CHAPTER 5

CONCLUSION, IMPLICATIONS, RECOMMENDATIONS AND LIMITATIONS

This chapter presents a conclusion of research findings, implications, recommendation for further studies and limitations of the study.

Conclusion

A descriptive correlational design was used to determine costs of intensive care for one patient day i.e. health personnel cost per patient day, nursing personnel cost per patient day, medical care cost per day and lengths of ICU stay. In addition, the effects of patient characteristics, types of ICU, day and time of patient admission and nurse staffing on patient costs and length of ICU stay were evaluated. The data analysis of the study relied on four sources of the hospital records. First, financial reports of hospital departments were used to obtain data about hospital expenditure and revenues in FY 2005. Second, records from 242 patients who were treated in general medical and surgical ICUs for at least 24 hours were analyzed. Third, assignment sheets of ICU personnel were reviewed to capture the total number of RNs, PNs and HPs in each 8-hour shift. Lastly, daily nurse reports were reviewed to obtain the total number of patients in each 8-hour shift. All data were collected prospectively by research assistants who was trained by the investigator and transmitted daily to the investigator. Based upon the findings and the preceding discussion, the following conclusions are listed as follows.

1. A mean patient cost per day for care in an ICU was 8,564.3 baht. Medical care cost per patient day comprised 70% (M = 6,864.7 baht, SD = 3,810.0) whereas the remaining 30% were health personnel cost per patient day (M = 1,699.6 baht, SD = 584.3).

2. Cost of care in ICU for a non survivor per patient day was nearly twice as higher as those for a survivor per patient day (12,149.8 vs. 7,978.2 baht). A daily cost of achieving a survivor in ICU was most expensive for renal failure patients (M = 10,172.4 baht, SD = 4,273.0).

3. The mean nursing personnel cost per patient day was 1,476.6 (SD = 466.5) baht with cost of care by RNs, 910.3 baht; and cost of care by other nursing personnel, 566.3 baht.

4. A mean length of ICU stay of patients in this study was 5.2 (SD = 2.2) days. There were approximately 14% of 242 patients staying in an ICU for more than one week. Mean lengths of ICU stay were different across surgical and medical patients. A mean length of ICU stay for a surgical patient was 4.1 (SD = 1.0) days whereas that for a medical patient was 6.6 (SD = 2.9) days.

5. Surviving patients with respiratory and renal diseases were more likely to have prolonged stay in ICUs. However, the outcome of care for these patients seems to be good with the percentage of survival for respiratory and renal patients being 87% and 75%, respectively.

6. Results of stepwise multiple regression analysis indicated a model of three predictors (the average ratio of RN to patient, the average ratio of RN to other nursing staff and day of patient admission) that significantly predict nursing personnel cost per patient day, $R^2 = 0.25$, R^2 adj = 0.24, $F(3, 212) = 24.00$, $p < 0.001$. This model accounted for 25 % of variance in nursing personnel cost per patient day. Nursing personnel cost per

patient day is predicted to increase by 8.98 baht for every one percent increase in the average ratio of RN to patient. There was an increase of about 5.17 baht on nursing personnel cost per patient day for every one percent increase in the average ratio of RN to other nursing staff. A mean nursing personnel cost per patient day incurred for each patient admitted to an ICU on a weekend day was lower than that for each patient admitted on a weekday by 134.71 baht.

The regression equation using these data is shown below

Nursing personnel cost per patient day = 1,657.53 + 8.98 (the average ratio of RN to patient) + 5.17 (the average ratio of RN to other nursing staff) + 134.71 (day of patient admission).

7. Covariance of medical care cost per patient day can be explained by severity of illness, groups of lymphocyte counts and the average ratio of RN to patient with $R^2 = 0.30$, R^2 adj = 0.29, $F(3, 213) = 30.54$, $p < 0.001$. Medical care cost per patient day increased 1% for every unit point increase in the severity of illness. For every one percent decrease in the average ratio of RN to patient, medical care cost per patient day increased 0.30%. Patients who had abnormal level of lymphocyte count were likely to have 1.45 times medical care cost per patient day relative to those with normal lymphocyte count.

The stepwise regression model predicting logarithmically transformed medical care cost per patient day is presented as follows.

Ln(medical care cost per day) = 8.34 + 0.01 (severity of illness) + 0.37 (the groups of lymphocyte count) - 0.003 (the average ratio of RN to patient).

8. Covariance of length of ICU stay can be explained by severity of illness, the groups of albumin level, the groups of lymphocyte counts, types of ICU, day of patient admission, time of patient admission, the average ratio of RN to patient with $R^2 = 0.31$, $R^2adj = 0.29$, $F(7, 209) = 13.35$, $p < 0.001$. Lengths of ICU stay increased 1 % for every unit decreasing in the severity of illness point. For every one percent decreased in the average ratio of RN to Pt, length of ICU stay increased 0.5%. A mean length of ICU stay for medical patients was 1.1 times longer than that of surgical patients. A mean length of ICU stay for the patients who had abnormal level of albumin was 1.2 times longer than that with normal albumin level. Patients with abnormal level of lymphocyte were likely to have 1.3 times the length of ICU compared to those with normal levels. Patients who were admitted to an ICU during non office hours were likely to have 1.2 times a length of ICU stay relative to those with an office hour admission. Patients who were admitted on a weekend day had an increased length of ICU stay to 1.2 times longer than those who were admitted on a weekday.

The stepwise regression model predicting logarithmically transformed length of ICU stay is presented as follows.

Ln (length of ICU stay) = 1.95 + 0.60 (types of ICU) - 0.01 (severity of illness) - 0.005 (the average ratio of RN to patient) + 0.18 (the groups of albumin level) + 0.24 (the groups of lymphocyte count) + 0.14 (time of patient admission) + 0.13 (day of patient admission)

Implications and Recommendations

The findings of this study provide information for implications in nursing practices, nursing and hospital administration, and policy development. These issues are discussed as follows. Further research is also recommended.

Implications and Recommendations for Nursing Practices

The findings indicated that patients with respiratory diseases were likely to have prolonged lengths of ICU stay; probably due to undergoing long ventilation periods. Therefore, protocols that accelerate weaning are likely to reduce duration of mechanical ventilator and overall length of ICU stay. Nurses should collaborate with other disciplines in developing and implementing weaning protocols.

Since malnutrition is frequently detrimental to outcomes, particularly length of ICU stay and patient cost per patient day in critically ill patients, plans to promote nutrition status of the patients are needed. Nurses should play a center role in providing information related to nutritional status of patients. They can observe and assess the patients more frequently than any other healthcare providers due to close care at the bedside. This allows early detection of subtle changes in nutritional status and providing appropriate nutritional support for the patients. In addition, nurses should provide doses of nutrition compatible with existing metabolisms and avoid complications related to the techniques of dietary delivery.

Implications and Recommendations for Hospital and Nursing Administration.

Nurses make up the largest group of healthcare providers. Consequently, nurses were a primary target for staff reduction. Hospital administrators expected that reorganized nurse staffing, including fewer professional nurses and the replacement of RNs with unlicensed assistive personnel would reduce hospital expenditure. On the surface it may appear that a

staff mix with a higher level of RNs would be more costly. However, the results of this study illustrate that a nurse staffing model with a lower number of RNs may ineffectively prevent adverse patient events resulting in patients having to stay longer and increase costs of intensive care more than necessary. The evidence also suggests that replacement of professional nurses with unlicensed assistive personnel is inappropriate to achieve cost containment objectives. Rather than decreasing the number of professional nurses, hospital should consider increasing the proportion of RNs as higher levels of knowledge and skills have been shown to reduce adverse patient events as well as lower patient resource utilization.

The results suggested that care of patient in adult ICU of this hospital was considerably more expensive and consumed more resources than a fixed reimbursement for a 30-baht health insured patient. This inevitably forces hospital managers to look critically at the expensive procedures and technologies that are used in ICUs. Health personnel who work in ICUs should be aware of the use of expensive technologies that may raise an individual patient's cost above those reimbursed according to the 30-baht health schemes. Organizational strategies to help the ICU personnel to reduce cost should include shaping cost conscious clinical behavior through education, feedback, better ordering practices and management reports with clinical auditing.

According to the growing demand for ICU services, coupled with reductions in nurse staffing on floors, it is likely to require more intermediate care areas (ICAs) to care for stable ICU patients who do not require full intensive care but need more services than those provided on wards. ICAs can help to decrease the need for ICU readmission by providing more monitoring and nursing care than is available on hospital units. They may also reduce the cost of treating patients by providing care in areas with a lower nurse per patient ratio and less complex technology. The results indicated the large number of survival respiratory

and renal patients requiring continuous treatment on ICAs. It would seem highly desirable that such ICAs should have both experienced personnel and the special equipment necessary for the management of these patients.

Since there was a high prevalence of malnutrition in critically ill patients during admission to ICUs, the hospital should have plans to solve and prevent malnutrition in the patients. Nutrition screening should be routinely performed at admission in order to quantify the risk or degree of malnutrition and identify the amount or types of nutrition support needed. Nutrition monitoring is also important to assess the changes in diagnosis or conditions that might put the patient at nutritional risk and the efficacy of nutritional support. The patients should be monitored closely so that early nutritional support can be provided and malnutrition and associated consequences are avoided.

The reduction of service capacity over the weekend days and non office hours might lead to prolonged length of ICU stay and increasing nursing care costs per patient day through delays in obtaining the necessary initial work-up for newly-admitted cases. Thus, the hospital should increase access to hospital services on weekend days and non office hours in order to maintain a consistent high quality of care.

Implications and Recommendations for Policy Developments.

Research confirmed that great availability of professional nurses was of great benefit to improve quality of care in an ICU and reduce cost of therapeutic interventions. Although increasing the number of RNs led to increased nursing personnel care cost per day, but the decreased medical care cost per patient day decreased by 0.3% when increasing one percent of RN to patient ratios ($\beta = -0.003$, $p < 0.001$), suggesting that cost savings appear to be balanced by RNs providing more efficient and effective health services as well as lower consumption of resources. With this in mind, nursing council should strive for a nursing

staff with an appropriate mix of profession and non-professional nurses. Moreover, critically ill patients should be cared for by experienced professional nurses who are familiar with the needs of these patients.

Nurse staffing must be recognized as a key intervention that affect all other healthcare interventions. Therapies such as drugs, medical procedures and equipment cannot be effective if nurses are not there to provide them at the right time, in the right way or at all. If healthy for all Thai population is a priority, then appropriate nurse staffing must be seen not as a burdensome expense but as cost-effective safety intervention worthy of intervention. When nurse staffing levels improve, so too will the quality of healthcare provided to patients.

A teaching hospital in this study tends to become financially vulnerable because of excess spending budgets for providing intensive care over incomes. This hospital budget deficit may threaten the ability of the hospital to provide professional health care. The investigator proposes that there should be reconsideration regarding the payment mechanism in the 30-baht health schemes. Patients admitted to ICUs should be assigned as a high cost group and require a higher reimbursement rate than non ICU patients. This may help to improve the financial situation of the hospital.

Length of hospital stay becomes the paramount issue important to hospitals since registration created the prospective payment system. Hospitals had to treat patients with the same diagnostic related groups (DRGs) within the prescribed LOS and predetermined reimbursement rate because days or expenses over the usual for that DRG were not reimbursed. In Thailand there is only the prescribed length of hospital stay but not the prescribed length of ICU stay for each DRG. Therefore, the Thai government should establish length of ICU stay for each DRG in order to determine the efficiency of resource utilization in an ICU. If any hospital has long length of ICU stays, it would be considered a

relatively inefficient user of resources. In contrast, any hospital with low length of ICU stays would be considered efficient in the use of resources.

Recommendations for Further Studies

Based upon findings and implications of the present study, the following recommendations for further study are derived:

1. A randomized controlled trial of nutrition support to determine the optimal timing and composition of nutrition therapy is needed to confirm the hypothesis that nutrition support during the convalescent period is more likely to improve nutrition status and lead to better rehabilitation outcome, decreased readmission rate, improved quality of life and contribute to reducing health service costs.

2. Transferring ICU patients to an ICA may decrease costs and improve ICU resource utilization. However, discharging patient too early and under emergency circumstances e.g., when beds or sufficient staff are not available has proven to increase risk for patient death or readmission. Therefore, a further study to explore the demographic and clinical characteristics of patients who can be admitted to care in ICAs should be done in order to provide useful information for healthcare providers who make decisions regarding ICU discharge.

3. A further study to compare the cost of a day spent in an ICU and a day spent in an ICA with a view to estimating the economic implications of substituting days of care is needed. This study should include examining health outcomes such as complication and readmission.

4. The current study focused on associations between the day and time of patient admission, length of ICU stay and cost of care and did not consider the possible mitigating effects of care on other subsequent days. Therefore, further study to evaluate the effect of

care on other days is needed.

5. The study should be replicated with other teaching hospitals in Thailand to increase generalizability of the findings.

Limitations

There are some limitations in the current study as follows.

1. The purposive sampling of patient records may lead to selected bias.

2. Data about resource utilization for treating patients during ICU stay were based on secondary data. This may lead to a potential bias due to the fact that the investigator must accept the existing database and the potentially unknown quality of the database with no option to redesign the data collection strategy.

3. The cost finding method was a limitation. The ratio of cost to charge in this study was determined by using the formula provided by OSHPD. Although OSHPD formula could yield a reasonably good estimation of the ratio of cost to charge, this method has relied on several assumptions, which could have considerable impact on the accuracy of the unit cost estimation e.g., practice variation is negligible. Furthermore, the accuracy of ratio estimation could be distorted by the quality of secondary data.

4. In this study, depreciation costs of buildings and equipment were estimated based on a straight-line method. This method has relied on an assumption that overall items of building and equipments were not used. This may lead to underestimation of cost of care.

5. The cost categories in this study included costs of radiological investigation, laboratory, life- supporting therapies, nutrition, blood, drugs, medical supply usage and health personnel working in the ICUs. The cost calculation not included several cost categories related to critical care delivery. For example, cost of care providing by students,

depreciation cost of building and equipment with year life longer than expected working life, management costs such as cost of employee turnover and retention, cost of lost productivity due to increased physical and emotional stress or lost client revenues or reimbursement. If these costs could be estimated and incorporated into the calculation, the mean daily costs of care in the ICU would be larger than the mean cost which was found in this study.

6. The time frame represented an additional limitation. Literature suggests there may be a significant seasonal fluctuation of resource use (Mogyorosy & Smith, 2005). Since the cost data in the current study covered seven months, a seasonal impact may have occurred. Yet, the sample of 242 patient records is believed to represent common types of ICU patients in university hospitals in Thailand.

7. In the current study, the data collectors did not inform physicians and /or nurses immediately when detecting critically ill patients who were at nutrition risk. This was due to the limitation of the use of RAs for data collection. Therefore, it is recommended that further study should consider this issue carefully.

8. The results of the study can be generalized with certain limitations since data used in this study represented only one teaching hospital in Thailand. This stems from a limitation of resources for investigation. However, it is the first study to indicate cost of intensive care in a teaching hospital in Thailand. Any hospital could perform the same cost finding method to determine cost of care for an ICU patient.