยุง 1 คน 6 เดินได้เอง โดยอาจใช้ไม้เท้า หรือเครื่องพยุงเดิน			
คะแนนรวม (36 คะแนน)			

หมายเหตุ ประเมินความสามารถในการทำหน้าที่ของผู้ป่วย โดยสอบถามจากผู้ป่วยหรือบุคคลที่อยู่ใกล้ชิดกับผู้ป่วย ถึงความสามารถในการทำกิจกรรมได้จริง

APPENDIX H

The Severity of Illness Measurement Form (APACHE II)

ส่วนที่ 6 แบบประเมินความรุนแรงของความเจ็บป่วย

คำชี้แจงที่ 1 จงใส่เครื่องหมาย √ ใน □ ให้ตรงกับข้อมูลความรุนแรงของปัจจัยด้านสรีระภายใน 24 ชั่วโมงแรกที่ผู้ป่วยเข้ารักษาในโรงพยาบาลตามรายการต่อไปนี้ (บันทึกค่าที่บ่งชี้ว่ามีความรุนแรงที่สุดในวันนั้น)

การประเมินความรุนแรงของปัจจัยด้านสรีระ (Acute Physiologic Factors)

Physiologic variable	High abnormal range					Low abnormal range			
	+4	**+3**	**+2**	**+1**	**0**	**+1**	**+2**	**+3**	**+4**
Temperature-rectal (^oC)*[1]	≥ 41 □	39 -40.9 □		38.5-38.9 □	36-38.4 □	34-35.9 □	32-33.9 □	30-31.9 □	≤ 29.9 □
Mean arterial pressure*[2](mmHg)	≥ 160 □	130-159 □	110-129 □		70-109 □		50-69 □		≤ 49 □
Heart rate	≥180 □	140-179 □	110-139 □		70-109 □		55-69 □	40-54 □	≤ 39 □
Respiratory rate	≥ 50 □	35-49 □		25-34 □	12-24 □	10-11 □	6-9 □		≤ 5 □
Oxygenation*[3] **a) FIO_2 > 0.5 วัด A-a DO_2**	≥ 500 □	350-499 □	200-349 □		< 200 □				
b) FIO_2< 0.5 วัด PaO_2 (mmHg)					PO_2 > 70 □	PO_2 = 61- 70 □		PO_2 = 55-60 □	PO_2 < 55 □
Arterial pH (ถ้าไม่มี)	≥ 7.7 □	7.6-7.69 □		7.5-7.59 □	7.33-7.49 □		7.25-7.32 □	7.15-7.24 □	<7.15 □
ใช้ serum HCO_3 (m mol/L)แทน	≥ 52 □	41-51.9 □		32-40.9 □	22-31.9 □		18-21.9 □	15-17.9 □	< 15 □
Serum Na (m mol/L)	≥180 □	160-179 □	155-159 □	150-154 □	130-149 □		120-129 □	111-119 □	≤110 □
Serum K (m mol/L)	≥7 □	6-6.9 □		5.5-5.9 □	3.5-5.4 □	3-3.4 □	2.5-2.9 □		<2.5 □
Serum Creatinine (mg/dl)*[4] ARF □ Y (x2) □ N	≥3.5 □	2-3.4 □	1.5-1.9 □		0.6-1.4 □		<0.6 □		
Hct (%)	≥60 □		50-59.9 □	46-49.9 □	30-45.9 □		20-29.9 □		<20 □
WBC (total/mm^3)	≥40 □		20-39.9 □	15-19.9 □	3-14.9 □		1-2.9 □		<1 □
15-GCS *[5]	(GCS = Glasgow - coma score) Score = 15 minus actual GCS = 15 - …… = ……..								

คะแนนรวมความรุนแรงปัจจัยด้านสรีระ = …… คะแนน (คะแนนเต็ม = 60 คะแนน)

หมายเหตุ

*[1] อุณหภูมิที่ต้องการคือ อุณหภูมิที่วัดทางทวารหนัก ซึ่งมีอุณหภูมิสูงกว่าที่วัดจากทาง ปาก และทางรักแร้ถึง 0.5 และ 1 องศาเซลเซียส ตามลำดับ ฉะนั้นจึงต้องบวกอุณหภูมิเพิ่มขึ้นจากอุณหภูมิที่วัดจริงทางปาก 0.5 องศาเซลเซียส และ1 องศาเซลเซียส สำหรับอุณหภูมิที่วัดทางรักแร้ เพื่อปรับค่าให้สอดคล้องกับการให้คะแนน

*[2] Mean arterial pressure = [(systolic blood pressure) + (2 x diastolic pressure)]/3

*[3] ถ้าไม่มีการเจาะ ABG ให้ใช้ค่า SpO_2 แทน โดยจะนำค่า SpO_2 มาใส่สูตรของ Oxyhemoglobin Dissociation Curve ทาง computer online (Kelman, 1966) เพื่อคำนวณแปลงให้เป็นค่า PaO_2 ก่อน

*[4] Serum Creatinine ในกรณีที่ผู้ป่วยมีปัญหา Acute renal failure คะแนนจะเพิ่มเป็น 2 เท่า คือคะแนนจะต้องคูณด้วย 2

*[5] **GLASGOW COMA SCALE** (Range 3-15 คะแนน)

การลืมตา สังเกตหนังตาบน	
ลืมตาได้เอง	4
ลืมตาเมื่อเรียก	3
ลืมตาเมื่อเจ็บ	2
ไม่ลืมตาเลย	1
การพูด	
พูดคุยได้ไม่สับสน	5
พูดคุยได้แต่สับสน	4
พูดเป็นคำๆ	3
ส่งเสียงไม่เป็นคำ	2
ไม่ออกเสียงเลย	1
การเคลื่อนไหว	
ทำตามคำสั่ง	6
ทราบตำแหน่งที่เจ็บ	5
ชักแขนขาหนี	4
แขนมี Abnormal flexion	3
แขนมี Abnormal extension	2
ไม่เคลื่อนไหวเลย	1

คำชี้แจงที่ 2 จงสอบถามประวัติโรค/ภาวะกดภูมิต้านทานของผู้ป่วยตามหัวข้อในตาราง ใส่เครื่องหมาย √ ในช่อง " มี " ถ้าผู้ป่วยมีหรือเคยมีประวัติ แต่ถ้าผู้ป่วยไม่มีประวัติให้ใส่เครื่องหมาย √ ในช่อง "ไม่มี "

ประวัติโรค/ภาวะกดภูมิต้านทานที่ผู้ป่วยมีอยู่หรือเคยมี	มี	ไม่มี
1. Liver		
1.1 documented cirrhosis	.....	.....
1.2 portal hypertension	.....	.....
1.3 UGI bleeding จาก varices	.....	.....
1.4 hepatic encephalopathy	.....	.....
2. Cardiovascular		
2.1 Functional class IV	.....	.....
3. Respiratory		
3.1 Chronic respiratory failure (home ventilator)	.....	.....
3.2 Chronic hypoxemia, Chronic hypercapnia	.....	.....
3.3 Chronic restrictive or chronic obstructive lung disease เป็นขนาดขึ้นบันไดหรือทำงานไม่ไหว	.....	.....
4. Renal		
4.1 ต้องการ chronic dialysis	.....	.....
5. Immunocompromised host		
5.1 ได้รับ immunosuppressive drug	.....	.....
5.2 Chemotherapy	.....	.....
5.3 Radiation therapy	.....	.....
5.4 High dose steroid (long term or recent)	.....	.....
5.5 เป็นโรคที่ immunity เสีย เช่น leukemia, lymphoma, AIDS	.....	.....

คำชี้แจงที่ 3 ใส่เครื่องหมาย √ ใน □ เพื่อให้คะแนนภาวะสุขภาพเรื้อรัง (Chronic health score) ตามรายละเอียดของการให้คะแนนที่กำหนดไว้

คะแนนภาวะสุขภาพเรื้อรัง (Chronic health score)

□ **5 คะแนน** สำหรับผู้ป่วยที่**มี**ประวัติโรค/ภาวะกดภูมิต้านทานที่มีอยู่หรือเคยมีตามตารางข้างต้น หรือผู้ป่วยที่ได้รับการผ่าตัดฉุกเฉิน

□ **0 คะแนน** สำหรับผู้ป่วยที่**ไม่มี**ประวัติโรค/ภาวะกดภูมิต้านทานตามตารางข้างต้น

……

คะแนนความรุนแรงของความเจ็บป่วย (คะแนนเต็ม 65 คะแนน)

= คะแนนรวมความรุนแรงปัจจัยด้านสรีระ + คะแนนภาวะสุขภาพเรื้อรัง

= …… + ……..

= ……

APPENDIX I

The Thai Version of the Confusional Assessment Method

ส่วนที่ 7 แบบประเมินภาวะสับสนเฉียบพลัน

คำชี้แจง จงประเมินว่าผู้ป่วยมีพฤติกรรมตามหัวข้อดังต่อไปนี้หรือไม่ใน 24 ชั่วโมงที่ผ่านมา ถ้ามีใส่เครื่องหมาย √ ใน ☐ หน้าคำว่า " มี " แต่ถ้าไม่มีใส่เครื่องหมาย √ ใน ☐ หน้าคำว่า "ไม่มี "

พฤติกรรมของผู้ป่วยใน 24 ชั่วโมงที่ผ่านมา	**วันที่**					
1. ระดับความจำ การรู้คิด และพฤติกรรมเปลี่ยนแปลงจากเดิมอย่างรวดเร็ว อาการไม่คงที่ขึ้นๆ ลงๆ เป็นๆ หายๆ เมื่อเปรียบเทียบกับวันก่อนหรือข้อมูลเมื่อแรกรับ	☐ มี ☐ ไม่มี	☐ มี ☐ ไม่มี	☐ มี ☐ ไม่มี	☐ มี ☐ ไม่มี	☐ มี ☐ ไม่มี	☐ มี ☐ ไม่มี
2. มีความตั้งใจและสมาธิลดลง หรือมีความใส่ใจเปลี่ยนแปลงขึ้นๆ ลงๆ ระหว่างการพูดคุยสนทนา หันเหความสนใจง่าย เช่น หันเหความสนใจไปพูดเรื่องอื่น หรือพูดตอบเสียงรอบๆ	☐ มี ☐ ไม่มี	☐ มี ☐ ไม่มี	☐ มี ☐ ไม่มี	☐ มี ☐ ไม่มี	☐ มี ☐ ไม่มี	☐ มี ☐ ไม่มี
3. มีความคิดสับสนไม่เป็นระบบ ไม่ต่อเนื่อง เช่น พูดไม่ปะติดปะต่อ พูดเรื่องโน้นต่อเรื่องนี้ พูดวกวน พูดจับใจความไม่ได้	☐ มี ☐ ไม่มี	☐ มี ☐ ไม่มี	☐ มี ☐ ไม่มี	☐ มี ☐ ไม่มี	☐ มี ☐ ไม่มี	☐ มี ☐ ไม่มี
4. มีระดับความรู้สึกตัวเปลี่ยนแปลงผิดปกติไปจากเดิม เช่น ไวต่อสิ่งเร้ามากผิดปกติ ง่วงซึม ปลุกตื่นยาก หรือไม่รู้สึกตัว	☐ มี ☐ ไม่มี	☐ มี ☐ ไม่มี	☐ มี ☐ ไม่มี	☐ มี ☐ ไม่มี	☐ มี ☐ ไม่มี	☐ มี ☐ ไม่มี
ผู้ป่วยที่มีภาวะสับสนเฉียบพลันจะต้องมีมีอาการแสดงข้อ1 และ 2 ร่วมกับข้อ 3 หรือ 4	☐ มี ☐ ไม่มี	☐ มี ☐ ไม่มี	☐ มี ☐ ไม่มี	☐ มี ☐ ไม่มี	☐ มี ☐ ไม่มี	☐ มี ☐ ไม่มี

ต่อ

อาการอื่นที่อาจพบในผู้ป่วยที่มีภาวะสับสนเฉียบพลัน

พฤติกรรมของผู้ป่วยใน 24 ชั่วโมงที่ผ่านมา	**วันที่**					
5. มีการเปลี่ยนแปลงด้านการรู้/จำ บอกสิ่งต่างๆ ไม่ถูกต้อง เช่น บอกเวลา สถานที่ บุคคล ไม่ได้	☐ มี ☐ ไม่มี	☐ มี ☐ ไม่มี	☐ มี ☐ ไม่มี	☐ มี ☐ ไม่มี	☐ มี ☐ ไม่มี	☐ มี ☐ ไม่มี
6. ความจำบกพร่อง เช่น จำญาติไม่ได้ จำไม่ได้ว่าเป็นอะไรมา	☐ มี ☐ ไม่มี	☐ มี ☐ ไม่มี	☐ มี ☐ ไม่มี	☐ มี ☐ ไม่มี	☐ มี ☐ ไม่มี	☐ มี ☐ ไม่มี
7. การรับรู้และการแปลความหมายของสิ่งเร้าผิดไปหรือมีอาการทางจิต เช่น หูแว่ว ภาพหลอน แปลเหตุการณ์ผิด	☐ มี ☐ ไม่มี	☐ มี ☐ ไม่มี	☐ มี ☐ ไม่มี	☐ มี ☐ ไม่มี	☐ มี ☐ ไม่มี	☐ มี ☐ ไม่มี
8A. เคลื่อนไหวมากผิดปกติ ไม่อยู่นิ่ง หยิบจับสิ่งของต่างๆ อยู่ตลอดเวลา 8B. เคลื่อนไหวน้อยผิดปกติ อยู่เฉยท่าเดียว เคลื่อนไหวช้า	☐ มี ☐ ไม่มี	☐ มี ☐ ไม่มี	☐ มี ☐ ไม่มี	☐ มี ☐ ไม่มี	☐ มี ☐ ไม่มี	☐ มี ☐ ไม่มี
9. แบบแผนการนอนหลับผิดปกติ เช่น นอนกลางวันตื่นกลางคืน	☐ มี ☐ไม่มี	☐ มี ☐ไม่มี	☐ มี ☐ไม่มี	☐ มี ☐ไม่มี	☐ มี ☐ไม่มี	☐ มี ☐ไม่มี

หมายเหตุ ประเมินโดยการสังเกตและสอบถามจากญาติหรือพยาบาลที่อยู่ใกล้ชิดผู้ป่วย

APPENDIX J

Testing Assumptions of Multiple Regression Analysis

These plots showed that the assumptions underlying the Multiple Regression Analysis were accepted.

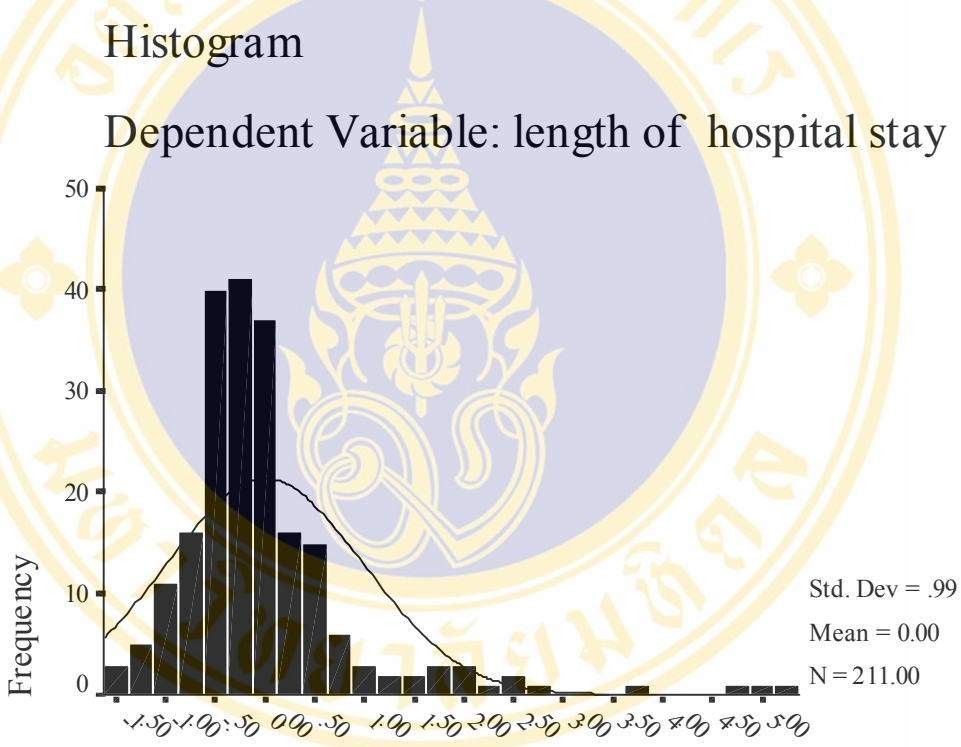

Figure 5 Distribution plot of residuals

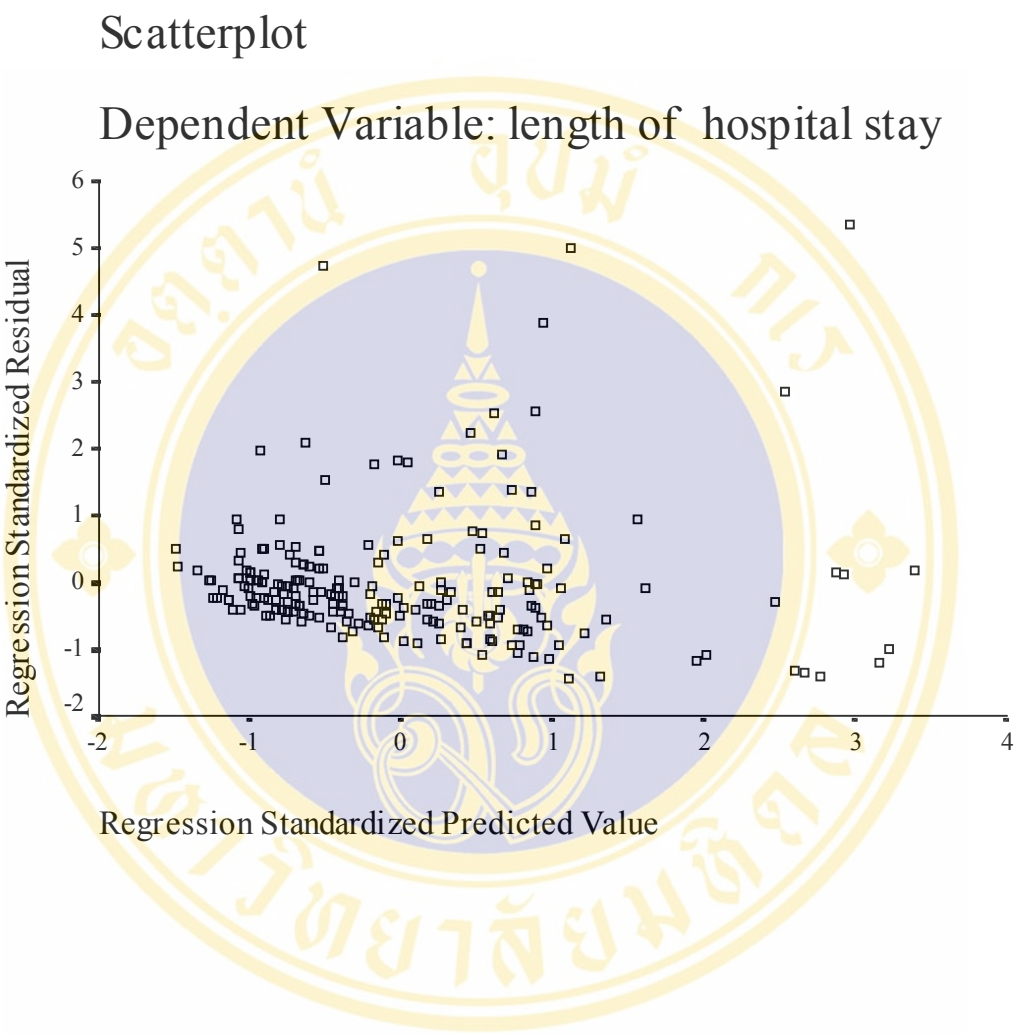

Figure 6 Scatterplot of residuals against the predicted values and against the independent variables

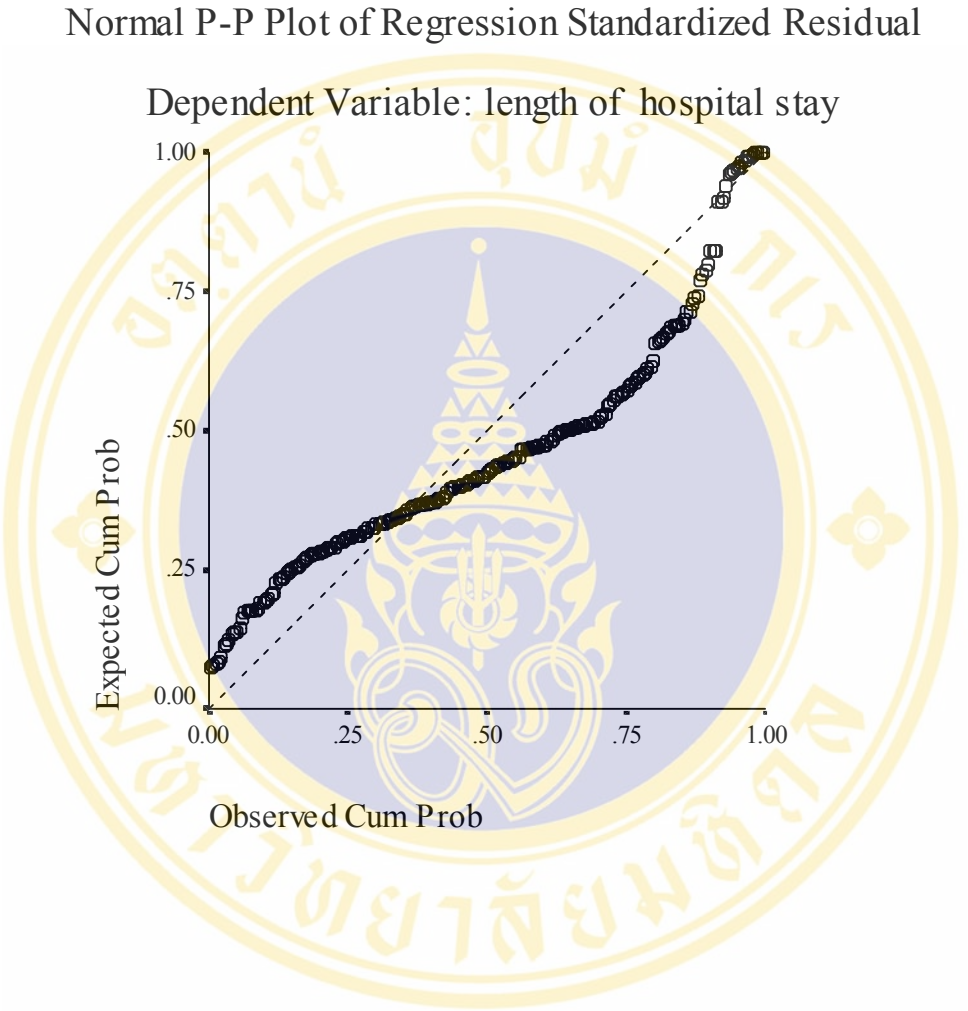

Figure 7 Normal probability plot of regression standard dependent variable: sum length of hospital stay

APPENDIX K

Plots of transformed data with LN(los)

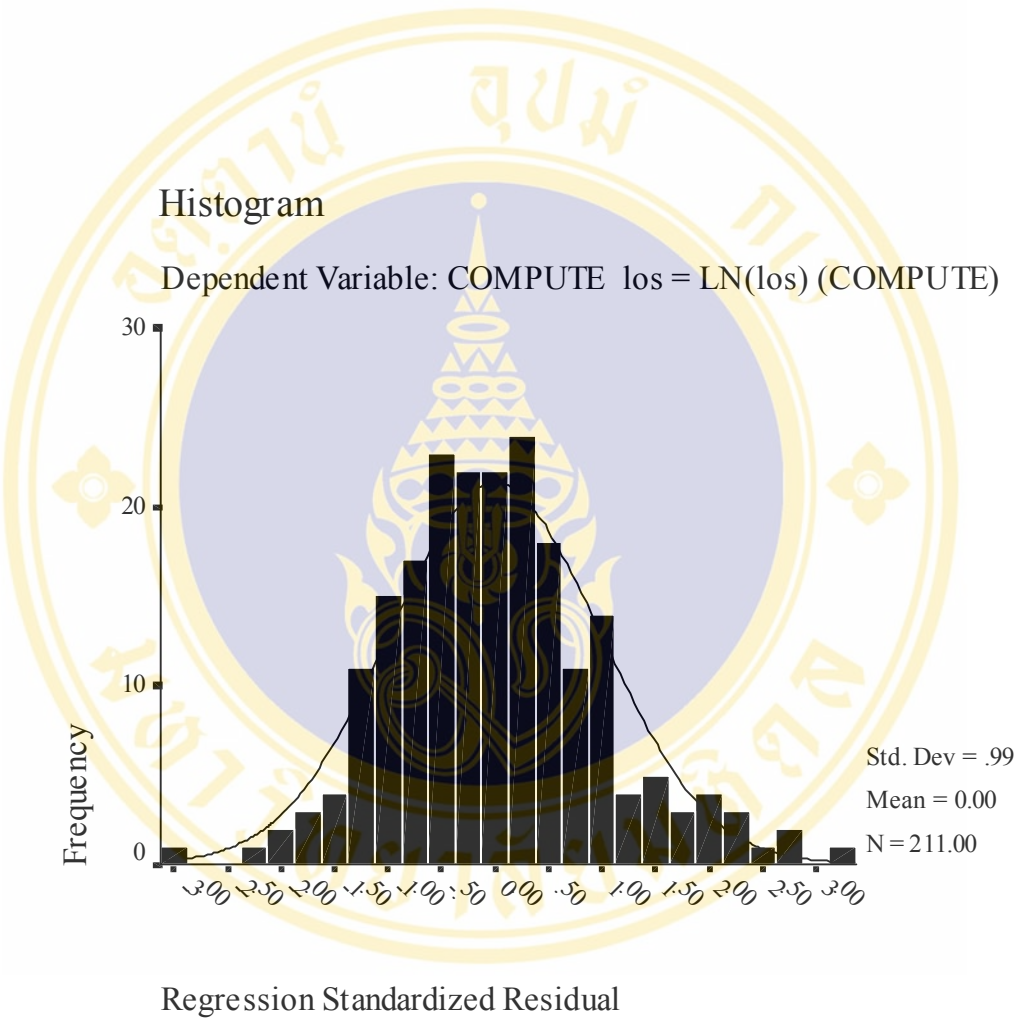

Figure 8 Distribution of residuals with log (length of hospital stay) computed

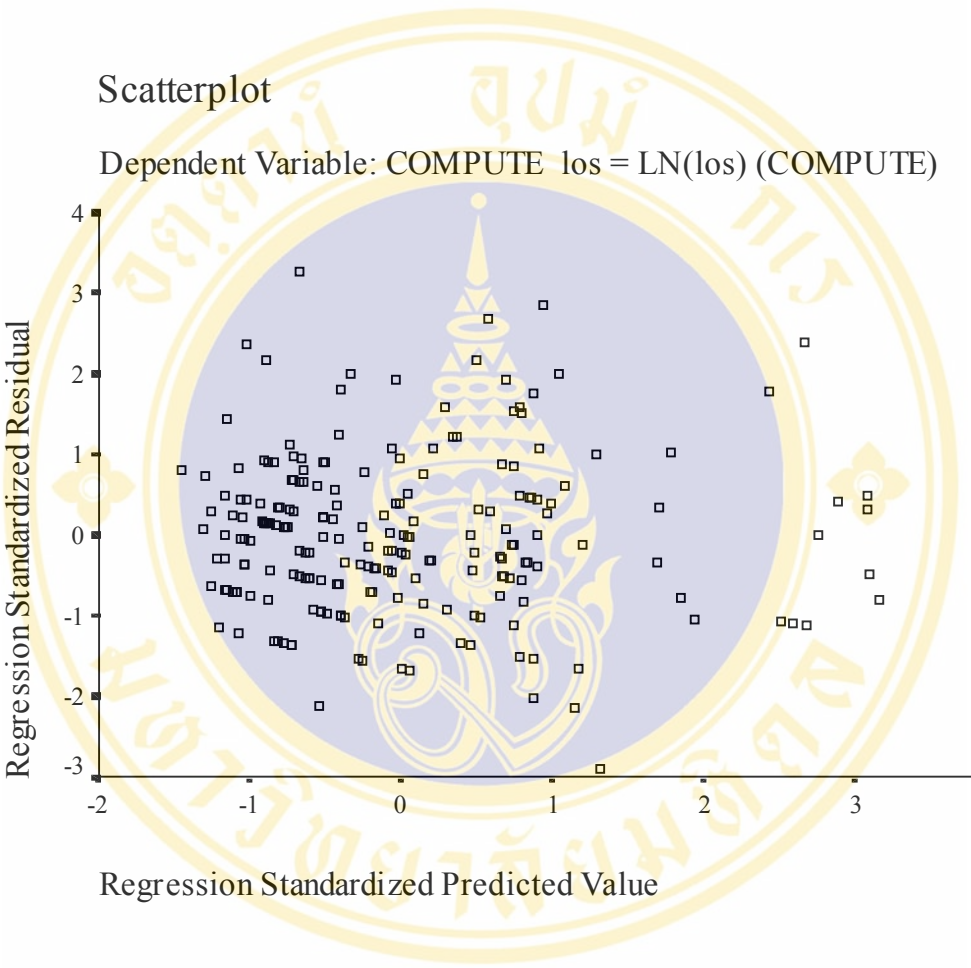

Figure 9 Scatterplot of residuals with log (length of hospital stay) computed against the predicted values and against the independent variables

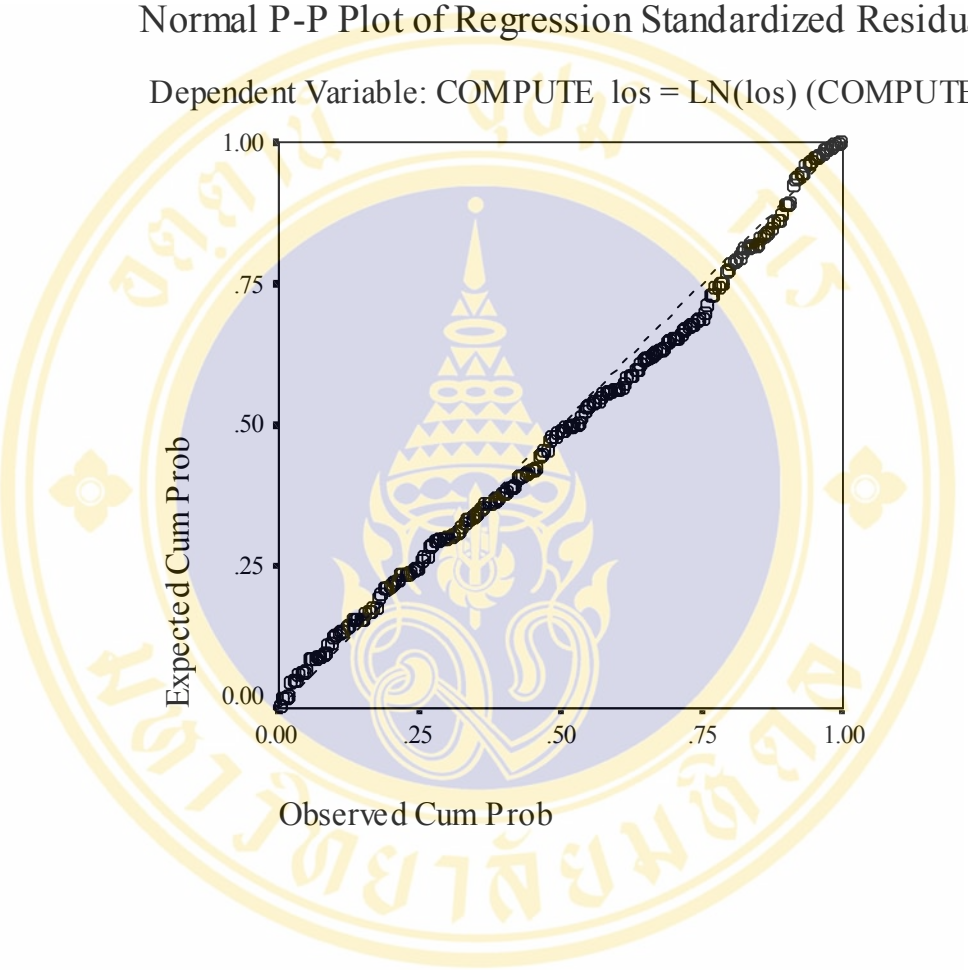

Figure 10 Normal probability plot of regression standard dependent variable: sum log (length of hospital stay)

APPENDIX K

Transformed length of hospital stay in multiple regression analysis

Table 10 Multiple Regression by the Enter Method in Predicting the Logarithm of Length of Hospital Stay of Older Patients (N = 211)

Variables	b	SE	Beta (β)	t
Age	-.004	.01	-.04	-.68
Functional ability at admission	-.01	.003	-.27	-3.84**
Severity of illness	-.001	.01	-.01	-.18
Serum albumin level	-.01	.01	-.07	-1.02
Acute confusional state[a]	.52	.16	.22	3.27*
The number of medications used	-.01	.01	-.04	-.61
Constant (a) = 2.85, **Multiple R** = .39, $\mathbf{R^2}$ = .155, $\mathbf{R^2adj}$ = .13, **SEE** = .59, $\mathbf{F_{(6,204)}}$ = 6.24**				

*p <.01 **p <.001

a = in the first week of hospitalization (n = 15)

Standardized Score Equations of LN(los)

ZLN(los) = - .27 Z(Functional ability at admission) +.22 Z(Acute confusional state)
- .07 Z(Serum albumin level) - .04 Z(Age)
- .04 Z(The number of medications) - .01 Z(Severity of illness)

Unstandardized Score Equations of LN(los)

LN(los) = 2.85 - .01 (Functional ability at admission) +.52 (Acute confusional state)
- .01 (Serum albumin level) - .004 (Age)
- .01 (The number of medications) - .001 (Severity of illness)

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