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BIRTH OF A NEW MATERNITY PROCESS

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ABSTRACT

Miami Valley Hospital, the largest hospital in the Dayton, Ohio area, experienced a steady increase in deliveries and births between 1990 and 1996. Maternity length of stay increased by 15 percent in 1997 due to maternity minimum length of stay legislation and physician practices. The combination of more patients and longer stays resulted in an acute capacity problem.

A computer model was developed to represent the patient flow and census. This model also analyzed the effect of differing patient types, increasing volumes, Maternity unit configurations, and policy changes. The model showed that minor construction enabled a 15-20% increase in volume and more balanced overall utilization without changing the licensed capacity. Additional parent transition rooms, a larger triage area, and a larger Perinatal intensive care unit were constructed in 1997.

1 INTRODUCTION

Miami Valley Hospital is a large urban hospital located in Dayton, Ohio. The hospital has 698 licensed beds. Miami Valley has an associated freestanding women's hospital named Berry Women's Health Pavilion. This center services many family needs including In-Vitro Fertilization, Neonatal Care, Perinatal Care, Ultrasound, High Risk Pregnancy Services, Prenatal Care, Labor, Delivery, Antepartum, Postpartum, Childbirth Education, and Family Health. Optimizing patient flow and building capacity for Berry Women's Health Pavilion Maternity Patients by modeling is the topic of this paper.

Miami Valley Hospital had a steady increase in deliveries and births. During the 1990s births climbed from under 5,000 to over 6,000 annually. Maternity length of stay increased over 15 percent since 1996 due to recent legislation and physician practice. The combination of more patients and longer stays resulted in an acute capacity problem in triage, labor and Postpartum rooms.

A working group was formed to determine optimal capacity and possible solutions. The group brainstormed and developed a cause and effect diagram which categorized major over-capacity causes. The working group later identified critical inputs through pareto analysis. The critical inputs included patient types, patient locations, length of stay at each location, hospital policy and physician practice. The group reviewed patient acuity and care for each of the areas. Later the group developed assumptions that were consistent with current patient volumes and length of stay. A computer model was developed using MedModel 3.0 to represent the patient flow and census (see Figure 1). This model was also developed to analyze the effect of increasing volumes, differing patient types and creating policy changes. The model was validated by taking an hourly census for 168 hours at 18 specified locations.

2 MATERNITY MODEL

2.1 Original Layout

The Maternity units were divided into five major areas: Triage, Perinatal Intensive Care Unit, Labor, PostPartum, and Antepartum. In general a patient registered then proceeded to a Triage area, labored, delivered and recovered for one to three days.

2.2 Model Inputs

The majority of patients enter the system from home to low or high-risk triage. Over 40 percent of patients in low-risk triage are in false labor and return home within a few hours. The remainder of patients in low-risk triage complete their labor in an individual labor room. Patients typically deliver in the labor room and later are moved to an individual Postpartum room. There are three Postpartum areas Maternity 1, Maternity 2, and Berry 1. After staying a few days Mom and baby are discharged home.

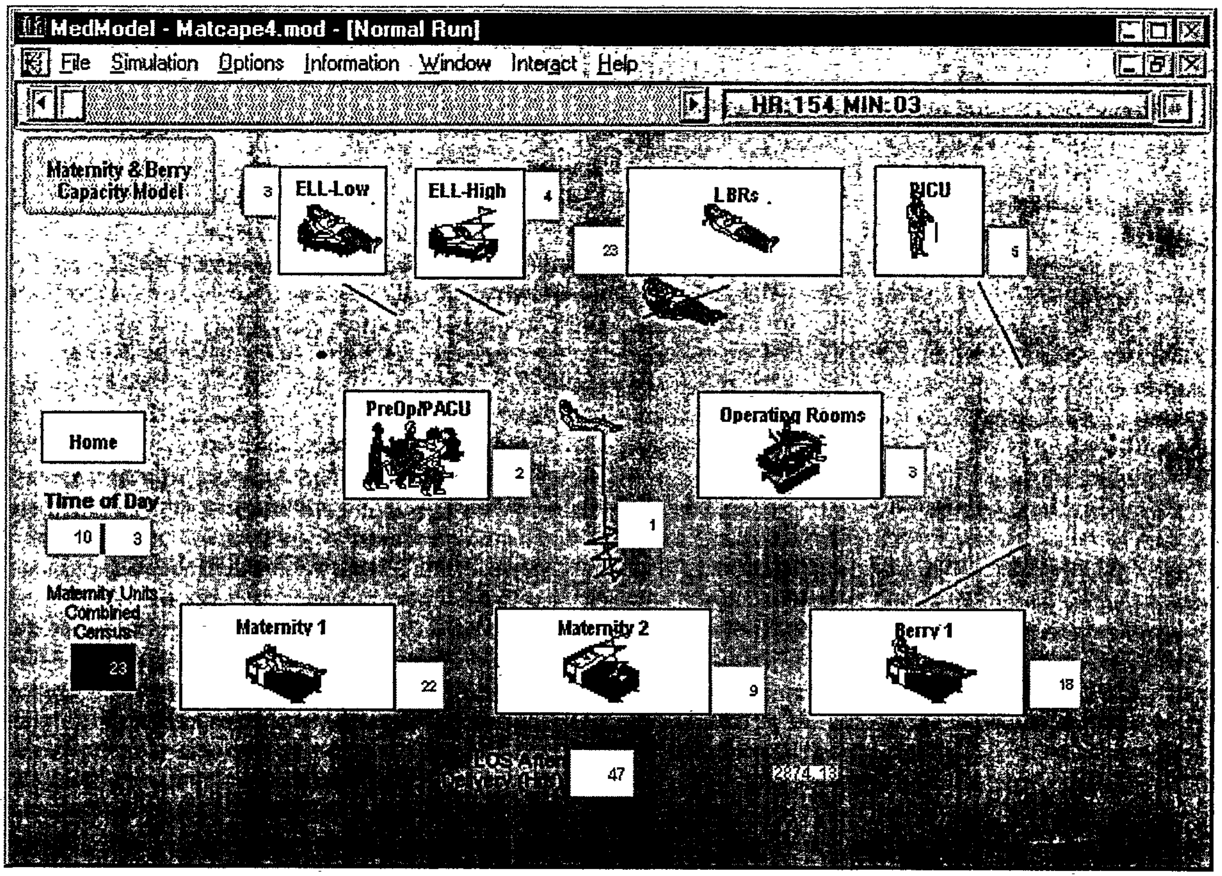

Figure 1: Maternity Capacity Model Layout

Less typically, high risk patients report through the High risk triage area and some also go to the Perinatal Intensive Care Unit. About eight percent of moms undergo scheduled Cesarean sections while about nine percent of patients undergo unscheduled Cesarean sections. In rare cases patients are admitted to the hospital for an Antepartum stay as well.

2.2.1 Model Issues

Simulation was used to solve the problems of customer satisfaction, utilization, and patient flow. The model was used to identify improvements, which maximized room utilization, opportunities for process changes, and optimal expansion opportunities.

- Issues addressed included:
- Room/bed utilization
- Maternity capacity
- Maternity routing process logic
- Hypothetical effects of increasing patient volume
- Hypothetical effects of a mandatory discharge time
- Hypothetical effects of an aggressive short stay option
- Hypothetical effects of legally mandated minimum stays
- Hypothetical effects of reconfigured Units and rooms

2.2.2 Model Components

Physical entities for the model included Perinatal patients and infants. Resources included nurses, physicians and other health-care workers. Additional virtual resources were used as gate-keepers which represented various policies.

The gate-keepers were inserted into the model to satisfy the Hospital's policy of only discharging patients from 8 AM until 10 PM—even if the required length of stay was past. These gate-keepers enforced the discharge policy by being a required resource to exit and by having scheduled work hours (initially from 8 AM until 10 PM and later with other variations). Another interesting modeling point was the complex over-capacity routing for each patient type and acuity. Patients were routed between clinical areas based on both mother's and infant's condition and the availability of treatment areas.

Eighteen physical locations were represented: early labor lounges, units, rooms, queues outside each major area, interface points, entry and exit points. Figure 1 below shows the model layout including waiting areas and timing points. The lightning shapes in various areas indicate swing-bed patients. A swing bed refers to an alternate location used to augment capacity.

Twelve different models were developed. The models included: The current process with mandatory discharge times, the process with the six incremental patient volume increases, the process with a short stay option, the process within legally mandated minimum length of stay (long stay option), and two versions of the process with reconfigured units and room layouts.

2.3 Model Findings

There were large fluctuations in volume and bed utilization in this clinical area. The existing process overextended the Perinatal Intensive Care Unit and traded Triage and Labor rooms depending on caseload. The process also traded Postpartum areas to accommodate Labor patients. The overall room assignment process was not robust and would have reached a critical situation within one year.

The Perinatal intensive care unit was extended far beyond capacity. Average census was 6.7 while the actual bed size of the unit was only 5.0. This required frequent utilization of labor rooms in an adjacent area.

2.4 New Laws

To make capacity matters worse, patient length of stay was expected to increase with passage of Ohio House Bill 199. This bill mandated that insurers cover the mother's stay for a period of at least 48 hours after vaginal delivery and 96 hours after Cesarean delivery. Previously, some insurers covered only one day. Similar laws were enacted throughout the country which allowed reasonable hospital stays for mothers and infants. A histogram depicting actual Postpartum time in hours is shown in Figure 2.

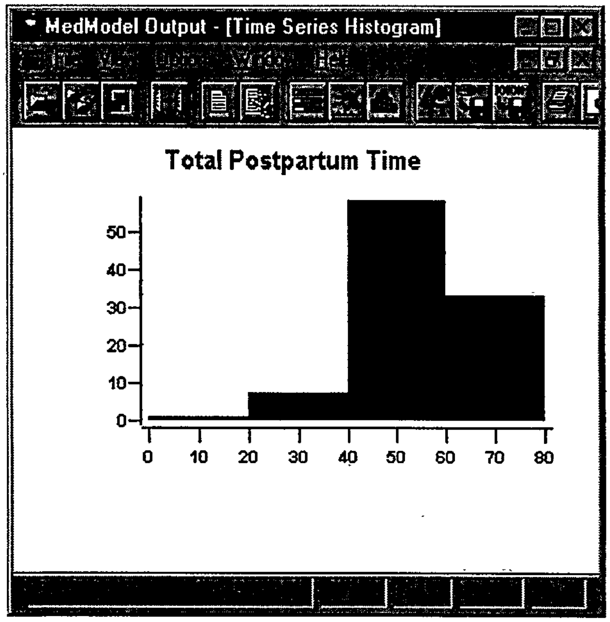

Figure 2: PostPartum Intervals

3 CONCLUSIONS AND RECOMMENDATIONS

In general, the Maternity areas had very high utilization levels. Based on model findings--additional bed space and unit reorganization was deemed necessary. Studies were done using patient volume projections by hour of day at the 99th percent confidence interval to assure adequate capacity with the wide variation of Maternity patient arrivals.

The institution desired a maximum utilization rate of 75% for any given area. Refer to Figure 3 for pre-construction utilzation levels. The model showed that nine additional beds were required in a worst case situation. The Maternity group was challenged in increasing number of available beds by nine without increasing the licensed capacity or adding an additional structure. This was accomplished by expanding the triage area by five beds, reconfiguring the Perinatal Intensive Care Unit/Postpartum area adjacent to the Triage area for sing bed patients and also with the creation of four parent transition rooms. Parent transition rooms are rooms for moms who are discharged but still want to remain at the hospital for personal reasons (when the baby is not yet discharged or the mom is waiting for family member to take her home).

Home visit follow-ups for all patients who voluntarily left prior to the 48/96 hour time frame were already being done and were continued. Close case management of patient stay was continued along with length of stay tracking from delivery to discharge.

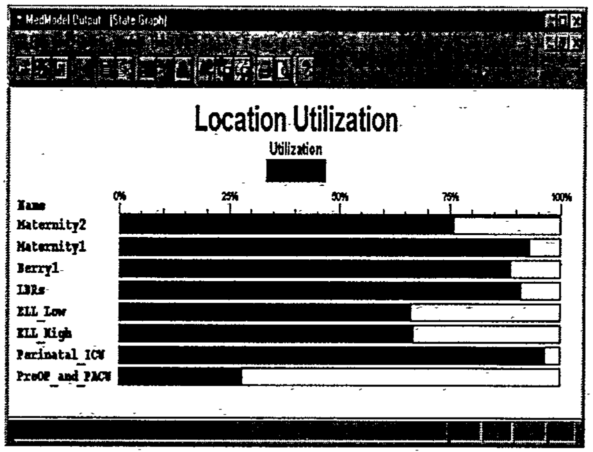

Figure 3: Location utilization for the busy "before"

The model showed that the recommendations allowed for a 15-20% increase in volume and more balanced utilization of all areas.

Patient flow was reviewed through the triage area to enhance utilization. Appropriateness of admission to the Perinatal Intensive Care Unit was also examined but provided only minimal utilization opportunities. Finally, increased education of the nursing staff as well as prenatal education of patients about the 48/96 hour stay was accomplished.

AUTHOR BIOGRAPHY

WILLIAM C. JOHNSON is Manager of the Management Engineering Department at Miami Valley Hospital in Dayton, Ohio. He received his B.S. degree from the United States Military Academy at West Point, his M.S. degree in Business Organizational Management from the University of LaVerne, and his M.S. degree in Materials Engineering from the University of Dayton. He is also a Certified Manufacturing Engineer.