Developing a Staffing Model that Responds to Varying Flow, Volume, and Acuity

Final Report

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Executive Summary

The PACU at University of Michigan Health System is divided into three different phases of care: pre-operative care, Phase 1 and Phase 2. Patients in Pre-Op are pre-surgery, while Phase 1 and Phase 2 are post-surgery patients, with Phase 1 patients requiring a higher level of care than Phase 2 patients. The pre-operative care area is staffed at a 1:3 nurse to patient ratio, although the nurse manager and clinical managers indicated that the pre-operative care nurses feel understaffed because of the large variances in flow, volume, and acuity. Flow is defined as the availability of slots and staff within the PACU, as well as the care associated with admission and discharge. The American Society of PeriAnesthesia Nurses (ASPN) standards for Phase 1 and Phase 2 areas of the PACU are staffed at 1:2 and 1:3 nurse to patient ratios respectively.

The PACU currently uses a scheduling model that determines the number of nurses needed for an average daily census of 73 patients, as well as the number of shifts, length, and start time needed for the schedule eight weeks in advance. PACU employees consist of nurses, a clinical care coordinator, two nurse education coordinators, clinical nurse specialist, assistive personnel and clerks that are supervised by nurse and clinical managers. The PACU also uses a staffing model to determine the total number of full-time equivalent nurses (FTE’s) needed to be hired. Currently, there are 59 FTE’s nurses who are assigned to shifts in pre-operative care, pre-operative phone calls, Phase 1, and Phase 2.

The PACU is at times understaffed. This could be due to the nurse to patient ratios needing updates, employee turnover, and staff levels between current model FTE totals. This can cause the staff in the PACU to feel over-utilized.

Methodology
The team developed an updated PACU staffing model by using staff interviews and historical data, performing a beeper study, performing a literature search, then analyzing data, and giving recommendations. The team interviewed the PACU staff in order to understand the problems they felt the PACU was facing, as well as any feelings of frustration towards staffing or PACU processes. The historical data, of nearly 400 cases, allowed the team to analyze admit and discharge times for every patient from the fiscal year 2014 in order to see how many patients are being admitted, cared for, and discharged every hour or every day. The beeper study, of over 700 data points, identified the types and frequencies of activities that the PACU nurses spend time on. It also provided the team with actual nurse to patient ratios, which will be compared to the ratios that are used in the staffing model. The literature search gave the team context as to problems that occur within the PACU.
Findings and Conclusions
From the historical data, the average number of patients being admitted, cared for, and discharged each hour was determined. Additionally, the average number of patients, or average number of beds in use, in the PACU, Pre-Op, Phase 1, and Phase 2, each hour of each day for the fiscal year of 2014 was determined along with the 80th percentile, which is standard practice.

The beeper study data led to the conclusion that the previous nurse to patient ratios, 0.37 for Pre-Op, 0.59 for Phase 1, and 0.37 for Phase 2, were needing updating. Nurses were asked to mark the level of care they were providing, and also if they had bandwidth to care for more patients. From the analysis of responses, the ideal nurse to patient ratios for Pre-Op, Phase 1, and Phase 2 within the PACU were 0.39, 0.53, and 0.43 respectively. This was an increase in nurse to patient ratios in Pre-Op and Phase 2, but a decrease for Phase 1.

The staffing model was updated using the updated Pre-Op and Phase 2 nurse to patient ratios, but leaving the Phase 1 nurse to patient ratio as it was previously. Additionally, the average number of patients in the PACU each hour in Pre-Op, Phase 1, and Phase 2 was updated from the findings in the historical data. The model indicated that the total number of direct care full-time equivalents to hire should be 64 FTE’s, an increase of 1 FTE from the previous year.

Recommendations
The team recommends that the new staffing model be used. The team determined the implementation of the updated staffing model was the most important recommendation after discovering that the nurse to patient ratios from the fiscal year of 2014 were not up to date based on the ratios acquired from the beeper study.

Based on the staffing model, the team recommends that 1 more FTE be hired in order to meet the demands of the PACU. With the hiring of more staff, the peak periods of admission and care for the Pre-Op and PACU can be staffed at a higher ratio so that nurses do not feel as overworked. Additionally, with the increase in number of staff, the time spent on admissions in both the Pre-Op and PACU should decrease so more time can be spent on care and charting, the two activities requiring the most of a nurse’s time.
Introduction

The Postanesthesia Care Unit (PACU) at the University of Michigan Health System (UMHS) is located outside of the Operating Room (OR). The PACU provides care for patients recovering from anesthesia, whether from surgery or another procedure, as well as pre-operative care to prepare patients to receive anesthesia.

The nurse manager and clinical managers have expressed concerns that the current staffing model is outdated. Nurses in the PACU at times feel understaffed. The American Society of Perianesthesia Nurses (ASPN) has standards for nurse to patient ratio in PACU Phase I and PACU Phase II, but no staffing model based on patient acuity.

To address these problems, the nurse and clinical managers in the PACU asked an IOE 481 student team from the University of Michigan College of Engineering to develop an updated staffing model using patient volume, flow into and out of the Pre-Op/PACU, and patient acuity. The team analyzed data from past PACU activity, performed time studies and interviewed staff to develop an updated and effective staffing model for the unit. Additionally, the team collected and analyzed data related to patient flow on a given week and the corresponding times of the day.

Background

The PACU at University of Michigan Health System is divided into three different phases of care: pre-operative care, Phase 1 and Phase 2. Patients in Pre-Op are pre-surgery, while Phase 1 and Phase 2 are post-surgery patients, with Phase 1 patients requiring a higher level of care than Phase 2 patients. Patients entering the PACU are designated into three types. First, hospital outpatient surgery patients come from home the day of surgery and go home that day after surgery. Second, surgery admits come from home the day of surgery then are admitted to the hospital after surgery. Lastly, in-patients are already at the hospital before surgery and then go back to a hospital bed after surgery.

Three nurses each day are staffed for pre-operative phone calls where they call all the patients who are receiving surgery the following day and give them instructions. Patients are asked to arrive two hours before their scheduled surgery and they are admitted to the PACU to receive pre-operative care for approximately 0.5 to 2 hours.

The pre-operative care area is staffed at a 1:3 nurse to patient ratio. The nurse manager and clinical managers indicated that the pre-operative care nurses feel understaffed because of the large variances in flow, volume and acuity. Flow is defined as the availability of slots and staff.
within the PACU, as well as the care associated with admittance and discharge. The Phase 1 and Phase 2 areas are both typically staffed at a 1:2 nurse to patient ratio. When patients leave surgery they enter Phase 1 or Phase 2 depending on the level of care they need, with patients in Phase 1 moving to Phase 2 before discharge to home, as their condition improves. The ASPAN standards recommend staffing Phase 1 at a nurse to patient ratio of 1:2 and staffing Phase 2 at a nurse to patient ratio of 1:3. This move does not always happen, which is why both areas are staffed the same. Nurses are assigned to slots in one of the two areas and don’t move with patients. The two areas are set up the same and both types of care, Phase 1 or 2 can be provided in either room. There are concerns from the managers regarding unnecessary or wasteful hand-offs as well as breakdowns in communication between the two areas. When patients meet the PACU discharge criteria they are discharged and either sent home or admitted to a unit in the hospital depending on their surgery and patient type.

The PACU currently uses a scheduling model that determines the number of nurses needed for an average daily census of 73 patients, as well as the number of shifts, length, and start time needed for the schedule eight weeks in advance. Additionally, the PACU uses a staffing model to determine the total pool of full-time equivalent (FTE) nurses. Although ASPAN has standards for nurse to patient ratio, currently there is no patient acuity model for the PACU anywhere in the United States. The managers have indicated that the average census of 73 patients is outdated and would like the model to incorporate flow, volume and patient acuity. The average census of 73 patients is not exact and does not mean the same number of staff cannot care for a range in the census. For example, one day a certain number of staff could care for 80 patients safely, while the next day they could only care for 70. This varies based on acuity, which the current scheduling model does not take into account.

PACU employees consist of nurses, a clinical care coordinator, two nurse education coordinators, clinical nurse specialist, assistive personnel and clerks that are supervised by nurse and clinical managers. There are 59 full-time equivalent (FTE) nurses who are assigned to shifts in pre-operative care, pre-operative phone calls, Phase 1, and Phase 2. The patient flow in the pre-operative unit is more predictable for the nurses than the PACU and because of the lack of metrics nurse and clinical managers are unsure of the flow of patients in and out, average number of patients in each area at different hours of the day, etc.

**Project Goals and Objectives**

In order to effectively update the staffing model for the Pre-Operative and Post-Anesthesia Care Units, the team did the following:

- Analyzed historical patient activity and staffing trends
- Performed a beeper study to give a clear picture of nurse workload distribution and update nurse-to-patient ratios
- Updated staffing model based on findings
Based on the results of this research, the team did the following:

- Recommended implementing the updated staffing model
- Provided PACU managers with data analysis to visualize and quantify patient flow and nurse workload

**Key Issues**
The following key issues are driving the need for this project:
- Activity data in the current staffing model was outdated
- Nurse workload distribution uncertainty
- Concern that PACU is understaffed

**Project Scope**
The project scope was limited to the updating of a nurse staffing model for only the Pre-Operative and PACU units at the University of Michigan Hospital and analysis of the process of admitting, treating, and discharging patients from the PACU. Furthermore, analysis of historical and current state information is limited to weekdays only, due to the availability of data. Any patient activity not included in the time between patient admission and discharge from the PACU was not considered for the project.

**Methodology**
The following sections outline how data was collected from four different methods: literature searches, interviews, time studies, historical data analysis, and a beeper study.

**Literature Search**
The team performed a literature search to learn more about the PACU and PACU nurse staffing. The team found three scholarly articles in the Journal of Perianesthesia Nursing that were helpful in determining an approach to the project and giving background on a PACU. The titles of these articles were as follows: “Impact of Average Patient Acuity on Staffing of the Phase I PACU [1],” “Why Calculating PACU Staffing is So Hard and Why/How Operations Research Specialists Can Help [2],” and “Safe Staffing for the Post Anesthesia Care Unit: Weighing the Evidence and Identifying the Gaps [3].” The references can be found in Appendix G.

“Impact of Average Patient Acuity on Staffing of the Phase I PACU [1]” references the use of computer optimization to determine the best staffing for the PACU due to the large number of staffing options. It also suggested the amount of data necessary to determine staffing (4 to 5 months). Lastly, the article discussed how to incorporate patient acuity and nurse to patient ratios into the staffing model.
The second article, “Why Calculating PACU Staffing is So Hard and Why/How Operations Research Specialists Can Help [2],” detailed the difference between staffing in PACU versus other parts of a hospital such as the Emergency Room. The article also explained the difficulties faced and strategies used in creating a successful model. A major theme was measuring success based on the number of admission delays into the PACU that occurred. A successful model should staff to minimize these delays. The article also spoke about bridging the gap between operations researchers/hospital engineers and nurses to create effective communication during a staffing project.

The last article the team referenced, “Safe Staffing for the Post Anesthesia Care Unit: Weighing the Evidence and Identifying the Gaps [3],” discussed the safety standards and guidelines that PACU’s across the country follow. The American Society of PeriAnesthesia Nurses (ASPAN) develops standards for nursing practice to ensure safe patient care throughout the United States. The team needs to be aware of these standards when observing in the PACU, speaking to nurses and developing the staffing model. Also, since the team will consider patient acuity and nurse-to-patient ratios it was helpful to read about the current recommendations from ASPAN to become familiar with how others in the industry view patient acuity.

Interviews
The team interviewed five nurses from the PACU staff in order to understand the distribution of nurse workload. The team also spoke with the nursing staff to find out what types of activities they do throughout the day in order to formulate the activity log for the Beeper Study.

Time Studies
The team observed the nursing staff in the PACU during the mid-morning in order to understand the flow between Pre-Op, Phase 1, and Phase 2. A process flow map can be found in the Appendix B. The team also conducted a morning and afternoon observation session in order to identify the amount of time the PACU nurses spend admitting and discharging patients. These time studies were completed in order to validate the anecdotal evidence provided by the PACU nurse managers that admissions and discharges require 30 minutes to complete. These assumptions are used in the historical data analysis.

Historical Data
The team was provided historical data from the 2014 Fiscal Year (7/1/13 - 6/1/14) on patient activity in the PACU. An extensive analysis was performed to provide the clients with a clear picture of patient flow by hour in the PACU as well as the nurse hours spent caring for each type of patient (admit, patient care or discharge). The team used the assumption that the first 30 minutes the patient was in the PACU they were being admitted and the last 30 minutes they were being discharged. The rest of the time the patient spent in the PACU was considered to be in the phase of patient care. The team performed time studies to validate these assumptions as well.
**Beeper Study**

A beeper study was performed on the nursing staff in the PACU from Monday, October 20 through Friday, October 24. The beeper study allowed the team to collect over 750 data points, capturing the types and frequencies of activities the nursing staff perform throughout a day for the week. The beeper study allowed the team to quantify the nursing staff’s workload and identify the activities taking the most time. Nurses from the staff were chosen at random to participate in the beeper study and when one nurse’s shift finished, she or he passed the beeper to the next nurse so that the study spanned the entire day. The initial distribution of the beepers was to two nurses in Phase 1, two in Phase 2, and one or two in Pre-Op. The beeper went off on average 3-5 times per hour. Each time the beeper went off, the nurse recorded the activity he or she was doing, the type of care they were providing, the number of patients they were responsible for, and their shift time and location. These categories were determined from discussions with the client and the interviews with the nursing staff and are as follows:

**Activities:**

- Admitting to Pre-Op
- Admitting to PACU
- Patient Care
- Discharging
- Charting
- Delays/Waiting
- Transferring Patient
- Post Op Calls
- Break/Lunch
- Other

**Number of Patients/Level of Care:**

- 0 patients
- Pre-Op
  - 1 PreOp / 1:1 Required
  - 1 PreOp / Could take another Pat.
  - 1 PreOp / Could take another 2 Pat.
  - 2 PreOp / Maxed
  - 2 PreOp / Could take another Pat.
  - 3 PreOp / Maxed
- Phase 1
  - 1 Phase 1 / 1:1 Required
  - 1 Phase 1 / Could take another Pat.
  - 2 Phase 1 Patients / Maxed
- Phase 2
  - 1 Phase 2 / 1:1 Required
  - 1 Phase 2 / Could take another Pat.
  - 1 Phase 2 / Could take another 2 Pat.
  - 2 Phase 2 / Could take another Pat.
  - 2 Phase 2 / Maxed
  - 3 Phase 2 / Maxed
- 2 patients (1 Phase 1, 1 Phase 2)

The form can be found in Appendix A.

**Findings and Conclusions**

The following sections outline the data analysis for both the historical data and beeper study.

**Patient Activity**

The clients expressed an interest in having a better understanding of when the spikes in admitting and discharging patients were occurring in order to properly understand patient activity. Figure 1 displays a stacked bar graph of patient types in the PACU by hour. As you can see, most admissions to the PACU occur between 8 and 10 am. After 10 am over 60% of the patients are in the patient care phase, while admit and discharge are both below 20%. The same analysis was also performed using patient activity in Pre-operative care, shown in Figure 2. However, with Pre-Operative care, the patients were considered to be admit or patient care types with no discharge. The following are visuals showing the findings from the historical data. The 80th percentile was used since this is the standard.

![Figure 1: Patient Type: 80th Percentile by Hour in the PACU](image)

Source: Historical Data, Period: FY14, Sample Size: 363 cases
In our analysis of nurse activity, it is clear that the vast majority of the nurses’ time is spent caring for patients and charting, accounting for over 50% of all work (28.61% and 24.15% respectively). The next largest portion of time spent, accounting for over 20% of all work time, was admitting patients to Pre-Op and the PACU (9.97% and 10.24% respectively). The complete distribution can be seen in the Figure 3 below.

In figure 4 below, the above information is broken down further by work area.
Figure 4: Distribution of Nurse Workload by Activity and Work Area
Source: Beeper Study Data, Period: FY14, Sample Size: 519

Nurse to Patient Ratios
Additionally, the team was able to graph the nurse’s response to their level of care in Pre-Op, Phase 1, and Phase 2, which can be found in Figures 5, 6, and 7 below.

Figure 5: Pre-Op Nurse to Patient Ratios
Source: Beeper Study Data, Period: FY14, Sample Size: 519
In order to use this data to determine the updated nurse to patient ratios, the team grouped similar responses into ratios of 1:1, 1:2, and 1:3. For example, nurses who responded that they were maxed out at one patient were considered to be a 1:1 nurse to patient ratio. Nurses that responded that they had one patient, but had the bandwidth to care for another were grouped with nurses who responded that they were maxed out at two patients to get an overall 1:2 nurse to patient ratio. The following three figures show the grouped responses of nurse to patient ratios for Pre-Op, Phase 1, and Phase 2. Since some of the nurses were not caring for patients when the beeper
went off, those responses could not be grouped into a nurse to patient ratio, thus the total does not add up to 100%.

Figure 8: Pre-Op Nurse to Patient Ratios Grouped Responses
Source: Beeper Study Data, Period: FY14, Sample Size: 519

Figure 9: Phase 1 Nurse to Patient Ratios Grouped Responses
Source: Beeper Study Data, Period: FY14, Sample Size: 519
In order to calculate the correct ratios, the percentage of responses of nurse 1:1, 1:2, and 1:3 nurse to patient ratios need to be scaled in order to equal 100% by taking out the data points with zero patients. The following table shows an example of how this was scaled for Pre-Op.

Table 1: Calculations to Obtain Scaled Nurse to Patient Ratio for Pre-Op

<table>
<thead>
<tr>
<th>Nurse to Patient Ratio</th>
<th>% of responses</th>
<th>1/% of responses</th>
<th># Patients</th>
<th>(1/% responses)*# patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Op</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1:1</td>
<td>12.37%</td>
<td>0.1378</td>
<td>1</td>
<td>0.137765898</td>
</tr>
<tr>
<td>1:2</td>
<td>17.20%</td>
<td>0.1916</td>
<td>2</td>
<td>0.38311616</td>
</tr>
<tr>
<td>1:3</td>
<td>60.22%</td>
<td>0.6707</td>
<td>3</td>
<td>2.012028065</td>
</tr>
<tr>
<td>Total</td>
<td>89.79%</td>
<td>1</td>
<td></td>
<td>2.5329101236</td>
</tr>
</tbody>
</table>

Using these calculations the nurse to patient ratio for Pre-Op was 1:2.53, for Phase 1 was 1:1.87, and for Phase 2 was 1:2.32. In order to find the number of nurses per bed in the PACU, the team calculated 1 divided by each ratio. The following were obtained:

- Pre-Op: 0.39
- Phase 1: 0.53
- Phase 2: 0.43

The nurse to patient ratio determined for Phase 1 was 0.06 lower than that of the previously used ratio. Therefore, the team decided to keep the previously used Phase 1 ratio of 0.59.
Staffing Model
The PACU uses a staffing model in Excel. The staffing model from fiscal year 2014 can be found in Appendix C. The model is fairly straightforward, taking in two parameters: the 80th percentile of patients in the PACU each hour and the Pre-Op, Phase 1, and Phase 2 nurse to patient ratios. The 80th percentile of patients for each hour in each area of the PACU was calculated using the historical data. These numbers were provided to the team in an initial analysis performed by the coordinators prior to the start of the project. The nurse to patient ratios were calculated using the beeper study data. For Pre-Op, the hours between 5 and 7 am are always staffed at a ratio of 1 nurse to 2 patients, or 0.50 due to the significant number of admissions for surgery. The model includes fixed positions and is not based on activity, such as charge nurses and the call center. Based on ratios calculated from beeper study data, the staffing model suggests the appropriate level of FTE’s is 64. This suggests that staffing an additional 1 FTE may be appropriate. The staffing model for the 2015 fiscal year can be found in Appendix D.

Recommendations
The following outlines the team’s recommendations from the staffing model and beeper study.

Staffing Model
Upon entering the updated ratios and average number of patients calculated from the beeper study and historical data into the staffing model, the model indicates that the PACU should have a total of 64 FTE (Full-time equivalent employees) direct care nurses. This is an increase of 1 FTE from the most recently used staffing model from fiscal year 2014. These calculations show that there is validity to the concerns of PACU nurses that they are understaffed and should lead to a more balanced workload. Therefore, the team recommends the implementation of the updated staffing model.

Beeper Study
The beeper study analysis also yielded that nurses are spending the largest portions of time caring for patients and charting, 28.61% and 24.51% respectively. Patient care will continue to take a large proportion of nurse’s time, as will charting since patients’ conditions are constantly changing. With the increase in total FTE’s for the fiscal year 2015, the time spent on other activities, such as admitting to Pre-Op and admitting to the PACU, will decrease. Even though nurses will continue to spend much of their time caring and charting, the decrease in time spent on other activities will help to alleviate the feeling of being overburdened with too many activities to perform.
The analysis of historical data allowed the team to find spikes in the Pre-Op and PACU throughout the day. For Pre-Op, there are spikes in admission at 5 am and spikes in patient care at 6 and 7 am. For the PACU, there are spikes in admission from 8-10 am and spikes in patients care and discharge simultaneously from 12-6 pm. With the staffing model indicating there is a need for 1 more FTE to be hired, the team recommends that management use these additional nurses during peak work times.

The team recommends that additional beeper collection in order to get a larger sample size to validate the new nurse to patient ratios. The current sample size may be too small to get accurate nurse to patient ratios, which is the ratio decreased for Phase 1.

**Expected Impact**

The team expects this project to impact the PACU in several ways.

- The updated nurse to patient ratios will help to create a more accurate staffing model based on patient flow and acuity
- The increase in the number of direct care nurses will lead to a more manageable workload for nurses, as well as higher employee satisfaction
- The updated staffing model will lead to a better understanding of the current nurse to patient ratios
- The activity analysis will show how the PACU nurses are spending their time and how long each activity requires nurses
- The new graphs by time of day that show % of admission, care, and discharge will help the managers to better identify peaks in admission and discharge, which take more time for the nurses.
<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>01/01/20</td>
<td>08:00</td>
<td>Breakfast</td>
</tr>
<tr>
<td>01/01/20</td>
<td>09:00</td>
<td>Study</td>
</tr>
<tr>
<td>01/01/20</td>
<td>12:00</td>
<td>Lunch</td>
</tr>
<tr>
<td>01/01/20</td>
<td>14:00</td>
<td>Study</td>
</tr>
<tr>
<td>01/01/20</td>
<td>18:00</td>
<td>Dinner</td>
</tr>
<tr>
<td>01/01/20</td>
<td>20:00</td>
<td>Relaxation</td>
</tr>
<tr>
<td>01/02/20</td>
<td>08:00</td>
<td>Breakfast</td>
</tr>
<tr>
<td>01/02/20</td>
<td>09:00</td>
<td>Study</td>
</tr>
<tr>
<td>01/02/20</td>
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</tr>
<tr>
<td>01/02/20</td>
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<td>Dinner</td>
</tr>
<tr>
<td>01/02/20</td>
<td>20:00</td>
<td>Relaxation</td>
</tr>
</tbody>
</table>
Appendix B: Process Map

1. Pre-Op
2. Care/Wait
3. Operating Room
4. PACU Admit
5. PACU
6. Care
7. Discharge

- No additional work needed to move patient from Pre-Op to OR
- 30 minute assumption

Possible internal “transfer” from P1 to Pre-Op

PACU Process Map

Possible internal “transfer” from P1 to P2
### Appendix C: Staffing Model FY2014

#### Table: Staffing Model

<table>
<thead>
<tr>
<th>Phase</th>
<th>Start</th>
<th>End</th>
<th>Hours</th>
<th>Days</th>
<th>Weekday Hours</th>
<th>Total Hours</th>
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<td>Phase 1</td>
<td>8:00</td>
<td>12:00</td>
<td>4</td>
<td>2</td>
<td>28</td>
<td>56</td>
</tr>
<tr>
<td>Phase 2</td>
<td>12:00</td>
<td>4:00</td>
<td>4</td>
<td>2</td>
<td>28</td>
<td>56</td>
</tr>
</tbody>
</table>

**Notes:**
- Weekday: Monday to Friday
- Total Staffing Hours: 700 hours
- Total FTE: 45.9

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#### Other Staffing Information

** Evened Out Call and all other On Call added in Step 6. Average per week from 03/01/13 to 08/31/13 **

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**Step 2: Basic FTE**

<table>
<thead>
<tr>
<th> </th>
<th>Total Staffed Hours / Week</th>
<th>40 Hours / Week</th>
<th>Basic FTE</th>
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<tbody>
<tr>
<td>106.3</td>
<td>106.3</td>
<td>40</td>
<td>40.0</td>
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</tbody>
</table>

**Step 3: Relief FTE**

<table>
<thead>
<tr>
<th>Period</th>
<th>Minutes/Day</th>
<th># Days</th>
<th>60 Minutes</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>24/7</td>
<td>24/7</td>
<td>1</td>
<td>1</td>
<td>0.5</td>
</tr>
</tbody>
</table>

**Step 4: FTE**

<table>
<thead>
<tr>
<th> </th>
<th>Basic FTE</th>
<th>Relief Hours</th>
<th>Total FTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>45.9</td>
<td>45.9</td>
<td>64.0</td>
<td>109.9</td>
</tr>
</tbody>
</table>

**Step 5: Minimum Direct Care Staff**

<table>
<thead>
<tr>
<th> </th>
<th>Basic FTE</th>
<th>Relief FTE</th>
<th>Total FTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>45.9</td>
<td>45.9</td>
<td>64.0</td>
<td>109.9</td>
</tr>
</tbody>
</table>

**Step 6: FTE**

<table>
<thead>
<tr>
<th> </th>
<th>Basic FTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>45.9</td>
<td>45.9</td>
</tr>
</tbody>
</table>

**Step 7: FTE**

<table>
<thead>
<tr>
<th> </th>
<th>FTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>63.0</td>
<td>63.0</td>
</tr>
</tbody>
</table>

---

**Notes:**
- Evened Out Call: Evened Out Call is calculated by dividing the total staffing hours by the number of hours in a week.
- Average FTE: Average FTE is calculated by dividing the total staffing hours by the number of weeks.

---

**Legend:**
- Basic FTE: Basic Full-Time Equivalent
- Relief FTE: Relief Full-Time Equivalent
- Total FTE: Total Full-Time Equivalent
Appendix D: Staffing Model FY2015

**Step 1: Staff Type Area Hours Number of Beds (30th Percentile) Days / Week # Staff per bed Weekly Hours Staffed / Week Total Hours Staffed / Week**

| Direct M-F | Pre 5:00am-9:00am 20.0 x 1 x 5 x 0.5 = 50.0 | Pre 6:00am-10:00am 25.0 x 1 x 5 x 0.5 = 62.5 | Pre 7:00am-11:00am 27.2 x 1 x 5 x 0.3 = 53.7 | Pre 8:00am-12:00am 19.2 x 1 x 5 x 0.3 = 37.0 | Pre 9:00am-1:00am 15.0 x 1 x 5 x 0.5 = 29.6 | Pre 10:00am-2:00am 17.0 x 1 x 5 x 0.3 = 33.6 | Pre 11:00am-3:00am 17.0 x 1 x 5 x 0.5 = 33.8 | Pre 12:00pm-4:00pm 16.0 x 1 x 5 x 0.3 = 31.6 | Pre 1:00pm-5:00pm 14.0 x 1 x 5 x 0.3 = 27.0 | Pre 2:00pm-6:00pm 13.0 x 1 x 5 x 0.3 = 25.7 | Pre 3:00pm-7:00pm 11.0 x 1 x 5 x 0.3 = 21.7 | Pre 4:00pm-8:00pm 8.0 x 1 x 5 x 0.3 = 15.9 | Pre 5:00pm-9:00pm 6.0 x 1 x 5 x 0.3 = 11.8 | Pre 6:00pm-10:00pm 3.0 x 1 x 5 x 0.3 = 5.3 | Pre 7:00pm-11:00pm 2.0 x 1 x 5 x 0.3 = 3.9 | Pre 8:00pm-12:00am 1.0 x 1 x 5 x 0.3 = 446.0 |

**PreOp Charge**

| Phase 1 | 7:00am-8:00am 1.0 x 1 x 5 x 0.5 = 3.0 | 8:00am-9:00am 4.0 x 1 x 5 x 0.5 = 11.8 | 9:00am-10:00am 11.0 x 1 x 5 x 0.5 = 32.9 | 10:00am-11:00am 16.0 x 1 x 5 x 0.5 = 47.2 | 11:00am-12:00am 20.0 x 1 x 5 x 0.5 = 59.0 | 12:00pm-1:00pm 20.0 x 1 x 5 x 0.5 = 64.0 | 1:00pm-2:00pm 25.0 x 1 x 5 x 0.5 = 73.8 | 2:00pm-3:00pm 25.0 x 1 x 5 x 0.5 = 76.7 | 3:00pm-4:00pm 26.0 x 1 x 5 x 0.5 = 76.7 | 4:00pm-5:00pm 26.0 x 1 x 5 x 0.5 = 76.7 | 5:00pm-6:00pm 30.0 x 1 x 5 x 0.5 = 75.0 | 6:00pm-7:00pm 23.0 x 1 x 5 x 0.5 = 67.9 | 7:00pm-8:00pm 26.0 x 1 x 5 x 0.5 = 65.8 | 8:00pm-9:00pm 16.0 x 1 x 5 x 0.5 = 47.2 | 9:00pm-10:00pm 10.0 x 1 x 5 x 0.5 = 30.7 | 10:00pm-11:00pm 8.0 x 1 x 5 x 0.5 = 18.9 | 11:00pm-12:00am 5.0 x 1 x 5 x 0.5 = 14.9 | 12:00am-1:00am 3.0 x 1 x 5 x 0.5 = 45.0 |

**Phase Charge**

| Phase 2 | 8:00am-9:00am 1.0 x 1 x 5 x 0.43 = 2.2 | 9:00am-10:00am 4.0 x 1 x 5 x 0.43 = 6.5 | 10:00am-11:00am 7.0 x 1 x 5 x 0.43 = 15.1 | 11:00am-12:00am 9.0 x 1 x 5 x 0.43 = 17.8 | 12:00pm-1:00pm 9.0 x 1 x 5 x 0.43 = 19.4 | 1:00pm-2:00pm 11.0 x 1 x 5 x 0.43 = 23.8 | 2:00pm-3:00pm 11.0 x 1 x 5 x 0.43 = 24.2 | 3:00pm-4:00pm 12.0 x 1 x 5 x 0.43 = 25.9 | 4:00pm-5:00pm 12.0 x 1 x 5 x 0.43 = 29.4 | 5:00pm-6:00pm 11.0 x 1 x 5 x 0.43 = 23.8 | 6:00pm-7:00pm 10.0 x 1 x 5 x 0.43 = 21.6 | 7:00pm-8:00pm 8.0 x 1 x 5 x 0.43 = 17.3 | 8:00pm-9:00pm 6.0 x 1 x 5 x 0.43 = 13.0 | 9:00pm-10:00pm 4.0 x 1 x 5 x 0.43 = 8.6 | 10:00pm-11:00pm 2.0 x 1 x 5 x 0.43 = 4.3 | 11:00pm-12:00am 1.0 x 1 x 5 x 0.43 = 2.2 | 12:00am-1:00am 1.0 x 1 x 5 x 0.43 = 2.2 |

**Nights**

| All | 7:00pm-7:00am 2 x 12 x 5 x 1.0 = 120.0 | 12:00am-12:00am 2 x 12 x 5 x 1.0 = 240.0 |

**Step 2: Basic FTE**

| Total Staffed Hours / 40 Hours / Basic FTE | 1867.5 / 40 = 46.7 |

**Step 3: Relief Employee***

<table>
<thead>
<tr>
<th>a) Personal Time</th>
<th>Hours</th>
<th>Total Personal Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breaks/Lunch</td>
<td>60</td>
<td>252 / 60 = 252.0</td>
</tr>
</tbody>
</table>

**b) PTO**

<table>
<thead>
<tr>
<th>Days/Year</th>
<th>Hours/Day</th>
<th>(2% of 208 working days)</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vacation/Sick</td>
<td>33</td>
<td>8</td>
<td>264</td>
</tr>
<tr>
<td>Business Time</td>
<td>14</td>
<td>8</td>
<td>112</td>
</tr>
<tr>
<td>Holiday</td>
<td>7</td>
<td>4</td>
<td>28</td>
</tr>
</tbody>
</table>

| Total Personal FTE | 492.0 |

**Step 4: Relief FTE**

<table>
<thead>
<tr>
<th>Basic FTE</th>
<th>Relief FTE</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>2880 Hours (220’s)</td>
<td>467.7 / 13.4 = 454.0</td>
<td></td>
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</tbody>
</table>

**Step 5: Minimum Direct Care Staff**

<table>
<thead>
<tr>
<th>Basic FTE</th>
<th>Total FTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>45.7 / 15.4 = 30.0</td>
<td></td>
</tr>
</tbody>
</table>

**Step 6: Fixed**

<table>
<thead>
<tr>
<th># Staff</th>
<th># Hours</th>
<th># Days</th>
<th>FTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Call Center</td>
<td>2</td>
<td>2</td>
<td>50</td>
</tr>
</tbody>
</table>

**Step 7: FTE**

**Grand Total Direct Care FTE’s to Hire**

**Based on ORMIS and Centricity data, 80th percentile, all of FY13**

**Based on nursing contract**

**Proposed Staffing for UH based on PACU Staffing Formula Using Data from 07/01/13 to 06/30/2014**

**Direct RN staffing**

**Updated: 5/17/14**

**On Call**

<table>
<thead>
<tr>
<th># Days</th>
<th># Staff</th>
<th># Hours</th>
<th># Days</th>
<th>FTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>253.1</td>
<td>26.0</td>
<td>46.7 / 15.4 = 30.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**On Call**

<table>
<thead>
<tr>
<th># Staff</th>
<th># Hours</th>
<th># Days</th>
<th>FTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>75.2</td>
<td>75.2 / 15.4 = 50.0</td>
<td></td>
<td></td>
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</tbody>
</table>
Appendix E: PACU Patient Type Graphs

E -1

PACU Patient Type: Average by Hour

E -2

PACU Patient Types: Percent of Total by Hour
Appendix F: Pre-Op Patient Type Graphs

F -1

PreOp Patient Type: Average by Hour

F -2

PreOp Patient Types: Percent of Total by Hour
Appendix G: References

