Plan Before You Design

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Just as you might do a strategic or business plan before expanding or starting a new hospital service, you also need to develop a functional program that describes and quantifies the new or expanded service. All your planning efforts need to take place before you embark on any design efforts. While you need to plan properly for the growth of any hospital department, it is especially critical for cost intensive departments (surgery, imaging, cardiovascular and emergency services). Each step in the planning and the subsequent design process is sequential with each step serving as the structural base for the next. Only if a firm foundation is created will your project be successful. One of the key steps in your pre-design planning efforts needs to be an *evaluation of future workloads* and the accurate calculation of future procedure room (including diagnostic, treatment and testing) needs. This workload analysis serves as the "Foundation" on which many departments' space needs are programmed. Predicting the "right quantity" of procedure rooms is crucial to optimizing capital expenditures and increasing department productivity. The workload analysis also determines the "proper mix" or "types" of procedure rooms needed to meet specific categories of workloads within the department.

The first step in the workload analysis includes the use of historical data to estimate future workload volumes. For a bed analysis the relevant data is patient days and admissions. For other departments it could be diagnostic procedures, cases or visits. Definitive historical statistical data needs to be collected for each type of room or item of medical equipment that is being considered in any proposed project. In order to make these estimates, an "agreed on" future workload for each type of procedure room must be made. This is critical in determining the right "mix" of procedure rooms within the department. The importance of analyzing needs by "type" of procedure room will be covered later is this paper.

Some planners use average annual percentage changes to historical workloads in predicting annual workloads for future years. "Linear Trending" of historical volumes is

the preferred method in predicting future workloads and is the method presented here. This is really a component of "Time Series Analysis" which is a forecasting technique based on patterns of change in data collected over time. This allows one to forecast future events based on trends occurring in the past. Most popular spreadsheet software includes a "function" for "Linear Trend" (see Figure 1 for a sample chart that can be generated). While an "Imaging" department is used as an example in this article, the methodology is equally applicable to determining operating room needs, cath labs, cardiology testing rooms and emergency trauma, treatment or exam rooms. It is extremely important to find out if there are any "abnormalities" in the historical workloads before doing any "trending", whether it be by the method proposed here or any other method. An example would be an abnormally low volume for a "Specials" room in imaging for one of the historical years caused by an equipment breakdown and subsequent replacement that took over three months. The workload volumes for the year in question had to be "adjusted" upward to reflect what would have been 12 months of "full" operation, otherwise, trending of workloads for future years would have been incorrectly calculated. There are also a number of other "factors" that can influence workloads, which will be addressed later.

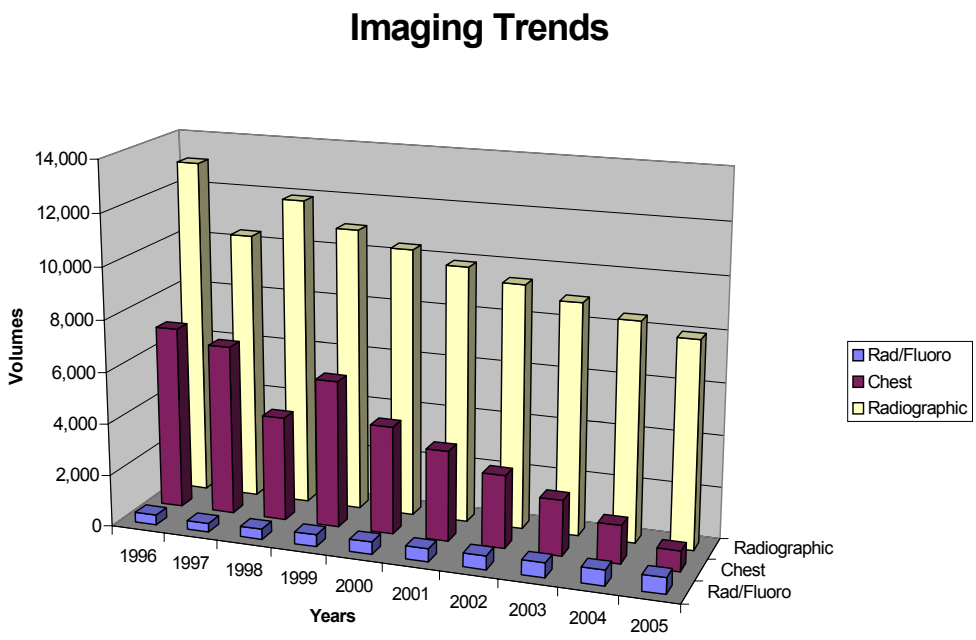

Figure 1

The next step in validating future workload volumes is reaching "consensus" with the department staff on the predicted future volumes. As mentioned previously, there are a number of "factors" that can affect historical and future workload volumes. A partial list may include the following:

- The closure of a competing hospital in your service area.
- Gains or losses to physician specialties on your medical staff.
- Changes in medical technology that may shift volumes from one type of equipment to another (e.g. invasive to non-invasive technologies such as ultrasound).
- Anticipated gains or losses of a major employer in your service area that can affect future demand for services.
- Increasing managed care penetration in the market that will have a negative impact on your future workload volumes.

Once the projected workloads have been established for the "target year" (typically five years in the future), procedure room needs can be calculated using additional department data such as case/treatment times and hours/days of operation. It is important that each factor used in the room needs computation be adequately defined with your staff so there will be no "miscommunication". Factors used in the calculations are listed below.

Calculating Procedure Room Needs

The formula used to compute room needs is $\frac{\mathbf{A \times B \times C}}{\mathbf{D \times E \times F}}$ where:

A - Annual Workload should be what you projected (target year) procedure workload volumes to be for the purpose of computing your diagnostic room and procedure room needs. As mentioned previously, please do not forget to consider any abnormalities in historical trends, market forces, changes in medicine, new services, future physician staffing and the like when projecting future workloads.

B - Average Hours Per Procedure/Test should include turn-around time so you can account for clean-up/set-up in addition to procedure time. Since the formula is set up

to use hours, minutes need to be converted to hours (e.g. 80 minutes should be entered as 1.33 in the formula).

C - Percentage of workload performed on the day shift represents those workloads done during the normal workday. If the workload for a particular department is not fairly even during the normal hours of operation, you may want to use "Peak Shift" hours in computing room needs (see below).

D - Number of annual days of operation is typically 250 days accounting for weekends and holidays. If the department operates for eight hours on Saturday for example, then you would add another 52 days. If it only operates for four hours on Saturday, then you would add 26 days to make the calculations work correctly.

E - Available hours per day should represent the daily scheduling hours for the department's procedure/testing rooms. If the workloads are not even during the normal shift, you may want to use "Peak Hours" in computing room needs (see below).

F - Utilization factor or Room Utilization Rate represents the percent of procedure/testing room usage during the normal daily schedule (% of time rooms are occupied with patients; typically 75%). If you use the "Peak Shift/Peak Hours" method in calculating room needs, the utilization rate percent is higher (typically 80-85%) than that used for the full scheduled hours available each day since room use is high during the peak shift.

The Peak Shift/Peak Hours method should be used if the workload volumes are not fairly even throughout the normal workday. This will insure that your calculations account for room needs during the high volume part of the workday. An example would be radiographic/flouro rooms that run from 8AM to 4PM (an eight-hour schedule) with very little scheduled say after 2PM. In this case the "Peak Shift" would be 8AM until 2PM or six hours, which is the value you would enter for "E" in the formula. This directly ties to what you will enter for "C" in the formula for the percent of cases done during the six hour "Peak Shift". Your percentage of volume during the "Peak Shift" should be almost as high as the percent done during the normal eight-hour day since there is little volume during the last two hours.

The following is an example of the spreadsheet format I use in computing imaging department needs using the formula mentioned previously which is entered in the "Rooms Needed" column of the spreadsheet. One of the reasons I break out chest, radiographic and rad/fluoro rooms is so the most cost-effective "mix" of rooms can be

programmed. For example, chest x-rays can be taken in a chest room, a radiographic room or a rad/fluoro room. If your calculations show a need for one but less than two chest rooms, you should program one chest room and apply the fraction over one to radiographic room calculated needs. In turn, fractional amounts of radiographic room needs can be applied to rad/fluoro rooms and rad/fluoro fractional amounts applied to the specials room. This typically results in less space, less construction cost and less equipment cost since chest rooms cost less than full radiographic rooms and radiographic rooms cost less than rad/fluoro rooms.

Imaging Department Calculations

Type Room	A Ann Proc	B Hours Per Proc	C %Cases Peak Shf	D No.Days of Oper	E Peak Shf Hours	F Util Factor	Rooms Needed
Radiographic	7,973	.50	70%	250	8	75%	1.86
Rad/Fluoro	625	1.0	95%	250	8	65%	.46
Chest	794	.17	70%	250	8	75%	.06
Tomography	195	1.0	90%	250	8	75%	.12
Mammography	2,270	.33	100%	250	8	75%	.50
CT Scanning	1,661	1.0	70%	250	8	70%	.83
Ultrasound	5,281	.67	80%	250	8	80%	1.77
Nuclear Medicine	3,635	1.0	90%	250	8	75%	2.18

Note: Using the formula shown previously, the number of diagnostic procedure rooms needed to meet the projected workloads can be calculated as shown above.
Based on case studies of imaging departments, there are a number of items to keep in mind when doing the workload analysis and room needs computations for this department.

- Exclude workloads done outside the department. These would include portable units, imaging rooms in the Emergency Department and those in outpatient diagnostic centers. Calculate those needs separately.

- When calculating radiographic and CT needs, find out the percentage coming from emergency department patients. In larger hospitals it may be more cost effective to locate a radiographic and a CT room in the emergency department rather than trying to expand the imaging department, especially if the ED needs to grow anyway.

- When room need calculations are fractionally over a whole number (e.g. 2.3) be prepared to think about increasing the departments hours of normal operation to increase the daily capacity of the equipment. This is especially important if the equipment in question is an expensive MRI.

In conclusion, your pre-design planning efforts should support (be the foundation) and justify what is going to be designed by your architect. In this day and age of declining reimbursement and limited capital dollars, we need to be able to "defend" our capital budget recommendations. Going the "extra mile" with your pre-design planning efforts will not only increase your ability to obtain the capital dollars needed for your project, but it will also make for a successful project that meets the needs of your community.

References

Hardy, Owen B., and Lawrence P. Lammers. Hospitals: The Planning and Design Process. Germantown: Aspen Systems Corporation, 1977.