

## Smith Hager Bajo, Inc. Simulation Modeling Case Study – NICU/Special Care Nursery

### ***The Problem:***

A community hospital in Oregon was in the planning stages for a new women and infant's center in a replacement hospital being built adjacent to the existing hospital. Preliminary planning with an architectural firm had raised concerns about the validity of the number of beds planned (there was a planned transition to a higher level special care nursery that was driving the bed need). Current annual admission volume for the special care nursery is approximately 670 annual admissions. There was consensus that the volume could increase to approximately 925 annual admissions over the next five years if the level of nursery care was raised.

Before finalizing the space program and design planning, the leadership team decided to engage Smith Hager Bajo to provide input on the bed needs for special care nursery, planned design, validate the volume and revenue projections and comment on its operational and staffing efficiency. The analysis requested by the hospital included the following components.

- **Volume and Revenue Projections:** A) validate the volume projections by neonatal DRG and B) validate the revenue projections based on payor mix by DRG
- **Facility Review:** A) review special care nursery bed quantity and mix taking into account functional relationships and B) provide input on general flow and layout of preliminary drawings
- **Operational/Staffing Analysis:** A) analyze current neonatal staffing, B) analyze current operational processes and provide input on opportunities to improve

efficiency and productivity and C) provided design implications on future staffing and operations

### ***The Analysis:***

Smith Hager Bajo worked with the leadership team and caregivers to complete the project. The detailed volume and revenue analysis was completed first. Then their computerized simulation model, designed specifically for neonatal services, was used as the tool for the neonatal facility bed need and staffing analysis. Five scenarios for the special care nursery were simulated using volume projections ranging from 855 to 925 annual admissions.

Computerized simulation modeling was used to complete the analysis for several reasons:

- Ability to include key variables such as the impact of scheduled procedures, seasonal variability and discharge times (could not be evaluated with former bed need prediction model)
- Allows the evaluation of staffing levels for each type of caregiver involved in the care process
- Flexibility to compare/contrast the results of a variety of scenarios

### ***The Results:***

- The results confirmed the 15 special care nursery spaces (4 intensive, 7 intermediate, 1 transition, 1 isolation and 2 parent care) planned are more than needed to support anticipated 925 annual admissions.
- The unit would need to add one caregiver 24/7 to meet the additional staffing needs for the anticipated 925 annual admissions. A unit clerk would also be added to the staffing model.

The model generated three types of results. They include:

- Bed need by type of bed
- Patient overages and days all beds full
- Staffing requirements by position

## Predicted Bed Need Results Summary

BED TYPE	1	2	3	4	5
	855 Admits 8.8 ALOS	872 Admits 8.9 ALOS	889 Admits 9.1 ALOS	907 Admits 9.3 ALOS	925 Admits 9.5 ALOS
Intensive	3	3	4	4	4
Intermediate	7	7	7	7	7
Transition	1	1	1	1	1
Isolation	1	1	1	1	1
Care by Parent	2	2	2	2	2
<b>TOTAL</b>	<b>14</b>	<b>14</b>	<b>15</b>	<b>15</b>	<b>15</b>

## Predicted Bed Need Results by Scenario

Scenario 1 - 855 Admits						
Room Type	Max	Mean	Std. Deviation	1 Std. Deviation (87% Confidence)	2 Std. Deviations (95% Confidence)	3 Std. Deviations (99.5% Confidence)
Intensive	5	1.03	.97	2.0	<b>2.97</b>	3.94
Intermediate	11	3.35	1.79	5.14	<b>6.93</b>	8.72
Transition	3	.14	.38	.52	<b>.9</b>	1.28
Isolation	2	.07	.26	.33	<b>.59</b>	.85
Parent	3	.34	.56	.09	<b>1.46</b>	2.02
Scenario 2 – 872 Admits						
Room Type	Max	Mean	Std. Deviation	1 Std. Deviation (87% Confidence)	2 Std. Deviations (95% Confidence)	3 Std. Deviations (99.5% Confidence)
Intensive	5	1.11	1.01	2.12	<b>3.13</b>	4.14
Intermediate	11	3.38	1.79	5.17	<b>6.96</b>	8.75
Transition	3	.14	.38	.52	<b>.9</b>	1.28
Isolation	2	.07	.26	.33	<b>.59</b>	.85
Parent	3	.38	.56	.94	<b>1.5</b>	2.06
Scenario 3 – 889 Admits						
Room Type	Max	Mean	Std. Deviation	1 Std. Deviation (87% Confidence)	2 Std. Deviations (95% Confidence)	3 Std. Deviations (99.5% Confidence)
Intensive	5	1.18	1.05	2.23	<b>3.28</b>	4.33
Intermediate	11	3.42	1.79	5.21	<b>6.90</b>	8.69
Transition	3	.14	.38	.52	<b>.9</b>	1.28
Isolation	2	.07	.26	.33	<b>.59</b>	.85
Parent	3	.41	.65	1.06	<b>1.71</b>	2.36
Scenario 4 – 907 Admits						
Room Type	Max	Mean	Std. Deviation	1 Std. Deviation	2 Std. Deviations	3 Std. Deviations

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			(87% Confidence)	(95% Confidence)	(99.5% Confidence)	
<b>Intensive</b>	5	1.25	1.11	2.36	<b>3.47</b>	4.58
<b>Intermediate</b>	11	3.46	1.79	5.25	<b>7.04</b>	8.83
<b>Transition</b>	3	.14	.38	.52	<b>.9</b>	1.28
<b>Isolation</b>	2	.07	.27	.33	<b>.59</b>	.85
<b>Parent</b>	3	.44	.7	1.14	<b>1.84</b>	2.54
<b>Scenario 5 – 925 Admits</b>						
Room Type	Max	Mean	Std. Deviation	1 Std. Deviation (87% Confidence)	2 Std. Deviations (95% Confidence)	3 Std. Deviations (99.5% Confidence)
<b>Intensive</b>	8	1.32	1.18	2.5	<b>3.68</b>	4.86
<b>Intermediate</b>	10	3.5	1.79	5.29	<b>7.08</b>	8.87
<b>Transition</b>	3	.14	.38	.52	<b>.9</b>	1.28
<b>Isolation</b>	2	.07	.29	.36	<b>.65</b>	.94
<b>Parent</b>	5	.47	.75	1.22	<b>1.97</b>	2.72

## Staffing Results By Scenario

Scenario	Mean	Std. Dev.	Mean + 1	Mean + 2	Mean + 3
			Std. Dev.	Std. Dev.	Std. Dev.
Scenario #1 – 855 Admits	1.68	.64	2.32	2.96	3.6
Scenario #2 – 872 Admits	1.71	.63	2.34	2.97	3.61
Scenario #3 – 889 Admits	1.75	.64	2.39	3.03	3.67
Scenario #4 – 907 Admits	1.78	.64	2.42	3.06	3.7
Scenario #5 – 925 Admits	1.81	.63	2.44	3.07	3.7
<b>Mean + 1 Standard Deviation</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Required caregivers	2.3	2.34	2.39	2.42	3.0
x 12 hrs. x 2 shifts x 7 days	389.8	389.8	401.5	406.6	497.3
x 52 weeks	20267.5	20267.52	20879	21141	25858.6
Divided by 2080	9.7	9.7	10.0	10.2	12.4
x 16% benefit factor	11.3	11.3	11.6	11.8	14.4
+ fixed FTE's	5.0	5	5	5	5.0
<b>TOTAL</b>	<b>16.3</b>	<b>16.3</b>	<b>16.5</b>	<b>16.8</b>	<b>19.4</b>
<b>Mean + 2 Standard Deviations</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Required caregivers	3.0	2.97	3.03	3.06	3.1
x 12 hrs. x 2 shifts x 7 days	497.3	499	509	514	515.8
x 52 weeks	25858.6	25946	26470	26732	26819.5
Divided by 2080	12.4	12.5	12.7	12.9	12.9
x 16% benefit factor	14.4	14.5	14.8	14.9	15.0
+ fixed FTE's	5.0	5	5	5	5.0
<b>TOTAL</b>	<b>19.4</b>	<b>19.5</b>	<b>19.8</b>	<b>19.9</b>	<b>20.0</b>

### ***The Results:***

The hospital is moving forward with its nursery transition while the new facility is being built. Coverage issues are being resolved and recommended operational changes that can be made prior to the new unit have implementation plans and timetables. The footprint of the new unit allowed for adequate bed numbers based on the analysis.