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Inpatient Bed Need Planning--Back to the Future?

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National inpatient bed use declined in the late 1980s and through most of the 1990s, but it began to level off around 1998 or 1999 and now appears to be climbing. Over the last couple of years, many hospitals have found themselves struggling to find beds. Various tools and techniques have been used to predict future bed need. This article presents a refinement on these models that incorporates scenario planning and statistical techniques to address the variability in bed demand. The key variables that drive bed need--population, discharges within the population, lengths of stay, and market share--are discussed, along with other forces from the local market, use of critical care beds, and observation care. Scenario planning techniques can be used to develop future bed need scenarios with several plausible views of the future--steady state, future utilization changes, and future marketplace changes are provided as examples. Key to predicting future bed need is understanding the variability of the demand, which might be seasonal, month-to-month, and possibly even day-to-day. The author recommends searching hospital and state-specific data to find the peak period of demand and applying statistical probability analysis to that peak. Hospitals need to understand bed availability during peak demand periods and not simply rely on a bed supply to meet an average daily census. Planning for the peaks must be balanced with an acceptable overall annual occupancy that is financially viable.

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How many new inpatient beds might I need to add to meet the future demand in my market?

If you are asking yourself this question today, you are not alone. You probably also find yourself reflecting on how many beds you actually decommissioned a decade ago and how you have permanently changed the function of these former nursing units, so that they can no longer be readily converted back to inpatient units. When it comes to future bed need planning, hospitals today are at a crossroads that few anticipated just a few years ago.

The Recent Rebound in Inpatient Bed Need

Predicting future bed need is particularly difficult. Throughout the 1990s, many healthcare planners believed that managed care would continue to push national inpatient use rates down to benchmark levels that had been established in the heavily managed markets in California. This had certainly been the trend in evidence during the late 1980s and most of the 1990s. However, in most markets across the country, these declining use rates began to level off around 1998 or 1999 before ever reaching the low levels of demand that had been predicted.

A review of recent national trends in use rates illustrates this apparent "bottoming out" of inpatient use rates, as illustrated in Figure 1.

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As a result of an apparent reversal in the two-decade-old trend of declining inpatient demand, healthcare planners find themselves today being called upon to predict future bed need with the intent of potentially adding bed capacity and not closing more nursing units. National inpatient use rate trends (both admissions and patient days per 1,000 population) appear to have bottomed out and in fact might well be climbing upward. However, accurately predicting the bottom of a long-term trend such as hospital admission rates is as difficult as it is for interest rates or stock prices.

Bed Need Modeling for the Future

With respect to inpatient bed need, "the future ain't what it use to be!" Therefore a more sophisticated set of planning tools for projecting future inpatient bed capacity needs are required today.

Various tools and techniques for projecting future bed need have been applied in healthcare over the years. A bed need planning model should be able to evaluate and quantify future demand under alternative future scenarios. The model should also incorporate statistical techniques to more accurately consider the variability of bed demand on a seasonal, month-to-month, and day-to-day basis.

Define the Key Variables and Data Elements

Developing this type of bed need planning model requires that the planner obtain the data necessary to incorporate at least the following key variables in the analysis:

- Population projections by age group (e.g., 0-14, 15-64, and 65+) for the service area
- Historical use rates in discharges per 1,000 population by inpatient service for the same populations and service area
- Lengths of stay by service and age group
- Historical hospital market share trends and hospital dependency (i.e., how much of your total business comes from the service area?)
- These key variables are the drivers in the bed need model flowchart presented in Figure 2. However, the future projections for these variables are obviously impacted by many factors, such as:
- Local hospital or other provider closures and local nursing home bed availability
- Current trends in the use of critical care beds or intermediate care beds in comparison to routine medical/surgical beds

It is also important to recognize that there are going to be shortcomings in the historical inpatient utilization data themselves.

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Include the Impact of Observation Care

Most statewide and national inpatient use databases include discharges that only occur when a patient is admitted as an inpatient. Since many observation care patients are not admitted as inpatients, their impact on historic and current hospital bed use is not routinely measured, nor is it included in historic rates. Individual institutions must therefore make an appropriate adjustment for observation care patients that are not reflected in the population-based use rates. An adjustment to the total bed need should be made based upon the historical trends and predictions of the future for observation days and beds in your local market.

Apply Scenario Planning Techniques

Individual hospitals are also impacted by variety of local factors that historical use and market share trend data cannot address, such as potential hospital closures or projected shortages of nursing home beds. The technique of scenario planning should be employed as a means to develop future bed need scenarios that will fit with several plausible views of the future.

Three basic future scenarios that might be modeled are as follows:

- "Steady State" - applies population changes only, with no predicted changes in use rates, lengths of stay, or market shares
- "Expected Future Utilization Changes" - applies both population changes and expected future changes in various use rates (e.g., reflecting a slight up-tick in future use rates and/or an increase in lengths of stay for the 65+ age group)
- "Expected Future Marketplace Changes" - applies population, use rate, and expected market share shifts that could occur in the local marketplace (e.g., market share changes that might be a reflection of an anticipated hospital closure in a nearby area or the addition or loss of a major physician group in the local market)

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Understand the Variability in Future Demand

Developing a mathematical model that can be employed to predict the expected total annual patient days for your institution under various future scenarios is sufficient to appreciate the impact on your institution's future bed need. However, these total annual patient day projections, which can be easily converted to an average annual daily census (ADC) statistic for future years, does not take into consideration the impact that variations in seasonal, month-to-month, and day-to-day bed demand will have on your future bed need.

As difficult as it is to predict future total annual patient days, and, therefore, future ADC, the variability of demand on any given day around that average census statistic is sometimes even harder to anticipate. Predicting the variability of future demand is probably the most critical element of a sound bed need planning model.

Account for Peak Demand Periods During the Year

The peak periods of inpatient demand cause most of the bed availability problems seen today. Individual institutions need to study their historical variations in daily census, on a month-to-month and day-to-day basis, to better define these critical peak periods. As an example, we have recently studied past demand on a month-by-month basis for numerous individual institutions, as well as in a number of statewide databases, to try to understand the peaking that occurs during the winter months (particularly in the Northeast and Midwest). On average, we have found that, during the three months of winter, patient day demand accounts for fully 30% of the total annual patient days reported (instead of the 25% that would be predicted if inpatient demand were random throughout the year). By incorporating 30% of the total projected annual patient day volumes into a three-month peak-demand period, the bed need model can be adjusted to account for peak period demand that more accurately reflects the higher needs that can be expected during the winter months. Peaks are also institution-specific and may occur for a variety of reasons, such as winter flu season, summer or winter at resort areas, etc. Failure to understand and incorporate peak demand periods in the bed need analysis can lead to a serious underestimation of your needs. One word of caution: when analyzing your data for peaks, take into account the impact of bed shortages, which may have simply depressed any peaks.

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Allow for Expected Variations in Day-to-Day Demand

Once the adjusted average daily census has been determined for the peak periods during the year, the model needs to predict the expected variability around that peak average daily census. It then needs to incorporate this reality when determining total future bed need. The key factor is the desired probability of having a bed available any given day to meet peak daily demand.

The variability of the actual daily census on any given day around the peak for the period will usually follow a normal probability distribution. Therefore, the use of the statistical model for the normal probability distribution is extremely helpful in predicting the probability of having a bed available to meet daily demand. This "bed availability" percentage is not the same as the annual occupancy percentage. In fact, these two statistics move in opposite directions. That is to say, as the desired probability of having a bed available to meet peak demand on any given day is increased, the total number of beds that are required above the average daily census statistic will increase, and, as a result, the average annual occupancy for the service will decline. Table 1 illustrates the impact of this phenomenon on bed need planning for a hypothetical medical/surgical service with a projected future annual ADC of 90 and an average peak census of 100 patients.

Table 1

Projected Future Average Daily Census (ADC)		Probability of Having a Bed Available to Meet Demand on Any Given Day	Number of Standard Deviations from the Mean (ADC) Required	Total Number of Beds Required to Meet Desired Level of Bed Availability at Peak	Resulting Average Annual Occupancy (ADC/Beds)
Annual	Peak				
90	100	90%	1.282	113	80%
90	100	95%	1.645	116	78%
90	100	99%	2.326	123	73%

A critical factor in defining the desired or acceptable level of bed availability during peak demand periods is to balance this need with an acceptable overall annual occupancy level that will still be financially viable for the institution. This will depend upon how much the peak period ADC varies from the annual ADC. If there is significant variation, our experience has shown us that the use of anything greater than a 90% probability of bed availability based on a peak period census might lead to an annual occupancy that is too low to be financially viable.

Summary

In the past, fairly simply bed need models have been employed to predict a hospital's future inpatient bed needs. The challenge for healthcare planners today is to more fully understand and take into account the variables that will have the greatest impact on future use and daily bed demand. This

information can then be incorporated into the institution's strategic decision-making and facility master planning process.

The techniques exist, and the data are available, to take a lot of the guesswork out of bed need planning. Those key elements of the analysis that have been summarized here and illustrated in Figure 2 are what we believe are required for more effective bed need planning.

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Related Facility Impacts

As the requirements for private patient rooms with toilets/showers have dramatically increased, so too have the needs of the nursing unit support areas. This is a very important related factor because there are usually no practical or cost-effective means to increase the square footage of this area. For comparative purposes, included below are examples of typical program requirement for 30-patient room nursing units planned, designed, and constructed since the 1980s:

- 1980s space program: Total area of nursing support--2000- to 3000-square-feet
- 2000s space program: Total area of nursing support--3000- to 4500-square-feet

Nursing support encompasses the family waiting area, rest rooms, nurse station, charting, medication prep, physician dictation, report room, conference room, nourishment center, clean utility, soiled utility, linen rooms, exam/treatment room, tub room, equipment storage, nurse locker/toilet room, nurse office and janitor closet. Nursing support does not include patient rooms, patient room toilets/showers, corridors, circulation not within departments, and vertical circulation.

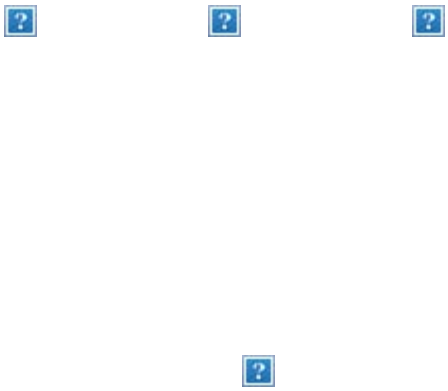
Hospitals and Healthcare Systems Need to Be Prepared

The primary goal of presenting and documenting this CPM is to provide a long-term and comprehensive view of the growing trend of increasing private patient rooms in hospitals and healthcare systems. Due to the 10-year planning timeframe, this CPM should be revisited and revised by hospitals and healthcare systems every several years. It certainly is understood that the majority of the steps within the methodology involve factors, assumptions, information, and data that are dynamic and will change the outcome of the methodology.

Comparative Analysis of Case Study--Lessons Learned

To emphasize the importance of this CPM, a comparative analysis was prepared using the example case study presented above. This comparative analysis describes various scenarios where an important step of the process was deleted from the methodology. This approach

significantly changed the number of private patient rooms to be added to the example case study.



What is evident from the comparative analysis is the significance of involving and including all of the steps of the CPM in the planning process. The impact of omitting one of the defined steps can be identified by comparing the charts above.

Through the involvement of a multi-disciplinary team of healthcare professionals and use of this CPM, the healthcare planning and design community can best serve its hospital and healthcare system clients.

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