University of Michigan Health System

Programs and Operations Analysis

Analysis of Clinical Obstetric Anesthesia Nurse Workload

Final Report

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EXECUTIVE SUMMARY

The University of Michigan Health System (UMHS) utilizes Clinical Obstetric Anesthesia Nurses (COBANs) to assist anesthesiologists and obstetric (OB) nurses manage the pain of laboring mothers in the OB unit. The COBAN group is comprised of seven nurses who have assumed responsibilities that traditionally belong to obstetric anesthesiologists and obstetric nurses. In addition to rounding on patients every two hours, COBANs are responsible for the following main tasks: collecting patient information, assisting with the placement of epidurals, delivering medication through the epidural (referred to as delivering a bolus), assisting in the OR, assisting with the replacement of epidurals, and replacing epidural cartridges.

According to the managing Certified Registered Nurse Anesthetist (CRNA), the COBANs have felt increasing pressure to keep pace with their numerous responsibilities. The increasing workload has led to many of the COBANs feeling overworked and underappreciated. The managing CRNA requested that an Industrial and Operations Engineering (IOE) 481 student team from the University of Michigan quantify the COBANs’ workload and make recommendations.

METHODS
The team performed four types of data collection methods to quantify the COBANs workload.

Time Studies
The team collected 63.5 hours of time studies and observed six of the COBANs. The time studies were completed for all tasks that the COBAN completed during shifts. These tasks included the six main tasks previously described, rounding on patients and other non-down time activities, which were defined as other tasks that add value to patient care.

COBAN Self-collection
The team collected five months of COBAN-collection sheets. These sheets recorded the frequency of main tasks completed, whether rounds were completed, the number of COBANs on duty, and the number of patients in the OB unit. The COBAN-collection form was modified after three months to include room for the frequency of tasks that COBANs were unable to complete, whether breaks were taken, and the number of non-English speaking patients in the OB unit.

Interviews
The team interviewed all six of the COBANs that were observed in the time studies and reported the findings anonymously. The interviews covered what COBANs like the most and least about their position, what the relationships between COBANs and other OB personnel are, and how the COBANs prioritize the tasks they must accomplish. After completing the interviews, the team created a post-interview survey for the COBANs to complete.
**Surveys**
The post-interview COBAN survey consisted of nine questions that expand upon trends discovered during the interview process. A different survey was distributed to the OB nurses. The OB nurse survey gauged the relationship between OB nurses and COBANs, the perception OB nurses have of the COBANs’ workload, and the possibility that work was being repeated by both teams.

**FINDINGS**
Through the data collection previously described, findings were made based on the time studies, COBAN-collection forms, interviews and surveys.

**Time Studies:**
The time studies were used to show two pieces of information: the average time to complete COBAN tasks, and that no correlation between the number of patients and the COBAN workload exists. The average time to complete each main task (except for assisting in the OR) was calculated, as well as the average time to round on each patient, wait for an anesthesiologist, and walk to a patient room.

**COBAN Self-collection:**
The following findings were made using the COBAN self-collection:
- The busiest 2-hour period of the day is 6am-8am
- No difference exists in workload between day and night shift
- Wednesday is busiest day of the week
- Rounds are not completed 22% of the time
- Fewer rounds completed as the number of patients increases
- Expected workloads exceed COBAN capacity 14% of the time

**Interviews:**
The following findings were made based on the COBAN interviews:
- The percentage of COBANs that feel overwhelmed at work is 83%
- All of the COBANs preferred 12 hour shifts over 8 hour shifts
- The COBANs rated collecting patient information and rounding on patients as the least important tasks

**Surveys:**
The post-interview COBAN survey showed that 100% of COBANs believe that patients should receive further educations on pain management. The OB nurse survey showed that 98% of the OB nurses believed that without a COBAN on duty the OB nurse’s job would be more difficult. Additionally, without a COBAN on duty 92% of the OB nurses think that patients would notice a
difference in patient care. History and physical information is collected 89% of the time by OB nurses. Of the OB nurses interviewed, 75% believe that all information is shared with COBANs.

CONCLUSIONS:

Based on the previous findings, the team made six conclusions:
1. COBANs are perceived as adding value to the OB unit
2. COBAN work has few patterns
3. COBAN workload is not correlated to the number of patients
4. COBANs do not have time to complete all of their work
5. COBAN office is too far away from patient rooms
6. COBANs are completing unnecessary work.

RECOMMENDATIONS

Based on the previous conclusions, the team recommends that the following four changes be made.

Allow COBANs to Work Overtime During Busiest Times
Allowing for an extra COBAN to work during the busiest times of the day will reduce the amount of work COBANs miss. The busiest time of day for COBANs is 6:00 a.m. to 8:00 a.m. especially on Wednesdays. If the workload of a COBAN exceeds her capacity, another COBAN would be allowed to stay and help complete the work.

Relocate the COBAN Office
The average time spent walking just to complete the main task was found to be 60 minutes, which is greater than the amount of time it would take to complete the rounds that they are currently unable to finish. Additionally, moving the office will reduce COBAN fatigue.

Further Educate Patients on Pain Management
The team recommends that patients receive more education on epidurals, prior to giving birth. COBANs expressed that many patients have unrealistic expectations concerning the amount of pain that epidurals can ease. Improving patient education may make patients easier to work with and reduce the number of boluses COBANs deliver. Another project team should investigate this recommendation and develop a strategy for patient education.

Redistribute the Responsibility of Collecting History and Physical Information
The collection of history and physical information was rated by the COBANs as one of the lowest priority tasks. Redistributing this task to OB nurses would be easiest for two main reasons: OB nurses already collect history and physical information, and COBANs and OB nurses have open communication. Redistributing this information could save the COBANs 1.3 hours per shift.
1.0 INTRODUCTION
The University of Michigan Health System (UMHS) utilizes Clinical Obstetric Anesthesia Nurses (COBANs) to help anesthesiologists and obstetric (OB) nurses manage the pain of laboring mothers in the OB unit. The COBAN group is comprised of seven nurses who represent 5.8 full-time-equivalents (FTE). The group is managed by a Certified Registered Nurse Anesthetist (CRNA) within the Anesthesiology Department at UMHS. Over the years, the COBANs have taken on a niche role by assuming responsibilities that traditionally belong to obstetric anesthesiologists and obstetric nurses. According to the managing CRNA, the COBANs have felt increasing pressure to keep pace with the numerous tasks they have taken over. The increase in workload has led to many of the COBANs feeling overworked and underappreciated. The managing CRNA requested that an Industrial and Operations Engineering (IOE) 481 student team from the University of Michigan quantify the COBANs’ workload. The purpose of this report is to present the project goals, methods, findings, conclusions, recommendations, and expected impact of the IOE 481 team’s project.

2.0 BACKGROUND
The COBAN model used at UMHS was adopted 15 years ago from the nation’s leading women’s care institution, Brigham and Women’s Hospital. The model was adopted after residents, who previously helped with OB-Anesthesia, were limited to working 80 hours per week.

According to one of the original COBANs, the COBAN group was brought to UMHS to compensate for staffing shortages as well as improve patient satisfaction by providing specialized care. The COBAN group consists entirely of former OB nurses who have taken on a more specialized role by primarily assisting OB anesthesiologists with the placement and maintenance of epidurals for patients in labor. The COBANs’ role has expanded to include rounding on patients with epidurals every two hours and performing the following six main tasks:

- Collecting patient information
- Assisting with the placement of epidurals
- Delivering medication through epidurals (referred to as delivering a bolus)
- Assisting in the operating room (OR)
- Assisting with the replacement of epidurals
- Replacing epidural cartridges

For a more detailed view of the COBANs work, refer to the flowcharts in Appendix A.

According to the managing CRNA, seven COBANs currently ensure coverage of the OB unit 24 hours a day, 7 days a week. COBANs work 12 hour shifts that are generally from 6am-6pm and from 6pm-6am. During the nights, two COBANs are sometimes scheduled to make up for the lack of residents who assist during the day shift.
According to the managing CRNA, COBANs feel overworked and are having trouble with missing scheduled breaks and balancing responsibilities throughout their shifts. COBANs often miss one or both of their two designated 15-minute breaks or have to shorten their lunches to accommodate the numerous requests for their assistance. While on duty, COBANs are often asked to assist with more tasks than they have time to complete; sometimes doctors have to place epidurals without the help of COBANs and COBANs are sometimes unable to round on patients every two hours.

According to one of the COBANs, in the past the COBANs were asked to note the time that they entered and exited each patient room; this was the beginning of an effort to quantify the COBANs’ workload. However, COBANs often forgot to note these times and the data was never analyzed. A modified approach began in November 2012. According to the managing CRNA, at this time the COBANs began completing forms to report the number of main tasks that they complete every two hours. These forms were completed by every COBAN on every shift. The team used these COBAN-collection forms along with other methods of data collection to quantify the workload of the COBANs and make recommendations.

### 2.1 Key Issues
The key issues that are driving the need for this project are that COBANs are:
- Having difficulty balancing responsibilities throughout their shifts
- Struggling to find time for scheduled breaks during shifts
- Feeling overworked

### 2.2 Goals and Objectives
The main goals of this project are to quantify the workload of the COBANs and to recommend ways to make the COBANs feel less overworked. To accomplish these goals, the project team’s objectives included:
- Performing time studies of the COBANs
- Analyzing COBAN-collected data
- Collecting qualitative data through surveys with OB Nurses and interviews with COBANs

### 2.3 Project Scope
The scope of this project included all of the activities that the COBANs completed and all of the activities that the COBANs did not complete. COBANs are on duty 24 hours a day, seven days a week, so this project included collecting data from both day shifts and night shifts.

The project scope excluded the tasks that do not involve the COBANs. The team did not examine or quantify the activities of other employees within the Anesthesia Department or the
employees of the OB Unit.

3.0 METHODS
To quantify the COBANs’ workload, the team collected and analyzed data. The team relied on data that was collected through four main methods: time studies, COBAN-collection forms, interviews, and surveys.

3.1 Data Collection
The team collected 63.5 hours of time study data, 5 months of COBAN-collection forms, 6 interviews of COBANs, and 58 survey responses from OB nurses. All of this data was collected as the beginning steps of quantifying the COBANs’ workload.

3.1.1 Time Studies
The team collected 63.5 hours of time studies, and observed all COBANs except for one. Time studies were performed for all tasks that the COBANs complete during their shifts. These tasks include the six tasks previously described, rounding on patients, and other non-downtime activities. Non-downtime activities are defined as tasks that add value to patients but are not one of the six main tasks. For this project, the following tasks were defined as being non-downtime activities:

- Charting patient information, while not in the patient’s room
- Communicating with OB nurses, OB doctors, or OB anesthesiologists about patient care
- Walking from a patient room to another patient room or to the COBAN office
- Gathering patient information from triage

The amount of downtime was also recorded. The team divided each of the six tasks into a group of subtasks, which are defined in Table 1.
Table 1. Subtasks for six main COBAN tasks

<table>
<thead>
<tr>
<th>Subtasks for collecting patient information</th>
<th>Subtasks for placing or replacing an epidural</th>
<th>Subtasks for delivering a bolus, assisting in the OR, or replacing an epidural cartridge</th>
</tr>
</thead>
<tbody>
<tr>
<td>● Walking</td>
<td>● Gathering supplies</td>
<td>● Walking</td>
</tr>
<tr>
<td>● Collecting history and physical information</td>
<td>● Walking</td>
<td>● Delivering Care</td>
</tr>
<tr>
<td>● Collecting epidural consent</td>
<td>● Waiting for anesthesiologist</td>
<td></td>
</tr>
<tr>
<td>● Charting</td>
<td>● Preparation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>● Epidural placement</td>
<td></td>
</tr>
<tr>
<td></td>
<td>● Post treatment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>● Patient monitoring</td>
<td></td>
</tr>
</tbody>
</table>

To ensure consistency, the team determined what actions would constitute the start and end of each of the subtasks. The start and end times of each subtask can be found in Appendix B.

For each of the main tasks, the time to complete the task was recorded two ways. First, the amount of time that COBANs spent actively working to complete the task was recorded. This time is referred to throughout the project as the “working time.” Second, the amount of time a task took from the patient’s perspective was recorded. This time is referred to as “total time.” Total time always begins when a COBAN receives a page stating that a task needs to be completed. For each of the six tasks and for both timing methods, a task ends when the COBAN leaves the patient’s room or the operating room. The data collection form used when performing time studies can be found in Appendix C.

3.1.2 COBAN-Collection

To collect needed data, the team modified the COBAN-collection forms in three ways. The modified COBAN-collection forms allowed COBANs to report if they were able to take any breaks. Breaks were denoted by writing a “B”, an “L”, or a “U” to represent an uninterrupted 15-minute break, an uninterrupted 30-minute break, or any interrupted break respectively. The modified form also requested that the COBANs note the number of non-English speaking patients the COBANs interacted with, and how many tasks the COBANs were asked to assist with but were unable to complete. The tasks that COBANs were unable to help with are denoted by a “0” in the task’s respective column. An example of a completed COBAN-collection form can be seen in Figure 1.
Figure 1. Completed COBAN-collection form

The team wrote instructions to explain the modified collection form to ensure that data was accurately reported. The COBANs received the modified collection forms and instructions on February 21, 2013. The COBAN-collection form and instructions can be found in Appendix D. The team collected COBAN-collection forms each day from October 31, 2012 through March 19, 2013. Forms collected between October 31, 2012 and February 21, 2013 did not contain the added information described above. The original COBAN-collection forms asked COBANs to record the number of main tasks they completed every two-hours, whether rounds were completed, the number of COBANs on duty, and the number of patients in the OB unit. COBANs will continue to complete the modified collection forms for their own use, but the team will not collect more forms.

3.1.3 Interviews
The team interviewed all six of the COBANs that were observed in the time studies and reported the findings anonymously. The interview questions can be found in Appendix E. These interviews were used to gather information in three major areas. The interviews covered what COBANs like the most and least about their position, what the relationships between COBANs and other OB personnel are, and how the COBANs prioritize the tasks they must accomplish. Each interview lasted approximately 25 minutes. After the interviews, the team sent all of the COBANs a nine-question survey to expound on preliminary findings from the interviews. The post-interview surveys will be discussed in the following section.

3.1.4 Surveys
The team wrote a post-interview survey that was sent to all of the COBANs. Qualtrics hosted the nine-question survey that the team created to expound on preliminary findings from the interviews. The team received responses from 4 of the 7 COBANs. To convert the qualitative answers gained through interviews into quantitative data, the team asked the following questions:

- What percentage of patients, besides high risk patients, do you visit to obtain epidural consent?
- Where do you chart most often and why do you choose that location?
- Where do you get medication to replace cartridges, if you are already in a patient room and do not have the needed medication?
When does a patient leave your care?

To better understand what changes the COBANs would believe to be useful, the team asked the following questions:

- Do you believe having two COBANs on staff at one time would help you?
- Do you believe that moving needed supplies to a more convenient location would help eliminate unneeded walking?
- Do you believe that moving your workroom will improve the care you provide to patients?
- Do you believe patients should be more educated on the pain management and the limitations of epidurals?

The full post-interview survey can be found in Appendix F.

The team also wrote a Qualtrics survey that consisted of 17 multiple-choice questions. The survey gauged the current relationship between OB nurses and COBANs, the perception OB nurses have of the COBANs’ workload, and the possibility that work is being repeated by both teams.

To better understand the relationship between the OB nurses and COBANs, the team asked OB nurses:

- How often do you interact with COBANs?
- What interactions do you commonly have with COBANs?

The team used this information to show that OB nurses interact with COBANs often enough to act as a valid source of COBAN evaluation.

To gauge the OB nurses’ perception of the COBANs’ workloads, the team asked OB nurses:

- If a COBAN was not on duty, would your job be more difficult?
- If a COBAN was not on duty, would the patient notice a difference in her care?

To measure repeated work by OB nurses and COBANs, the IOE 481 team asked OB nurses which of the following tasks they ever perform and on what percent of their patients:

- Collection of history and physical information
- Obtainment of epidural consent
- Assessment of patient’s airways

The IOE 481 team believed that these three areas were where the most overlap was likely to occur, because these tasks involve obtaining patient information. If tasks are being repeated, the team wanted to know how well OB nurses believed information was shared. The team used this information to determine if COBANs are performing tasks that were already completed by the OB nurses, and therefore are completing unnecessary work.
The full OB nurse survey can be found in Appendix G. The team sent the survey to all OB Nurses and received 58 responses. According to the OB Nurse Manager, approximately 140 OB nurses work at UMHS.

3.2 Data Analysis
The team analyzed the time studies, COBAN-collection forms, and sections of the surveys for quantitative findings; surveys and interviews were analyzed for qualitative findings.

3.2.1 Time Studies
The team entered all of the time study data into an Excel spreadsheet and calculated average task times and correlation values.

3.2.1.1 Calculation of Average Task Times
The team entered all of the time study data regarding the six main tasks and rounding into an Excel spreadsheet that used both the working time and total time to calculate:
- Standard deviation between data points
- Maximum time to complete a task
- Minimum time to complete a task
- Average time to complete a task

The team found that the standard deviation for the main tasks’ subtasks were too high to use for quantifying the COBANs workload; however, the standard deviation of each main task as a whole was much lower. The team also discarded the values for assisting in the OR, since only two data points were collected for this task. For the rest of this report, the main tasks will refer to all of the six main tasks except assisting in the OR. The time values of each of the main tasks and rounding, which were calculated using the working time, were used to quantify the COBANs’ workload.

The time study data was used to find the amount of time that COBANs spent waiting for anesthesiologists and the amount of time that COBANs spent walking. Waiting for anesthesiologists can occur during two different tasks: placing an epidural and replacing an epidural. The time COBANs spent waiting for anesthesiologists was calculated separately for each of these tasks. As defined in Appendix B, the time spent waiting for an anesthesiologist is defined as the difference between the time that the anesthesiologist enters the patient’s room and the time that the COBAN enters the patient’s room.

The minimum, maximum, and mean amount of time COBANs had to walk per one of the six main tasks was calculated, along with the standard deviation. These values were not separated by task because the time it takes to walk to a patient’s room is independent of the task that would be completed in the patient room. Only time walking to one of the six main tasks was recorded.
3.2.1.2 Calculation of Correlation Values
The team also calculated the correlation between the number of patients and the amount of COBAN downtime. Each of the patient values listed in Table 2 were compared to each of time values in Table 2 for a total of nine comparisons.

<table>
<thead>
<tr>
<th>Patient Values</th>
<th>Time Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>● Number of patients with epidurals</td>
<td>● Amount of non-downtime activity not counted in six main tasks</td>
</tr>
<tr>
<td>● Number of patients in labor</td>
<td>● Total amount of non-downtime activity</td>
</tr>
<tr>
<td>● Mean of number of patients with epidurals and number of patients in labor</td>
<td>● Total amount of downtime activity</td>
</tr>
</tbody>
</table>

The team calculated the correlation between the number of patients and the amount of time COBANs took to round on one patient. Each of the patient values listed in Table 3 were compared to each of time values in Table 3 for a total of nine comparisons.

<table>
<thead>
<tr>
<th>Patient Values</th>
<th>Time Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>● Number of patients with epidurals</td>
<td>● Total amount of time to round on one patient (includes walk time and care time)</td>
</tr>
<tr>
<td>● Number of patients in labor</td>
<td>● Amount of time to walk to a patient’s room during round</td>
</tr>
<tr>
<td>● Mean of number of patients with epidurals and number of patients in labor</td>
<td>● Amount of time spent in patient’s room during round</td>
</tr>
</tbody>
</table>

3.2.2 COBAN-Collection
The team entered all of the COBAN-collected data into an Excel spreadsheet and calculated nine main pieces of information: main task frequency, quantification of workload, workload differences, workload level determination, distribution of patients, percentage of rounds completed, quantification of missed work, distribution of workload, and percentage of breaks taken.

3.2.2.1 Calculation of Main Task Frequency
The frequency of the main tasks was calculated using the COBAN-collection data. The number of times each task was performed in a day was averaged over all of the days that COBANs

\[\text{Time values were normalized by dividing the amount of time by the total amount of time observed that shift.}\]
completed the collection forms. This value is the average number of times per day for each main task is performed.

3.2.2.2 Quantification of Expected Workload
The COBAN workload was calculated per two-hour period, per shift, and per day. The workload was calculated as a function of the main tasks, and as a function of the main tasks and rounds. To calculate the workload, the number of times a task was completed in the time period was multiplied by the mean time COBANs took to complete the task (as calculated by the time study data). All of the tasks that were completed within the specified amount of time were summed to calculate the total workload.

When calculating the workload as a function of both the main tasks and the rounds, the team accounted for COBANs not reporting the number of patients who had epidurals. If the number of patients with epidurals was not reported, the team did not consider that time period when analyzing the data. When analyzing the difference between night and day shift, if any two-hour period within a shift was missing the number of patients with epidurals, the entire shift was not considered in the analysis. Likewise, if the number of patients with epidurals was missing for any of the two-hour periods within a day, the day was not considered. The team calculated that 66% of 2-hour periods, 47% of shifts, and 24% of days contained enough information to be analyzed.

3.2.2.3 Difference in Workload by Period of Time
The team conducted two-tailed t-tests to determine if a significant difference existed between each two-hour time period, the day and night shift, and each day of the week. If the t-test produced a value lower than 0.05, the two time periods were determined to be significantly different.

3.2.2.4 Determination of High, Medium, Low Workloads
Because work in the OB unit is highly variable, the team did not feel only providing a mean workload was adequate. Instead, the team used the shift workload data to define a high, medium, and low volume workload. A low volume workload is defined as ranging from the minimum value to the 25th percentile; a medium volume workload ranges from the 25th percentile to the 75th percentile; a high volume workload ranges from the 75th percentile to the maximum value.

3.2.2.5 Distribution of Patients
The team sorted the COBAN-collection data by the number of patients with epidurals per two-hour period. If the number of patients with epidurals was not recorded, that two-hour period was not considered during analysis. The team then calculated the percent of time each possible value of patients with epidurals was in the OB unit.
3.2.2.6 Percentage of Rounds Completed Based on Number of Patients
The team sorted the COBAN-collection data by the number of patients with epidurals. Times were discarded if a COBAN indicated that zero patients had epidurals or if no indication was made of having patients with epidurals. In each case of having one through seven patients with an epidural, the team calculated the percent of times that rounds were completed. This percentage is the likelihood that rounds were completed.

3.2.2.7 Quantification of Missed Work
Missed work was defined as work that should have been completed by the COBANs, but the COBANs did not have enough time to complete. The COBAN-Collection forms asked the COBANs to report any instances when they were asked to assist with one of the six main tasks but were unable to; however, the team only collected 16 instances of missed main tasks out of over 4000 data points collected\(^2\). Such a low response would lead to negligible results, so the team only considered missed rounds when quantifying missed work.

The information found when calculating the distribution of patients and percentage of completed rounds was combined to quantify the amount of rounds COBANs missed. The team sorted the COBAN-collection data by the number of patients with epidurals and the day of the week. If the number of patients with epidurals was not recorded, that two-hour period was not considered during analysis. For each day of the week, the team determined the percent of time each possible number of patients with epidurals were in the OB unit. The team multiplied the likelihood of having a certain number of patients with epidurals by the likelihood of rounds being completed for that number of patients. The resulting value is the percentage of rounds that were completed. From this the team was able to determine the number and time value of rounds that were not completed. See Appendix H for more information on this calculation.

3.2.2.8 Distribution of COBAN Work
The team divided the COBANs’ time into four categories of work: main tasks, rounding, non-downtime tasks, downtime. The team then determined what percent of each day was spent on these tasks. The average time per day spent on main tasks was previously calculated when determining the difference in workload by day. The average time per day spent on rounds was calculated by multiplying the percentage of rounds completed (as calculated in the previous section) by the average number of patients per day and the average time needed to round on one patient. The team used the time study data to compare what percent of the time that is not spent on main tasks or rounding is spent on non-downtime tasks and on downtime.

\(^2\) It should be noted that during the interviews, COBANs reported on average not being able to assist with 2.4 epidurals per week
3.2.2.9 Percentage of Missed COBAN Breaks
The team used the data collected through the modified COBAN-collection forms, to calculate the percentage of breaks missed. The team determined how many 15-minute and 30-minute breaks should have been taken and divided the number of breaks that were taken by this value. The team calculated the percentage of 15-minute breaks taken, 30-minute breaks taken, and the percentage of all breaks that were interrupted.

3.2.3 Interviews
The team interviewed six of the COBANs and transcribed these interviews to use in analysis. Each of the COBANs are referred to as a number 1 through 6, to ensure COBAN anonymity. The team created a post-interview survey for the COBANs to complete that expounded on initial findings from the interviews. Percentages of similar responses were taken for questions involving numeric responses. The mean was taken for each task in the question involving the 6 main tasks completed by COBAN. Calculated means were then ordered to portray a group-wide rank of task importance. The team noted differences among the responses for all of the qualitative questions. Noted differences or missing responses were analyzed further using a post-interview survey for the COBANs.

3.2.4 Surveys
Qualtrics hosted both the post-interview survey that the COBANs completed and the survey that the OB nurses completed. For each question, Qualtrics computed the percent and number of OB Nurses who selected each possible answer. Free response questions were analyzed by the team for trends in responses.

4.0 FINDINGS
Through the data analysis previously described, findings were made based on the time studies, COBAN-collection forms, interviews and surveys.

4.1 Time Studies
The time studies were used to show two pieces of information: the average time to complete COBAN tasks, and that no correlation between the number of patients and the COBAN workload exists.

4.1.1 Average Time to Complete Tasks
Figure 2 shows the mean amount of time that each of the main tasks take to complete, while highlighting the difference between value added and non-value added time.
Non-value added time is defined as time spent walking to the patient’s room or time spent waiting for the anesthesiologist. These tasks do not benefit the patient. Value added time is the remaining amount of time to accomplish a task. Refer to Appendix I for more detailed time calculations about each of the COBANs main tasks, including

- Standard deviation between data points
- Maximum time a task took to complete
- Minimum time a task took to complete
- Average time a task took to complete
- Number of data points per main tasks

The time study data also showed that the average time to complete a round was 5 minutes per patient.

When assisting with the placements of epidurals, the COBANs waited between 0 and 15 minutes for an anesthesiologist to arrive. The mean waiting time was just over 5 minutes. However, when assisting with epidural replacement, the team never observed a COBAN waiting for an anesthesiologist.

4.1.1 No Correlation between Number of Patients and COBAN Workload
The correlation between the number of patients and the amount of COBAN downtime was never above 0.3. Such a low correlation value indicates that the number of patients with epidurals
cannot be used as a valid way to predict the amount of COBAN downtime. More information on calculating this correlation value can be found in Appendix J.

The correlation between the number of patients and the time to round on one patient was never above 0.36. Such a low correlation value indicates that the number of patients cannot be used as a valid way to predict the amount of time to complete rounds. More information on these calculations can be found in Appendix K.

4.2 COBAN-Collection
The COBAN-collection data was used to develop the majority of the team findings. Below nine of the main findings and described.

4.2.1 Frequency of Main Tasks
As shown in the Figure 3, the most common task is the collection of patient information.

![Figure 3. Most frequently performed task is collecting patient information](image)

Epidural replacement is the least frequent task, which suggests that most epidurals are placed correctly the first time.

Figure 4 shows the average amount of time spent performing each task on an average 24-hour day.
Epidural placement tasks the longest amount of time per day because each procedure, according to the time study data, takes on average 47 minutes to complete and on average 7 epidurals are placed every day. Despite frequently delivering boluses and changing cartridges, these tasks do not, relatively speaking, take much time.

4.2.2 Differences in Workload by Time Period
The team determined that 6am-8am was the busiest 2-hour period of the day. No difference in workload exists between day and night shift, and Wednesdays were significantly busier than any other day of the week.

4.2.2.1 Busiest Time Period of the Day: 6am-8am
The team calculated the average workload for each two hour time period. The workload shown is a combination of main tasks (not including assisting in the OR) and the time COBANs would take to round on all patients in the OB unit with epidurals. As shown in Figure 5, the workload is significantly higher during the time period of 6:00 am to 8:00 am, but little difference exists elsewhere.
The team conducted t-tests between every two-hour period of time, to determine if any statistically significant differences in the average expected workloads existed between two hour time periods. Based on this analysis, a significant difference exists between 6:00am-8:00am and the other time periods. Between 6am and 8am the average workload is 82.8 minutes, compared to an overall average of 66 minutes per two hour time block. Refer to Appendix L for more information.

4.2.2.2 No Difference in Workload Exists Between Shifts
The t-test conducted between the day (6:00am-6:00pm) and night (6:00pm-6:00am) shift calculated a p-value of 0.5, and thus showed that no significant difference exists between the shifts. More information on this comparison can be found in Appendix M.

4.2.2.3 Busiest Day of Week: Wednesday
The t-test conducted between the days of the week showed that Wednesday had a significantly larger workload than all of the other days of the week. For specific p-values see Appendix N. The average workload per twelve hour shift is 9.95 hours. On Wednesdays, the workload increases to 11.3 hours of work per twelve hour shift. Figure 6 shows how the COBAN workload varies by day.
Figure 6. Wednesday has the largest workload of the week

The daily workload shown in Figure 6 only takes into account time spent completing the main tasks (not including assisting in the OR). The time COBANs took to complete rounds was not accounted for because only 24% of days that the COBANs completed COBAN-collection forms included full information on the number of patients with epidurals. Without a full day of information on the number of patients, the time spent completing rounds would not be accurate. Figure 6 serves as visual representation of the variance in workload by day, not as a visual representation of all work completed per day.

4.2.3 High, Medium, Low Workloads Defined
The workload per 12-hour shift, which only includes time spent completing the main tasks, was divided into three categories. Table 4 shows the range of workloads that are included in each volume of workday.
The team later used the values in Table 4 to show differences in specific areas of work based on the difference in workload volume.

### 4.2.4 COBANs Spend One Hour per Shift Walking

The time study data shows that for every main task the COBANs complete, on average the COBAN takes two minutes to walk to the patient’s room. This information, combined with the data from the COBAN-collection forms, shows how long the COBANs spent walking per 12-hour shift. The team calculated the number of miles walked per shift by assuming that the COBANs walk 1 mile in 15 minutes. Table 5 shows how the amount of time and distances differs for a high, medium, and low volume shift.

<table>
<thead>
<tr>
<th>Volume of Shift</th>
<th>Amount of time walking to complete six main tasks per 12-hour shift (minutes)</th>
<th>Distance (Miles)</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>92.6</td>
<td>6.2</td>
</tr>
<tr>
<td>Medium</td>
<td>58.8</td>
<td>4.0</td>
</tr>
<tr>
<td>Low</td>
<td>32.4</td>
<td>2.2</td>
</tr>
</tbody>
</table>

The time values in Table 5 only account for the time COBANs take to walk to a patient room complete one of the six main tasks, and the time COBANs take to walk back to their office. This value does not include the time COBANs time spent walking during rounds, or time spent walking to find OB nurses or anesthesiologists.
4.2.5 OB Unit has 2 or Fewer Epidural Patients 42% of the Time

Figure 7 shows the distribution of patients with epidurals.

Figure 7. OB Unit has 2 or fewer epidural patients 42% of the time

Figure 7 shows that COBANs are most likely to have 2 patients with epidurals at one time, and that 42% of the time the OB unit has 2 patients or fewer with epidurals. In general, as the number of patients with epidurals increases, the less frequently that number of patients is seen the unit.
4.2.6 Fewer Rounds are Completed as Number of Patients Increases

Figure 8 shows that as the number of patients increases the percentage of rounds missed also increases.

Figure 8. COBANs complete fewer rounds as number of patients increases

The team only investigated having up to 7 patients with epidurals because less than 30 data points were collected for having more patients than that. When the team accounted for having up to seven patients with epidurals, 95% of all data points were included.
4.2.7 Missed Work Quantified

Figure 9 shows the percentage of rounds that are not completed each day.

![Bar chart showing percentage of rounds missed each day.]

On average, COBANs do not complete 22% of rounds each day. On Wednesday, this value rises to 29% of rounds not being completed. This is consistent with the previous finding that Wednesday has the highest workload.

Figure 10 shows the amount of time COBANs would take to complete main tasks and rounds in each two hour period.
Figure 10. Expected workload exceeds COBAN capacity 14% of the time

Figure 10 shows the amount of time COBANs would need to complete their workload is often greater than the actual two hour period. Based on the above analysis, 14% of the expected workloads are greater than 2 hours. This can be seen by looking at the section on the line of the graph that lies above the horizontal line that marks two hours. This discrepancy indicates that the workload can be greater than the actual capacity of the COBANs.
4.2.8 Distribution of COBAN Work

Figure 11 shows how COBAN work is distributed each day as a function of four main categories of work (main tasks, rounds, non-downtime activities, downtime).

Sample Size: 63.5 hours; 1175 two-hour periods

Figure 11. COBAN Work Distribution

Figure 11 shows the amount of time that rounds take to complete taking into account the percentage of rounds that are missed per day. This figure does not show how long COBANs would take to complete all of the rounds that need to be completed. The time study data showed that after accounting for the time spent on the main tasks and time spent on rounding, 70% of the remaining time was spent on non-downtime activities. This information was used when preparing Figure 11.

4.2.9 COBANs Miss 42% of Lunch Breaks

Between February 21, 2013 to March 19, 2013, COBANs reported missing 42% of their 30-minute uninterrupted lunch breaks. Of the total breaks taken, 21% were reported as interrupted.

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3 The data used to quantify the time spent on the main tasks and rounding were based off 1175 two hour time periods. The data used to quantify the time spent on non-downtime activities and downtime were based on 63.5 hours of time studies.
breaks. COBANs also reported missing 78% of their 15-minute uninterrupted breaks; however the team believes that more data would need to be collected to validate this percentage.

4.3 Interviews
The interviews provided the team with a better understanding of how COBANs perceive their role. In the interviews, 83% of COBANs reported feeling overwhelmed at work; 100% of COBANs prefer 12 hour shifts over 8 hour shifts; and COBANs report being responsible for gathering epidural consent from 93% of non-high risk patients. The COBANs also ranked each of their responsibilities by how urgent they perceived the tasks to be. Collectively the COBANs rated the tasks as follows, with 1 being the most urgent:

1. Replacement of an epidural
2. Delivery of bolus
3. Placement of an epidural
4. Assistance in the OR
5. Replacement of the epidural cartridge
6. Collection of patient information
7. Rounds on patient

Tasks that correct how the epidural is working were ranked as the most important. Collecting patient information and rounding on patients were considered the least urgent tasks. In the interviews COBANs also mentioned that patients should receive more information, prior to coming to the OB Unit to give birth, about pain management. COBANs said that patients often do not understand the limitations of epidurals and have unrealistic expectations of the pain they will experience during childbirth. In the post-interview survey, COBANs were asked specifically if they believed that patients should be further educated on pain management and 100% of COBANs said that patients should be.

As mentioned in section 4.2.2.2 No Difference in Workload Exists Between Shifts, no significant difference was found between day and night shifts; however, in the interview COBAN #2 stated that COBANs, “don’t work well at night” and that COBANs, “don’t think as well” at night. Working the night shift may cause the work the COBANs complete to be more difficult even if the workload is not significantly different. For a transcription of COBANs’ interviews see Appendix O.

4.4 Surveys
Of the OB nurses surveyed, 72% report interacting with a COBANs at least once per shift, and 58% report interacting multiple times per shift. The three most common interactions, and what percentage of nurses reported interacting in such a way, are reported in Table 6.
Table 6. OB nurses commonly interact with COBANs

<table>
<thead>
<tr>
<th>Interaction</th>
<th>Percent of OB Nurses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discussing patient information</td>
<td>93%</td>
</tr>
<tr>
<td>Positioning a patient</td>
<td>80%</td>
</tr>
<tr>
<td>Checking the vitals of a patient</td>
<td>54%</td>
</tr>
</tbody>
</table>

Because COBANs and OB nurses interact frequently, the team used this information to validate that OB nurses are a qualified source to evaluate the COBANs.

The team found that 98% of OB nurses believed that if a COBAN was not on duty, the OB nurse’s job would be more difficult. The three most popular reasons for this belief can be found in Table 7.

Table 7. OB nurses believe their job would be more difficult without COBANs

<table>
<thead>
<tr>
<th>Reason</th>
<th>Percent of OB Nurses</th>
</tr>
</thead>
<tbody>
<tr>
<td>I would need to assist the anesthesiologist in the placement or replacement of an epidural</td>
<td>77%</td>
</tr>
<tr>
<td>I would not have someone to ask for a second opinion concerning the patient’s pain management</td>
<td>68%</td>
</tr>
<tr>
<td>I would need to bolus the patient</td>
<td>66%</td>
</tr>
</tbody>
</table>

The team also found that 92% of OB nurses believed that if a COBAN was not on duty, patients would notice a difference in their care. The two most popular reasons for this belief can be found in Table 8.

Table 8. OB nurses believe patients would notice a difference in care without COBANs

<table>
<thead>
<tr>
<th>Reason</th>
<th>Percent of OB Nurses</th>
</tr>
</thead>
<tbody>
<tr>
<td>The response time for placing and maintaining an epidural would be longer</td>
<td>86%</td>
</tr>
<tr>
<td>Someone with an extensive knowledge of epidurals and pain management would not be present</td>
<td>64%</td>
</tr>
</tbody>
</table>

When the team investigated the possibility that work is being repeated by both the COBANs and OB nurses, the team found that COBANs and OB nurses repeated some of the same work. The task that is repeated the most often by both OB nurses and COBANs is collecting history and
physical information. COBANs gather this data for the majority of the patients that enter the OB Unit; of the 54 OB Nurses who answered the question, 89% report also gathering history and physical information (and 63% report gathering this information from all of their patients). Gathering history and physical information twice is redundant work and does not add value to patient care.

Little work was repeated concerning checking patients’ airways and obtaining epidural consent, as these are not the responsibility of OB nurses. Of the 54 OB nurses who answered the question, 9% of OB nurses reported checking the airway of any of their patients (5% reported checking the airway of 100% of their patients). None of the OB nurses reported being responsible for obtaining epidural consent.

The OB nurses were asked how well they believe information is shared between their team and COBANs. Figure 12 shows that 75% of OB nurses believe that all information is shared with COBANs.

![Bar Chart](chart.png)

**Figure 12. OB nurses believe all information is shared with COBANS**

For full results of the OB nurse survey, see Appendix P.

### 5.0 CONCLUSIONS

Based on the previous findings, the team made six conclusions:

1. COBANs are perceived as adding value to the OB unit
2. COBAN work has few patterns
3. COBAN workload is not correlated to the number of patients
4. COBANs do not have time to complete all of their work
5. COBAN office is too far away from patient rooms
6. COBANs are completing unnecessary work.
5.1 COBANs are Perceived as Adding Value to the OB Unit
The findings from the OB nurse survey support that COBANs add value to the OB unit. Of the OB nurses surveyed, 98% stated that without a COBAN on duty, the job of an OB nurse would be more difficult. Of the OB nurses, 92% stated that patients would notice a difference in their care if a COBAN was not on duty. This combination of beliefs shows that COBANs are perceived to add value to both other care providers and to patients. Because the OB nurse survey showed that OB nurses work one on one with patients and work closely with COBANs, OB nurses were considered a qualified source to determine if COBANs add value to the OB unit.

5.2 COBAN Work has Few Patterns
The findings from section 4.2.2 Differences in Workload by Time Period supported that COBAN work has few patterns. When the COBAN workload was analyzed by 2-hour period, the team found that the time period between 6am-8am was significantly busier than any other 2-hour period. No other differences were identified among two-hour time periods. The workload between the day and night shift was also found to have no significant difference. When COBAN workload was analyzed by day of week, the team found that Wednesdays were significantly busier than any other day. No other differences were identified among days of the week.

5.3 COBAN Workload is Not Correlated to the Number of Patients
The findings in section 4.1.1 No Correlation Between Number of Patients and COBAN Workload support that the COBAN workload is not correlated to the number of patients. After nine different comparisons of COBAN patients and workload, none of the comparisons had a p-value greater than 0.3. Nine comparisons were also made between the number of patients and time to complete rounds. None of these comparisons had a p-value greater than 0.36. All 18 situations support that COBAN workload is not correlated to the number of patients.

5.4 COBANs Do Not Have Enough Time to Complete All of their Work
The findings from section 4.2.7 Missed Work Quantified and section 4.2.9 Percentage of Missed COBAN Breaks support that COBANs do not have enough time to complete all of their work. On an average day, COBANs are not able to complete 22% of their patient rounds. This percentage increases as the number of patients increases, and rises as high as missing 58% of rounds when 7 patients with epidurals are in the OB unit. Though COBANs are entitled to an uninterrupted 30-minute lunch break, COBANs miss 42% of these breaks. The team also found that 14% of two-hour periods have an expected workload that exceeds two hours. This data supports that COBANs do not have enough time to complete all of their work.

5.5 COBAN Office is Too Far Away from Patient Rooms
The findings from section 4.2.4 COBANs Spend One Hour per Shift Walking support that the COBAN office is too far away from the patient rooms. COBANs spend an average of one hour
per twelve hour shift walking to and from their office to patient rooms to perform main tasks. COBANs return to their office to obtain medication and epidural pumps, and to chart patient information. The time spent walking to and from the COBAN office is greater than the time needed to complete all of the COBANs missed rounds. Time spent walking does not add value to patient care, and the large amount of walking contributes to COBAN fatigue. The calculated time spent walking does not include time spent walking for rounds, between patient rooms or to find other care providers.

5.6 COBANs are Completing Unnecessary Work
The findings in section 4.3 Interviews and section 4.4 Surveys support that COBANs are completing unnecessary work. From the interviews, the team discovered that COBANs believe that further educating patients on pain management would make the COBANs’ job easier. It is thought that if patients better understand the limitations of epidurals, the patients would be easier to work with and may request fewer boluses.

From the surveys, the team discovered that 89% of OB nurses are already procuring history and physical information from patients. Gathering history and physical information twice is redundant work and does not add value to patient care. The COBAN workload could be decreased if patients were further educated on pain management and if COBANs did not collect redundant history and physical information.

6.0 RECOMMENDATIONS
Based on the previous conclusions, the team recommends that the following four changes be made to the current state:

- Allow COBANs to work overtime during the busiest times
- Relocate the COBAN office
- Further educate patients on pain management
- Redistribute the responsibility of obtaining history and physical information.

6.1 In Scope Recommendations
In scope recommendations are recommendations that exclusively involve the COBANs and their work. Of the recommendations made, two are in scope: allow COBANs to work overtime during busiest times, and relocate the COBAN office.

6.1.1 Allow COBANs to Work Overtime During Busiest Times
Based on the workload patterns identified in previous sections, the team recommends that the COBANs be allowed to work overtime during certain times. The busiest time is 6am-8am, especially on Wednesdays. COBANs who work the night shift, currently work 6pm-6am shifts. Allowing a COBAN to stay an extra hour or two, if the unit is particularly busy, would be easy and convenient. This option would allow the COBANs to autonomously judge whether the
workload at 6am exceeds the capacity of a single COBAN. If the COBAN did believe the workload was too high, the night shift COBAN could stay to help the day shift COBAN. COBANs are currently working no more than 36 hours per week, so the extra hours would not be billed at overtime rates. This solution will allow for better patient care, decrease the COBANs’ feelings of being overworked, and not cost the unit a large amount of money.

6.1.2 Relocate the COBAN Office
The amount of time that COBANs spend walking supports the recommendation of relocating the COBAN office. The amount of time COBANs spend walking to and from their office to perform main tasks is greater than the amount of time it would take to complete the rounds that COBANs are currently unable to finish. It would only take an additional 44 minutes on the average day to complete all missed rounds. If the COBAN office were moved to a location that was halfway between where the office currently is to where the majority of patient rooms are, COBANs would have an additional 30 minutes to spend on patient care.

6.2 Out of Scope Recommendations
Out of scope recommendations are recommendations that involve a group of people other than the COBANs. However, these out of scope recommendations will still directly impact the COBANs and their workload. Of the recommendations made, two were out of scope: further educate patients on pain management, and redistribute the responsibility of collecting history and physical information.

6.2.1 Further Educate Patients on Pain Management
All of the interviewed COBANs agreed that their workload would be reduced if patients were better educated on how epidurals function and the degree of pain relief the epidural will afford. The team recommends that another project team investigate different methods to improve patient education around the epidural process. The team thinks that one method to further investigate would be to have patients go to an epidural information session while the patients are touring the hospital before coming to the hospital to deliver. Better educated patients are easier to work with because they require less attention from the COBANs. Patients also have a better experience when they are fully informed of the process they will endure. The team also believes that if patients were better educated on epidurals, patients would also request fewer boluses because they would understand the limitations of an epidural.

6.2.2 Redistribute the Responsibility of Collecting History and Physical Information
If the responsibility of collecting history and physical information were redistributed, the amount of work that COBANs need to complete would be decreased. In interviews, COBANs ranked collecting patient information as being the least urgent task, besides rounds, that they complete. Because collecting patient information has such a low priority, it is the easiest task to delegate to other care providers. Redistributing this task to OB nurses would be best for two main reasons: OB nurses already collect history and physical information and COBANs and OB nurses have
open communication. Both of these reasons were shown in the *Surveys* section of *Findings*.

If the responsibility of collecting history and physical information was redistributed, COBANs would save an average of 1.3 hours per shift. That time could be used to complete missed rounds, improve the quality of patient care, and allow the COBANs to take their scheduled breaks.

**7.0 EXPECTED IMPACT**

The team expects that if these recommendations are implemented, the COBANs will feel less overworked. If all recommendations are implemented, the team expects that the COBANs’ workload will be decreased by two hours per shift. Even if all of the recommendations are not implemented, implementing one or two of the recommendations will still lower the COBANs’ workload. If the COBANs’ workload is lessened, the team expects that COBANs will feel less overworked. Each implemented recommendation will reduce the COBAN workload, increase the value-added patient care, and help the COBANs feel less overworked.