University of Michigan Health System

Analysis of Nursing Workload in the Trauma Burn ICU

Final Report – Results and Recommendations

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Executive Summary

Introduction
The nursing workload in the Trauma Burn Intensive Care Unit (ICU) in The University of Michigan Hospital (UMH) is perceived as overwhelming. The large variation in patients makes staffing the unit a difficult task. The current scheduling system is based solely on the hours per patient day (hppd), which is a budgeting figure that allows for a certain number of nursing hours for every day a patient remains in the hospital. This number does not fluctuate throughout the year and thus does not account for seasonal variations. The fiscal year 2004 (FY04) allots 17.4 hours of care for each 24-hour day a patient remains in the ICU. The number of patients fluctuates following seasonal trends while the number of nurses remains fairly constant.

![Figure 1: Average # Daily Staff and Patients, by Month](image)

The Trauma Burn Unit requested the help of the project team to analyze the workload of the nurses in the ICU to determine ways to reduce workload and increase efficiency. This report presents our analysis and findings, and provides recommendations for improvement.

The major goals of this project were to:
- Determine the major causes of workload
- Identify methods to change or eliminate workload
- Improve scheduling

Analysis Methods
- Interviews
  - Spoke with nurses and technicians about current operations and improvement options in the ICU
  - Findings: Most common responses included requesting a standard organization of materials, better housekeeping, and more efficient paperwork
• Observations
  o Spent time observing and shadowing nurses in efforts to determine how time is spent and to identify inefficiencies
  o Findings: Results were consistent with responses from interviews and supported data collected from work sampling study

• Work Sampling
  o Participants carried random alarms and reported activity when alarm sounded
  o Developed figures to illustrate how much time is spent on specific tasks during the work day

![Pie chart](image.png)

Figure 2: Nurse Workday by Task Category

  o Administration/Paperwork 2\textsuperscript{nd} largest category, which can be more easily adjusted than patient care

• Data Analysis
  o Admissions (9/1/01 – 8/31/03)

![Graph](image.png)

Figure 3: Admissions by Month

- Determined seasonal trends: highest in July and August, lowest November through February
Daily Census (9/1/01 – 8/31/03)
- Determined the number of patients in the unit on any given day
- Seasonal trends similar to admissions, showing that admissions is a strong predictor of workload

Past Staffing Data (1/1/02 – 8/31/03)
- Found trends of patients and staff
- Both the average number of patients and the average amount of staff are increasing, however the patients are increasing at a faster rate, and workload will only become greater

Recommendations

Standardize the unit. Use clearly labeled drawers and rooms, so that anyone can be able to tell exactly how much of an item goes in exactly which place. This will reduce confusion and allow for more time spent providing care to the patients.

Reduce paperwork, which is currently 27% of a nurse’s day or just over 3 hours of a 12 hour shift. Streamline the process and improve computer implementation. Wound documentation sheets could easily be improved by using a digital camera rather than coloring and labeling the sheets.

Minimize inconsistencies between patient load and staff per shift. Anticipate admissions based upon seasonal trends and forecast future needs based on current patients. The UM-TABS worksheet program can be used to predict the patients in the ICU in upcoming weeks.
Project Overview

Introduction

The current perception in the Trauma Burn Intensive Care Unit (ICU) at The University of Michigan Hospitals & Health Center (UMHHC) is that existing workloads are overwhelming available nurses. The current scheduling system is based solely on the hours per patient day (HPPD) that is determined by nursing administration. This number is given to the unit to be used as their annual budget for staffing; however, it does not address variability within the year. Despite the fact that the HPPD have been increasing over the past years, the Trauma burn ICU is finding it difficult to meet patient care needs without the staff feeling overworked. Having an insufficient number of staff on a shift increases on-duty nurses’ workload, and can possibly compromise patient care. To address these problems, the Trauma Burn Unit requested the help of our project team in collecting and analyzing both present and past data. These data were used to determine a scheduling model that would address the variability within the Trauma Burn ICU. Furthermore, our team made general observations in order to decrease nurses’ workload and increase efficiency. This report presents our analysis and findings, and provides recommendations for improvement.

Goals and Objectives

The goals of this project were to:
- Determine the major causes of workload
- Identify methods to change or eliminate workload
- Define a set of criteria for scheduling
- Flowchart current and recommended scheduling processes
- Increase employee satisfaction

Background

The Trauma Burn ICU at the University of Michigan Hospitals & Health Center (UMHHC) is becoming an increasingly active unit. Since 2002, the average HPPD, the actual amount of nursing time required for each patient in a given day, has increased from 16.83 to 17.40. This growth is a continuation in the upward trend of workload that the unit has been experiencing over past years. The Trauma Burn ICU has a very high variation of patient diagnosis and wound severity, with the length of stay (LOS) ranging from overnight stay to several months of intensive treatment. According to patient admissions records, on average 30% of the patients are burn patients; however, this number can fluctuate greatly, and may be increasing due to a good referral initiative which encourages hospitals to send patients to a level one burn unit. In addition, burn patients require more care and a longer hospital stay than trauma patients, requiring
approximately one month for every 10% of the body burned (ICU and acute care combined). Trauma patients’ LOS varies depending on the severity of injuries.

Meeting staffing requirements of the Trauma Burn ICU has been a difficult task. Several factors affect staffing requirements, such as varying HHPD, seasonal changes, and the number of nonproductive nurses (nurses not directly involved in patient care). The unit is typically busier during the summer months. In addition to the typical trauma-related pressures, patients and their families have been found to exhibit negative behaviors and attitudes which can add unnecessary stress to the nurses’ jobs. These factors, coupled with a nationwide nursing shortage, are creating difficulty in retaining staff and filling new positions.

**Scope**

This project focused on the workload of Registered Nurses (RNs) and technicians (techs) in the Trauma Burn ICU. This workload begins when a patient enters the ICU, including all direct care and associated paperwork during the patient’s stay, and ends when nurses finish the paperwork after the patient is discharged.

Tasks not directly related to the nursing workload of the ICU were not examined in this project. In particular, activities and staff involved in other patient care units, such as the adjoining Trauma Burn Acute-Care Unit, were excluded. Also, workloads of doctors, volunteers, social care workers, unit clerks and other non-nursing employees were not studied in this project.

**Project Elements**

This project consisted of three main types of data collection: interviews, a work sampling study, and collecting and analyzing past data.

**Interviews and Observations**

**Methodology**

During the study, our team interviewed seven nurses and one tech. Nurses from both the day and night shifts were interviewed. Also, to attain an unbiased view of the unit, our team was careful to interview nurses with varying levels of experience.

The interviews were conducted during several shifts throughout the week of October 12, 2003. As interviewers, we ensured that the nurses discussed each question completely before moving on. Below are the key questions that were asked in each interview.
1. What is your perception of the nursing workload?
2. Do you have any ideas to change or eliminate some of your workload?
3. What are your key tasks?
4. What type of paperwork do you typically have to fill out?
5. How much downtime do you think you have in a normal shift?
6. What are your main complaints about your job?
7. If you could change 2-3 things, what would they be?

Results

The following are responses that we received multiple times throughout the interviews:

- There are seasonal trends in workload that need to be accounted for
- The unit should be more uniform, i.e. the same thing in the same place in every room
- Better housekeeping should be requested to ensure that the floors and toilets in each room are thoroughly cleaned
- Paperwork is time consuming and redundant, it should be reduced
- The hand-drawn wound documentation sheets should be replaced with digital pictures

Individual answers to these questions can be found in Appendix A.

Recommendations

Improve Unit’s Organization

The majority of nursing complaints dealt with the lack of organization in the unit. For this reason, our team recommends that the Trauma Burn ICU unit implement a 5S program. Five S stands for Sort, Set in order, Shine, Standardize, and Sustain. The 5S program focuses on having visual order, organization, cleanliness and standardization. The 5S program can also greatly simplify the work environment. A basic 5S program could be implemented with little cost to the unit. Possible costs could include training time; man-hours spent to get the unit cleaned and organized; possible equipment purchases, such as buying a quality labeling system; and time spent on sustaining the 5S program once it is in place.

The five phases of this program can be implemented as follows:

1. "Sorting" is the first step in organizing a work area. Only necessary items should be kept. Materials, tools, equipment and supplies not frequently used should be moved to a separate, common storage area. Space can be freed up by discarding unused items. As a result, objects will become easier to find.
2. “Set in order” means organize, arrange and identify everything in the unit for the most efficient and effective retrieval and return to its proper place. The objective in this step is: A place for everything and everything in its place, with everything properly identified and labeled.

Commonly used items should be readily available. Storage areas, cabinets and shelves should be properly labeled. Shadows for common equipment can be painted, making it easy to quickly see where each item belongs. For example, a circle on the floor would denote where an oxygen tank belongs. This portion of the program would address the nurses’ concerns about the lack of labeling inside the drawers. A label should be placed underneath each material’s spot in the drawer stating the name and required quantity of the particular item. If this is done, a nurse or tech will immediately know what and how much is missing by reading the label. This will also help with organization since everyone will be able to read the labels and sort any unorganized materials accordingly.

3. “Shine” refers to keeping the newly organized environment clean. Frequent cleaning is needed or everything will return to the way it was. The nurses would not have to take over the responsibility of housekeeping; however, they should regularly inspect the unit to ensure that cleanliness is being upheld.

Regular cleaning and inspection makes it easy to spot potential problems in the unit. Two nurses mentioned the lack of cleanliness in the rooms. They said that the floors and toilets were not cleaned often enough. In an area where burn patients are being taken care of, cleanliness is of the utmost importance. If cleaning and inspecting are done regularly, this step will not take much time to achieve. As a result of continuous cleaning, there will not be a need for ‘extensive cleaning’ which can be extremely time-consuming. Therefore, nurses will save time.

4. “Standardize” means to develop a work structure that will support the new practices and make them into habits. Standards should be used to help people work into new habits that are a part of the 5S program. An easy way to make people aware of, and remind them about the standards, is to use labels, signs, posters and banners.

5. “Sustain” means to ensure that the system remains in place. If close attention is not given to this step, all previous progress could be lost within weeks. This step can never truly be completed since 5S is a method of continuous improvement. Nurses, techs, and managers should strive to maintain the standards set in place and develop new ones.

The optimum strategy would be to appoint two or three staff members as 5S supervisors. These people would inspect the unit to make sure that 5S standards are being upheld. Once they feel that the unit has completed a step, such as Sort, they would notify everyone in the unit to begin work on the next step. Rewards could also be considered to encourage employees to continuously improve the unit.
The most important steps for the Burn Trauma Unit would be Sort and Set in Order. The completion of these two steps will address the vast majority of current complaints and concerns. Once 5S is implemented and enforced, the unit will become cleaner and more efficient.

*Improve Wound Documentation*

Several nurses commented on the inefficiency of the wound documentation sheets. These forms require the nurses to color in the wounded areas of a patient’s body on the sheet, as well as enter the information into a computer. If the patient has multiple wounds, the sheet quickly becomes cluttered and difficult to read. Furthermore, due to the time consuming and repetitious nature of the sheets, several nurses stated that they do not fill out these forms as frequently as they should. A digital camera could easily solve this problem. The UMHS Emergency Room currently takes digital pictures of their patients and uploads them onto a computer. Implementing a similar process would be a very cost effective solution to the wound documentation inefficiency.

*Work Sampling Study*

**Methodology**

Work sampling was conducted to gain a better understanding of the workload in the Trauma Burn ICU. Work sampling is a method of studying the proportion of total time spent on various tasks comprising a job by making observations at random points in time. The goal of the study was to determine how a worker’s time is allocated amongst tasks in the ICU. Work sampling was chosen over a time study (stopwatch observation) analysis because time studying the nursing tasks would have been difficult due to the limited available study period. For example, dressing changes can take anywhere from an hour to over four hours depending on the patient, thus making it unrealistic to time study a task with such a great amount of variability. Due to this, work sampling was the best method for what needed to be accomplished.

The study was designed after interviewing seven nurses and spending several hours observing the unit on different shifts. A test work sampling sheet was created to be used in conjunction with random alarms which were set to go off at random time intervals, averaging 1.5 alerts per hour. Each randomly chosen study participant carried a pager and the sampling sheet for an entire shift. Each time the random alarm sounded, the worker marked on the sampling sheet what he or she was doing at that moment. Our team designed the sampling sheet with the aim of encompassing all of the tasks a nurse or tech would be doing, including breaks and infrequently performed tasks (labeled as ‘other’). After conducting a pilot-test and talking with the nurses, our team determined that the form needed minor revisions, and that the study needed to be less intrusive. The work sampling categories were reworded so that they matched nursing terminology. Also, the random time intervals were reduced to an average of one alert per hour. With
these changes implemented (see Appendix B for the final sampling sheet) and less-frequent sampling, the study yielded the following results:

Results

Figure 1 illustrates the percentage of time that the ICU nurses spent on various categories of work throughout the day.

As shown in Figure 1, the largest portion of a nurse’s time is spent on patient care, which includes everything from changing bandages in wound care to collecting samples for lab tests. Figure 2 shows a further breakdown of the patient care group, as found from the work sampling study.
Figure 2: Distribution of Nursing Patient Care Activities

According to these data, the largest part of a nurse’s work within the patient care category is assessing the patient. Many of the nurses interviewed stated that wound care was their most labor-intensive task; however, that perception is not supported by the nursing work sampling data.

To determine the roles of technicians in the ICU, a smaller work sampling study was conducted using only technicians. This smaller study was due to the smaller number of techs working in the ICU and the time available to conduct the study. The study showed a relatively similar category breakdown between techs and nurses, especially in the patient care category. These results are illustrated in Figure 3.
As shown in Figure 3, patient care accounts for over half of a technician’s work. However, there are significant differences in how patient care is divided. Figure 4 below shows that the amount of wound care is a very large portion of the total patient care provided by technicians. Whereas a nurse spent 12% of the total patient care time (6.1% of total time) on wounds, technicians averaged 66% of the total patient care time (or 31.8% of the total).
Conclusions

Several conclusions can be drawn from these graphs. First, the perception that wound care is the largest portion of a nurse’s workday is not supported by the data. It is true that changing and dressing wounds can take hours to complete; however, in terms of the total amount of work done by nurses, the percentage is relatively small (6.1% for nurses and 31.8% for techs). The graphs show that both the nurses and techs have an adequate amount of time for breaks and lunch. For an average twelve-hour nursing shift, nurses were on a break approximately 7.9% of the time (57 minutes), equating to just less than one hour of downtime (including lunch). Technicians on the other hand had a higher break time, with about 14.5% break time equating to about 1.7 hours (1 hour, 44 minutes) of break time (including lunch). This may be because technicians are not assigned to specific patients; rather they float to assist different nurses and multiple patients.
The results of this study are an accurate assessment of how the average nurse or technician spends the workday. It is important to note that the results are not valid for a single day, but rather as a complete work evaluation over the course of approximately one month. It is also important to keep in mind that this study was conducted during the month of November; historically the average number of patients in the unit during this month is lower than other months. Thus, our finding that the staff has an adequate amount of downtime is not surprising for the sample of time being studied.

The margin of error for the nursing study ranged from ±4.4% for the most prominent tasks (assessing the patient) to ±0.8% for the least prominent tasks. The technician study, because of a smaller sample size, yields up to ±11% error for the most prominent task (wound care) down to ±2.8% for the least prominent tasks. These errors are based on the number of samples collected and a specified confidence interval. The math and analysis for these calculations are included in Appendix C.

**Recommendations**

The work sampling study does not provide an effective means of improving work; it only shows what the current situation is and identifies problem areas. Despite this, one specific problem area appears to be the administration and paperwork category (27% of a nurse’s day, equaling over three hours of work). As noted in the interviews, required paperwork is often redundant and time consuming. Some amount of paperwork is certainly necessary, however the process should be evaluated in an effort to reduce the amount of time required to complete. An emphasis should be placed on computer utilization since it reduces paperwork and allows for future data analysis.

**Collecting and Analyzing Past Data**

There are three different types of past data that were collected and analyzed, namely, past admissions data, daily census sheets, and staffing data.

**Past Admissions Data**

During our initial client meeting held on September 17, 2003, Nancy Mamolen, Manager UMH Trauma Burn ICU, stated that her unit experiences seasonal trends in admission rates among patients, which results in varying levels of workload throughout the year. She felt that the summer months and the holiday season (November-January) were typically busier. She also said that the current scheduling metric, HPPD, does not account for these trends. To confirm this perception, the Trauma Burn department provided our team with data containing all of the patients admitted to the ICU from September 1, 2001 through August 31, 2003. Our team analyzed this data and developed the graph below which displays seasonal trends.
Figure 5 shows that seasonal trends exist in the Trauma Burn ICU. Admission rates typically increase from February through July, and then decrease relatively steadily until January, with peaks typically occurring in July or August. Nurses and technicians believe that this is because people tend to engage in more high-risk outdoor activities during the summer months. There are, of course, exceptions to this trend, which can be seen in June and July of 2002. Nancy Mamolen’s belief of the summer months being busier has been supported by our analysis of the admissions data, however her belief of the holiday season (November – January) being busier has not been supported.

**Daily Census and Trauma Burn Registry**

The Trauma Burn Department provided our team with daily census records spanning September 1, 2001 to August 31, 2003, as well as information from the Trauma Burn registry giving information about each patient in the ICU within the given timeframe. The registry gave information about the diagnoses of each patient, as well as their length of stay, both in the entire hospital and the Trauma Burn ICU itself. This data was used to determine the following:

- Average number of burn and trauma patients in the ICU during any given month
- The relationship between average ICU LOS and Injury Severity Score (ISS)
- The relationship between average ICU LOS and percentage of body burned

(See Appendix D)

From these data we developed a graph comparing the number of burn and trauma patients in the ICU each month.
Figure 6: Burn and Trauma Daily Census

Figure 6 shows that, in general, the number of burn and trauma patients move in tandem throughout the year. The relationship between admission rates and patient census becomes evident when comparing Figures 5 & 6. Figure 6 is more representative of monthly workload because it shows how many patients are actually in the unit at any given time. Admissions data can be deceiving because a peak during one month could have a great effect on later months after taking the ICU LOS into account. Figure 6 reinforces the fact that workload increases during the summer months and declines as winter approaches.

* Insufficient data

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<th>≤1 Week</th>
<th>1-2 Weeks</th>
<th>2-3 Weeks</th>
<th>3-4 Weeks</th>
<th>4-5 Weeks</th>
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</table>

Table 1: Length of Stay vs. ISS

Table 1 shows the relationship between the ISS that is assigned to a trauma patient upon entering the Trauma Burn ICU and the average ICU length of stay. The ISS is an anatomical scoring system that provides an overall score for patients with multiple injuries. The score serves as a predictor to a patient’s mortality, morbidity and hospital stay. The ISS score takes values from 0 to 75; the higher the number the more severe the injury. For example, when ISS is below 25, the mortality risk is minimal and above 25, it is an almost linear increase. When ISS is 50, the mortality is 50% and when above 70, it is close to 100%. Table 1 shows the probable length of stay a patient will have depending on their ISS score. For instance, a patient with an ISS in the range of 0-10 has a 97.3% probability of spending less than 1 week in the Trauma Burn ICU, while they only have a
0.9% probability of spending 3-4 weeks in the unit. This table has the potential to help predict scheduling needs for trauma patients entering the Trauma Burn ICU and decrease the disparity between the scheduled staff and existing workload in the unit.

* Insufficient data

<table>
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<th>% Body Burned</th>
<th>&lt;1 Week</th>
<th>1-2 Weeks</th>
<th>2-3 Weeks</th>
<th>3-4 Weeks</th>
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</tbody>
</table>

Table 2: Length of Stay vs. % Body Burned

Table 2 shows the relationship between the percent body burn of a patient entering the Trauma Burn ICU and their average length of stay. Depending on the range in which the patient is burned, the table shows the probability that a patient will be in the unit anywhere from less than 1 week to over 5 weeks. For example, a patient sustaining 0-9 percent body burns has an 83.8% probability of being in the unit for less than 1 week; while that same patient only has a 13.5% probability of being in the unit between 1-2 weeks. This table has the potential to help predict scheduling needs for burn patients entering the Trauma Burn ICU to decrease the difference between the staff scheduled and the workload present in the unit.

As part of this project, our team has developed a forecasting tool known as UM-TABS (University of Michigan – Trauma and Burn Scheduler) software. The worksheet is based off of equations developed by comparing a patient’s LOS with their acuity upon admission (either ISS or % total body burned). This software can be used to predict how long a patient will be in the ICU, as well as an approximation of how much nursing care the patient will require. This information is then combined across the ICU to output an approximation of the staff required on any given day. Appendix E gives information and instructions on the UM-TABS software itself, while Appendix F presents a recommended scheduling process based upon the data collected.

**Past Staffing Data**

To determine if the number of nurses working in each shift has met past seasonal workload trends, and to compare day vs. night shifts, Daily Staffing Reports were obtained. The two-year time period of September 1, 2001 through August 31, 2003 was analyzed. The daily sheets provided the number of burn and trauma patients in the ICU during each shift along with the total number of nurses and techs working. To determine the number of nurses and techs working specifically in the Trauma Burn ICU during each shift, the number of nurses assigned to the Acute Care unit was subtracted from the daily total.
Figure 7: Day and Night Shift Comparison

Figure 7 shows the nurse to patient ratio during both the day and night shifts. The ratio does not include the number of techs that worked. As shown by the graph, the day and night shifts are almost identically staffed. This disproves the perception that the night shift is less staffed than the day shift.

Figure 8: Average Staff and Patient Numbers in Trauma and Burn ICU

The relationship between the number of staff and number of patients in the Trauma Burn ICU in a given month is displayed in Figure 8. The data shows that as the number of patients fluctuates, slight adjustments are made in the number of staff scheduled.
However the ideal situation would be to have the number of staff and patients more closely aligned, taking into account patients who need more care.

Figure 9: Trends in Staffing and Patients Per Month and Year

Figure 9 shows the overall trends that have been taking place from January 2002 to July 2003 in patient and staffing numbers. The graph shows an increase in patients at a slightly higher rate than the increase in staffing for these patients. This could indicate an increase in workload for the nursing and tech staff. However this graph does not take into account the type of patients in the unit during this time.

**Recommendations**

The results of the data analysis indicate that gaps exist between staffing and patient levels. Staffing levels should always be slightly above the workload, however when they are greatly above the workload it is costly to the unit. In an effort to reduce inconsistencies and to align the level of staff with the workload, seasonal trends should be planned for. For example, more staff should be scheduled during the months of August and July since these months are typically busier. In addition, the Trauma Burn Unit should use our UM-TABS scheduling forecaster to better anticipate the unit’s needs in the near future.
Conclusions

This project provides the groundwork for an improved Trauma Burn ICU. In order for the ICU to remain one of the top nationally recognized level one trauma and burn units, it must take steps to proactively enhance patient care. The best way to improve care is to improve the environment in which it is received. The nurses and technicians are an invaluable resource in the Trauma Burn ICU. By implementing the aforementioned recommendations, the unit will see improvement in scheduling and overall efficiency.
APPENDIX A: Interview Responses

1. What is your perception of the nursing workload?
   Six nurses and one tech stated that workload is overwhelming while one nurse believes that it is manageable. The nurse that believed workload was not overwhelming had recently transferred from a different hospital with fewer resources. Her perception was that the nurses in the Trauma Burn unit were spoiled in comparison to the hospital where she previously worked. All nurses mentioned that the unit experiences seasonal trends in workload.

2. Do you have any ideas to change or eliminate some of your workload?
   Every nurse responded by saying “we need more staff.” After that comment, some mentioned that the night shifts have less support staff than the day shifts (a wound team is needed). They also commented on the lack of organization and standardization in the unit. For example, they think that supply drawers should be labeled so that new employees can immediately identify what is missing. One nurse noted that it would be a great help if volunteers could stock rooms and drawers. The nurses feel that this would allow the techs to spend more time on patient care.

3. What are your key tasks?
   The key tasks include general patient care (i.e. mouth hygiene, bathing, bed changing, positioning patients, turning patients), assessing patients’ vitals, stocking the room, administering medication, and advocating for the patients.

4. What type of paperwork do you typically have to fill out?
   The nurses mentioned various forms that need to be filled out daily. These forms include wound documentation sheets which must be completed when a patient is admitted and after each dressing change, admission paperwork, nursing care plans, and medication records.

5. How much downtime do you think you have in a normal shift?
   The nurses stated that downtime depends on the patient. A few nurses estimated that they had a total of two hours during a 12-hour shift. Others said that there are days when they do not even get a real lunch break. Several nurses commented that often what little downtime they have is taken up by meetings.

6. What are your main complaints about your job?
   Nurses stated that there was a lack of organization in the unit. Also, communication with physicians and administration staff could be improved. The nurses resent the fact that the hospital views them as an expense. They also mentioned that the paperwork is often redundant and overly standardized (for example, they have to ask 90-year old patients about their sex lives). One nurse mentioned that it is frustrating that the IV team won’t come to the ICU to start IV’s even though they go to the Acute Care unit.

7. If you could change 2-3 things, what would they be?
   - Place an oxygen tank in every room so no one to look for one before going on a road trip.
   - Reinforce uniformity – everything should be in the same spot in every room.
• Change Room 29 – There shouldn’t be two beds in one ICU room.
• Enforcement visiting hours.
• Chart medication online (If pharmacy is online) instead of MAR so doctors could access the information.
• Request better housekeeping (toilets and floors are rarely thoroughly cleaned)
• Improve hospital wide recruitment (i.e. pens/t-shirts, the unit has a hard time getting its name out)
• Replace hand-drawn wound documentation sheets with digital pictures
APPENDIX B: Work Sampling Sheet

<table>
<thead>
<tr>
<th>Date _____________</th>
<th>Start Time _____________</th>
<th>End Time _____________</th>
</tr>
</thead>
<tbody>
<tr>
<td>Job Function (check one)</td>
<td>Nurse</td>
<td>Tech</td>
</tr>
<tr>
<td>Patient Diagnosis: ________________________________________________</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Instructions:** When the beeper sounds, place a tick mark in the box next to the ONE category that best describes your work at that moment.

<table>
<thead>
<tr>
<th>ADT</th>
<th>Hygiene</th>
</tr>
</thead>
<tbody>
<tr>
<td>Admission</td>
<td>Changing beds</td>
</tr>
<tr>
<td>Discharge</td>
<td>Bedpans</td>
</tr>
<tr>
<td>Transfer</td>
<td>Bathing</td>
</tr>
<tr>
<td></td>
<td>Pericare</td>
</tr>
<tr>
<td></td>
<td>Oral Care</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Paperwork</th>
<th>Administering Meds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inter-shift communication</td>
<td>IV Drip</td>
</tr>
<tr>
<td>Checking charts</td>
<td>Replacing IV Fluids</td>
</tr>
<tr>
<td>Writing in charts</td>
<td>Obtaining meds from OmniCell</td>
</tr>
<tr>
<td>Scheduling</td>
<td>Orals</td>
</tr>
<tr>
<td>Computer data entry</td>
<td></td>
</tr>
<tr>
<td>Other paperwork</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Patient Care</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient Transport</td>
<td>Downtime/Lunch</td>
</tr>
<tr>
<td>Moving/turning patient</td>
<td>Patient related phone call</td>
</tr>
<tr>
<td>Collecting samples</td>
<td>Non-patient phone call</td>
</tr>
<tr>
<td>Talking with patient family</td>
<td>Consulting on another unit</td>
</tr>
<tr>
<td>Assessing patient</td>
<td></td>
</tr>
<tr>
<td>Changing bandages/Woundcare</td>
<td>Note: If two or more tasks are being done at the same time, please place one mark by the dominant task</td>
</tr>
<tr>
<td>Checking vitals</td>
<td></td>
</tr>
<tr>
<td>Discussing status with Doctor</td>
<td></td>
</tr>
</tbody>
</table>

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APPENDIX C: Work Sampling Calculations

Work Sampling Error Calculations
The limit of error (L) is based on a standard 95% confidence interval.
For each task, a probability of occurrence is found by dividing the task observations by total observations.

So:
L = limit of error (± percent of the total)
p = probability of a single occurrence
n = total number of observations

With a 95% confidence interval (meaning α=0.5), the z-value equals 1.96

The equation for the limit of error is as follows:
L = 1.96*√[p*(1-p)/n]

The result, L, is the amount by which the probability of occurrence may be statistically off.
APPENDIX D: Regression Analysis (Trauma)

Regression Analysis: Average LOS versus ISS Category

The regression equation is
Average LOS = -0.0939806 + 0.218332 ISS Category

S = 0.680549      R-Sq = 98.3 %      R-Sq(adj) = 98.0 %

Analysis of Variance

<table>
<thead>
<tr>
<th>Source</th>
<th>DF</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>1</td>
<td>133.473</td>
<td>133.473</td>
<td>288.188</td>
<td>0.000</td>
</tr>
<tr>
<td>Error</td>
<td>5</td>
<td>2.316</td>
<td>0.463</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>6</td>
<td>135.789</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Fitted Line Plot: Average LOS versus ISS Category
APPENDIX D: Regression Analysis (Burn)

Cubic Regression (from MINITAB)

Regression Plot

The regression equation is

\[ \text{LOS} = -6.29691 + 0.606898 \text{Burnage} + 0.0080944 \text{Burnage}^2 - 0.0001393 \text{Burnage}^3 \]

\[ S = 8.82712 \quad \text{R-Sq} = 72.6 \% \quad \text{R-Sq(adj)} = 58.9 \% \]

Analysis of Variance

<table>
<thead>
<tr>
<th>Source</th>
<th>DF</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>3</td>
<td>1236.85</td>
<td>412.284</td>
<td>5.29126</td>
<td>0.040</td>
</tr>
<tr>
<td>Error</td>
<td>6</td>
<td>467.51</td>
<td>77.918</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>9</td>
<td>1704.36</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Source</th>
<th>DF</th>
<th>Seq SS</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linear</td>
<td>1</td>
<td>7.13</td>
<td>0.0336</td>
<td>0.859</td>
</tr>
<tr>
<td>Quadratic</td>
<td>1</td>
<td>1169.81</td>
<td>15.5260</td>
<td>0.006</td>
</tr>
<tr>
<td>Cubic</td>
<td>1</td>
<td>59.91</td>
<td>0.7689</td>
<td>0.414</td>
</tr>
</tbody>
</table>
APPENDIX E: UM-TABS Software Instructions

1. Click on the current month.

```
Go to Month:  
  January 2004  
  February 2004  
  March 2004  
  April 2004  
  May 2004  
  June 2004  
  July 2004  
  August 2004  
  September 2004  
  October 2004  
  November 2004  
  December 2004
```

2. Enter the Patient Number, Name, Admit Date, and ISS (or Percentage Total Body Burn). **Percentage Body Burn values between 60% and 79% do not have sufficient data to calculate standard deviations. Only averages can be calculated for this range.**

```
January 2004

Patient Information

<table>
<thead>
<tr>
<th>Patient Number</th>
<th>Patient Name</th>
<th>Admit Date</th>
<th>ISS</th>
<th>% Total Body Burn</th>
<th>Expected ICU Length of Stay</th>
<th>Exp. Disc.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
```

3. Review the results in the white columns.

4. Based on the results, enter the number of days the patient should be in the unit in the Expected ICU Length of Stay (green) column. To achieve an accurate forecast, we recommend entering the number provided in the Average ICU LOS column because this gives the most common scenario for an average patient. However, if a patient has excessive co-morbidities, values within one (68% confidence) and two (95% confidence) standard deviations are also provided. One confidence interval means that 68% of all patients will fall into that category. Two confidence intervals mean that 95% of all patients will fall into that category (5% will stay longer). **The 68% and 95% values should be used for extreme cases only!**

5. Enter the number of nurses needed to treat this patient in the Expected Number of Nurses Needed for Patient Care column. If a nurse could handle two of these patients (1 nurse to 2 patients) enter 0.5. These numbers can be updated as a patient improves or worsens. **If the patient is discharged earlier than the predicted date, this number must be deleted.**
6. Scroll down to the month’s Staffing Forecast to see how many nurses are needed based on the patients currently in the unit. Also, review the expected number of admits for the current month. This will tell you on average how many total patients the unit can expect to receive.

<table>
<thead>
<tr>
<th>Possible Max Range (68% confidence)</th>
<th>Max Stay (95% confidence)</th>
<th>Possible Max Discharge (95% confidence)</th>
<th>Possible Min Stay</th>
<th>Possible Min Discharge</th>
<th>Expected Number of Nurses Needed for Patient Care</th>
</tr>
</thead>
<tbody>
<tr>
<td>2/0/2004</td>
<td>28</td>
<td>1/29/2004</td>
<td>1</td>
<td>1/2/2004</td>
<td>1</td>
</tr>
<tr>
<td>7/0/1900</td>
<td>0</td>
<td>1/0/1900</td>
<td>1</td>
<td>1/0/1900</td>
<td></td>
</tr>
<tr>
<td>7/0/1900</td>
<td>0</td>
<td>1/0/1900</td>
<td>1</td>
<td>1/0/1900</td>
<td></td>
</tr>
<tr>
<td>7/0/1900</td>
<td>0</td>
<td>1/0/1900</td>
<td>1</td>
<td>1/0/1900</td>
<td></td>
</tr>
</tbody>
</table>
Current Scheduling Flowchart

- Administrative assistant posts blank scheduling sheets for the upcoming month four weeks in advance.
- Nurses and techs self schedule following guidelines. This lasts one week.
- Remove and note what changes need to be made to fulfill staff requirements.
- Schedule is reposted for an additional week so that staff can change their personal schedules to meet the required changes.
- Schedule is removed and reworked so that it is as close as possible to the allotted HPPD.
- Schedule is given to the administrative assistant.
- Decide if schedule is acceptable.
  - YES: Final Schedule is posted and a personal schedule is placed in each staff member's mailbox.
  - NO: Schedule is given to Nancy who reworks it by making deals and switches with nurses.
APPENDIX F:

Proposed:

Recommended Flow Chart

1. Administrative assistant posts blank scheduling sheets for the upcoming month four weeks in advance.

2. Nurses and techs self-schedule following guidelines. This lasts one week.

3. Remove and note what changes need to be made to fulfill staff requirements based on UM-TABS forecasts.

4. Schedule is reposted for an additional week so that staff can change their personal schedules to meet the required changes.

5. Schedule is removed and reworked using UM-TABS software.

6. Schedule is given to the administrative assistant.

7. Decide if schedule is acceptable.
   - YES: Final schedule is posted and a personal schedule is placed in each staff member's mailbox.
   - NO: Schedule is given to Nancy who reworks it by making deals and switches with nurses.
APPENDIX G: References


3 December 2003 <http://www.kaizen-consulting.com/training_5s.htm>