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Advanced Analytics Must Drive the Next Round of Productivity Initiatives

By Therese A. Fitzpatrick, Kristopher Goetz, and Brian Cole

Doing what we do now and doing it incrementally more efficiently is not going to achieve the productivity increases most providers are seeking.

The healthcare industry is unique in many ways, but it is not immune to a key economic principle: lowering costs over the long term is contingent upon improving productivity. To lower workforce costs, many hospitals and health systems have reduced the numbers of productive employee hours, often with unsustainable results. Inpatient nursing departments with their large nursing budgets and labor force have been a primary focus of finance teams searching for savings.

This traditional approach of lowering hours per patient day as the single means to achieve savings is now returning diminishing results, particularly as revenue is increasingly based on quality indicators. Staffing units with fewer or more narrowly skilled workers may create quality of care issues and lower patient, staff, and physician satisfaction. Workforce shortages in many positions also make this approach untenable. Some organizations operate under systems referred to as flexible staffing, whereby staff are scheduled, but if demand falls, some staff are sent home.

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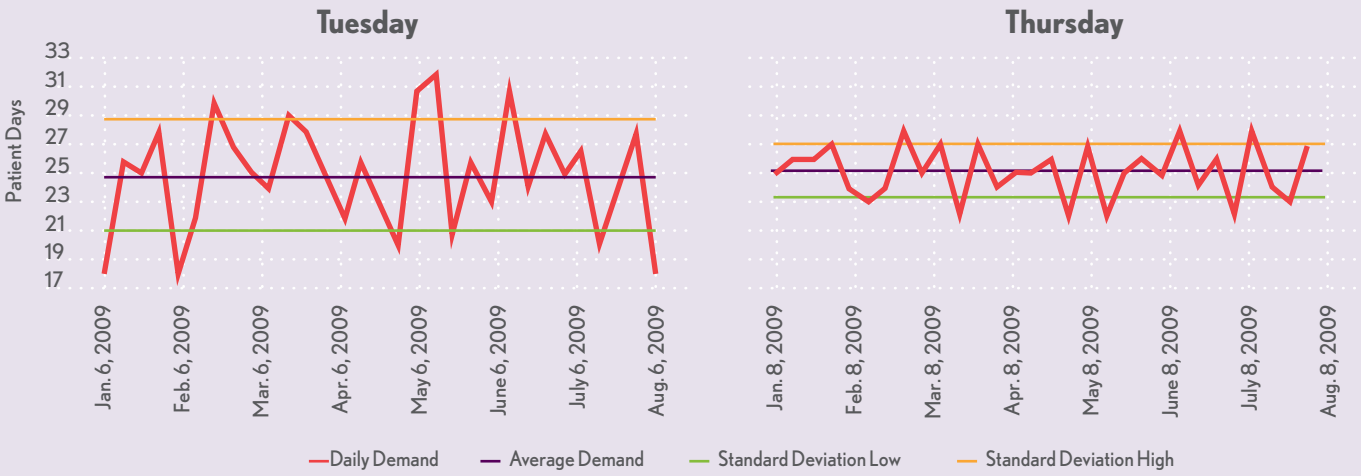
How the Flaw of Averages Impacts Staffing

Using the midnight census exposes hospitals to potential understaffing or overstaffing. For example, the exhibit below illustrates this "flaw of averages" on a surgical unit that has budgeted staffing based on an average daily census of 25. Adjustments to staffing are required to accommodate actual demand, meaning staff are sent home on Tuesday and costly premium labor is used on Thursdays.



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Smaller paychecks and insecure employment situations have created significant staff satisfaction and potential labor issues in numerous organizations.

According to the *New England Journal of Medicine*, unlike almost all sectors of the U.S. economy, healthcare has not experienced productivity gains over the past 20 years (Kocher, R. and N. Sahni, "Rethinking Health Care Labor," *New England Journal of Medicine*. October 2011).

For example, from 1990-2013, productivity growth in hospitals averaged between 0.1 and 0.6 percent per year, compared with an average 1 percent per year in the private non-farm business sector (Sheiner, L., and Malinovskaya, A.,"Productivity in the Health Care Sector," Hutchins Center on Fiscal and Monetary Policy at Brookings. July 2016). In healthcare, labor productivity is the volume of activity, including all encounters, tests, treatments, and surgeries, per unit of cost—a definition that does not appropriately account for recent efforts to improve quality (Kocher and Sahni, 2011).

To achieve the next round of cost-reduction goals facing hospitals, care delivery models using a different mix and quantity of healthcare professionals must be put in place, supported by advanced analytics and statistical modeling that can demonstrate how fewer labor hours and lower total costs can deliver consistent and excellent clinical outcomes.

Doing More of the Same, But Expecting Different Results

Doing what we do now and doing it incrementally more efficiently is not going to achieve the productivity increases that most providers are seeking. If strategies from the 1990s have lost relevance given dramatic shifts in how care is provided and paid for, it is more important than ever to understand how the current workforce can be precisely deployed to meet patient needs, while ensuring that costs remain reasonable.

Relying solely on more traditional information that is often readily available and trusted, such as line-item expense categories on P&L statements, makes personnel, space, equipment, and supplies attractive targets. While reducing spending in these areas can generate immediate results, these reductions often overlook skill mix and staffing to demand, both of which are needed to deliver excellent patient outcomes in an efficient manner.

To make this transition, healthcare leaders must have access to credible and accurately attributed data and analytics that identify opportunities to improve financial and clinical performance and isolate root causes of suboptimal performance that require correction. When data on quality, utilization, patient satisfaction, and cost are available and benchmarked to internal and external best-practice care, leadership can identify underperforming areas where appropriate attention should be directed.

A More Granular Look

The midnight census has long been the cornerstone for determining how many nurses are needed for each shift. The midnight census has been used as the average census for a nursing unit, representing the average number of patients on the unit for the entire 24-hour period. This measure is then lined up to the nursing unit's target

for hours per patient day to determine the minimum number of nurses needed on the unit at any given time.

When the logic of this exercise is examined, flaws emerge. How does the unit adjust to variations in patient demand throughout the day, and how do we know the census at midnight is not the lowest point of the day when applying it as an average? Given these caveats, potential understaffing or overstaffing is likely. The exhibit on page 2 illustrates this "flaw of averages" on a surgical unit that has budgeted staffing based on an average daily census of 25. As these data demonstrate, adjustments to staffing are required to accommodate actual demand, meaning that staff are sent home on Tuesday and costly premium labor is used on Thursdays.

In another scenario, the exhibit below illustrates how understaffing and overstaffing occurs on monthly, daily, and four-hour shift levels, translating into unnecessary costs and potentially lower patient satisfaction as well as quality impacts. The greatest opportunities to identify unnecessary labor costs typically can be identified at the daily and four-hour levels. If a hospital uses all 12-hour shifts across its nursing units, this approach presumes that demand remains the same across all 12 hours. When the daily and four-hour shift levels are examined, it is clear that demand at 7 a.m. is not the same as demand at noon. In this scenario, adding eight-hour shifts to the 12-hour shifts, hospitals can better match staffing to patient demands and realize cost savings.

The Future Is Advanced Analytics

Approaches that use advanced and predictive analytics to anticipate customer demand and proactively improve productivity are now common in grocery stores, automotive plants, and even professional sports to solve common yet seemingly unsolvable problems. While nascent in healthcare, productivity approaches that leverage data to predict volume and other clinical challenges have the potential to make redesigning patient care and safety, managing hospital throughput, and improving clinician and patient satisfaction more science and less art. This data-driven approach also helps align and embed workforce optimization and planning with overall hospital strategic and operational planning.

For example, a large Midwestern health system examined patient demand across its nursing units in hourly increments. The system was able to realize a 5 percent savings in its nursing workforce, which translated into $16 million in annual savings. In addition, a 30 percent improvement in the number of units meeting their target hours per patient day (HPPD) was realized. Previously, only 50 percent of the units met their target HPPD. Two years after implementation of changes, 80 percent of the units are meeting their target HPPDs.

Advanced Analytics Basics

With advanced analytics, a much more precise approach to productivity is possible. A three-step modeling process can be used to calculate and schedule the optimal number of nurses needed for a unit using a patient demand model, a nursing workforce supply

Example of Understaffing and Overstaffing on a Monthly Daily and 4-Hour Shift Level

The average over-staffing level for this unit was 13.1 percent, while the average under-staffing level was 37.7 percent. Below, you will find over- and under-staffing are measured in three-time frequencies: monthly, daily, and at four-hour shift levels.

Monthly	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Overstaffed	14.3%	7.1%	9.5%	7.1%	14.3%	21.4%	28.6%	21.4%	7.1%	14.3%	7.1%	4.8%
Adequately Staffed	50.0%	23.8%	28.6%	40.5%	40.5%	66.7%	61.9%	71.4%	57.1%	57.1%	45.2%	47.6%
Understaffed	35.7%	69.0%	61.9%	52.4%	45.2%	11.9%	9.5%	7.1%	35.7%	28.6%	47.6%	47.6%

Daily	Sun	Mon	Tues.	Wed.	Thur.	Fri.	Sat
Overstaffed	5.6%	13.9%	15.3%	16.7%	12.5%	13.9%	13.9%
Adequately Staffed	54.2%	37.5%	33.3%	45.8%	56.9%	63.9%	52.8%
Understaffed	40.3%	48.6%	51.4%	37.5%	30.6%	22.2%	33.3%

4-Hour Shift Level	12A-3A	4A-7A	8A-11A	12P-3P	4P-7P	8P-11P
Overstaffed	0.0%	57.1%	10.7%	0.0%	8.3%	2.4%
Adequately Staffed	51.2%	38.1%	57.1%	27.4%	66.7%	54.8%
Understaffed	48.8%	4.8%	32.1%	72.6%	25.0%	42.9%

Source: Kaufman Hall & Associates, LLC. Used with permission.

model, and a nurse workforce schedule model.

The Patient Demand Model

The demand model is similar to the midnight-census approach in that it calculates the optimal number of nurse FTEs based on forecasted demand; however, this model is much more advanced than simply applying an average. By examining several years of historic hourly patient census data for each hospital unit, a series of forecast models using maximum likelihood estimators can be created. When analyzing patient census data at the hourly levels, hospitals can achieve what the midnight census is not able to: account for daily variation in patient demand, seasonality, and other trends. Multiple forecasts can be created for each unit, and the forecast with the best fit can be selected based on a series of statistical measures.

Nursing Workforce Supply Model

Once the demand model is selected, a nursing workforce supply model can be used to maximize patient coverage while reducing the cost of care. This model determines the optimal mix of unit-based (core) FTEs, float pool FTEs, and overtime FTEs based on forecasted patient demand and takes into account many variables, such as a unit's nurse-to-patient ratio, staff start times, and weekend shift patterns, to determine the optimal patient coverage at the lowest labor cost.

Nurse Workforce Schedule Model

After the optimal workforce supply model has been selected, a scheduling model is created to determine the best scheduling pattern for the FTE mix based on the nursing workforce supply model. This schedule model uses a genetic algorithm that creates an environment of thousands of possible solutions to compete with one another until the "fittest" solution survives as the best approach for managing patient demand and cost. The output of this model is a schedule listing each nursing FTE's optimal scheduling pattern.

Long-Term Productivity Initiatives

Legacy healthcare providers have just scratched the surface of examining how advanced analytics and statistical modeling can result in improved productivity and lower costs across healthcare enterprises. The complexity of this task requires that provider organizations adopt a long-term perspective to planning that incorporates a robust analytic management approach capable of harmonizing day-to-day variations while building a durable workforce for the future.

With fewer and fewer options available for lowering healthcare costs, hospitals and health systems must consider investing in these robust and longer-term productivity initiatives that lower costs and deliver quality outcomes using advanced analytics. +

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