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Improving Healthcare Productivity Using Data Visualization

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DATE
December 2009

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Introduction

In our real-world example hospital, it's the job of the Chief Nursing Executive (CNE) to manage overall patient care including staffing levels. As part of the hospital's initiatives to reduce costs and increase efficiency, the CNE's team looked at processes ripe for improvement. Managing labor hours in a constantly changing environment was one of their biggest challenges. They couldn't make the connection between budget overruns and staff who were clocking in early and clocking out late. With the help of the CNE's business intelligence team, they were able to find and quickly implement a solution. With just a few IT resources and in less than six weeks, they were able to integrate data from disparate sources and create live, interactive dashboards and reports.

With the first goal accomplished, the CNE's business intelligence team developed more reports and dashboards containing key decision making information faster than the CNE could come up with reporting ideas. In fact, so effective were the reports and dashboards that a staffing board was created allowing the CNE and her team to adjust staffing levels in real-time using data throughout the day. The result has been the ability to cut the amount of overtime paid in half. Over-budget staffing has become a thing of the past.

The CNE's hospital now manages labor hours more effectively than ever before with server-based shared dashboards across the company's intranet, providing easy access to knowledge workers, analysts, and management. Where it was once difficult for them to make the connection between budget overruns and staff who were clocking in early and clocking out late, the Chief Nursing Executive and her teams now adjust staffing levels in real-time using data throughout the day.

Challenges

When times are tough and budgets tight, healthcare organizations of all sizes need to use their resources wisely and produce value quickly. A major challenge is to manage workforce efficiently. For healthcare teams, business intelligence innovation and key insights can yield significant value in the short-term.

Most hospitals are challenged by simultaneously managing a healthcare workforce that is able to maintain caregiver hours and patient volume ratio while



achieving target labor costs. Hospitals and care centers must constantly control variances caused by over or under-staffing. In addition, information on variances must be communicated to all levels of the organization that make decisions on it.

Using visual data analysis hospitals are better able understand trends and see patterns allowing them to quickly make changes necessary and provide a support structure for better decision making. Using the example above, this paper will show how your hospital can leverage existing data to make better decisions and share and distribute this information meaningfully with key staff and executives.

Time for Evaluation

Hospitals need systems that can support better decision-making and increase labor productivity. Units like Patient-Care Services are typically responsible for a wide range of critical hospital functions such as inpatient units, various therapies, cathlab, pharmacies, patient case management, spiritual care, and more. A key goal for hospital managers is to be able to react to a variety of environmental changes in real-time so they can take immediate action.

An IT system can make a huge difference in achieving this goal by providing adequate support for decision making. This system must help manage caregiver resources effectively by:

- Maintaining predetermined caregiver hours and patient volumes ratio
- Achieving target labor costs
- Controlling variances caused by over staffing and under staffing for clinical care hours
- Having better ways to communicate the information to users
- Providing accurate and real-time tools for management to respond on-the-fly
- Supporting statistical process control (such as Six Sigma), marking an emphasis on lowering variability

Moving to Real-Time Staffing Management

Proper staffing is really what drives patient safety & quality. In addition to being important financially, a unit that's always understaffed and not able to support quality of patient care is cause for alarm for any executive in charge of patient care. Having the ability to monitor patient volumes and staffing needs in real-time, not only allows for immediate adjustments, but allows hospitals to provide an increased level of care and quality of service to its patients.

More often than not, hospitals rely on monthly reports that provide information after-the-fact, sometimes up to 10 days into the next month. Unfortunately, by that point, the hospital is already 40 days into budget overruns. To be able to



accomplish their goals of being more efficient with staffing and the ultimate goal of reducing labor costs, it is critical to be able to view this data and assess variables in a real-time environment enabling staffing changes on the fly.



Figure 1:
Shows the relationship between how much time nurses are able to spend with patients and the injury rate.

The mission is to provide timely, accurate, and secured information to management via simple reports and dashboards available in a self-service environment such as a hospital intranet. This kind of access will also allow users to explore the data interactively - analyze trends and compare relationships in an easy-to-use interface. With this ability, hospitals can integrate data from several sources into a data warehouse and update caregiver data using real-time reports across the various areas in a Patient-Care Services unit.

Why data visualization?

Data visualization can do more than just increase data comprehension; it allows people to uncover a greater number of trends or patterns within the data. Because of its visual qualities, information is easier to understand and feels more accessible. With the right tools, people will be more active in exploring data, which increases the possibility for new insights. Those who are closest to the data are better able to dive into initial results and ask additional critical questions.



One of the many benefits of using an ad-hoc visual analysis application as core to your overall business intelligence approach is that it provides an easy to use interface that sits on top of the data you're currently using for mining and reporting. Ad-hoc data visualization tools are designed to allow for better visibility into your data. You and your colleagues will quickly see and understand trends, patterns, and outliers that may not have been as easy to spot using traditional reporting.

The following are steps that hospitals can take to incorporate data visualization to improve healthcare labor productivity quickly and effectively.

Why data visualization?

Step 1: Get Buy-in

Implementing a major change in staffing management will garner high visibility from hospital management and executives. Start by evaluating which groups and players will need to be involved in planning and providing input for these changes. Take the time to gather input for what challenges current systems create and what the different goals are for this project, checking to mitigate which goals are achievable and realistic, especially when it comes to initial findings.

Establish who the key players will be for this project from both the management and the IT/technology side. Set clear expectations on progress, timelines, reporting, etc. By having a shared set of information and having buy-in from executives and management groups, you increase accountability within this team.

It's also worth considering how any changes will impact the staff. Changes to how staffing is done can wreak havoc with employees – and they can wreak havoc with your changes.

Step 2: Create a Staffing Board

Create a Staffing Board who together is responsible for both staffing and process evaluation. It is the work from this team that will help to streamline efforts, find the most effective and efficient way to implement on-the-fly staffing changes, and who can monitor staffing and patient care volumes to manage staffing needs while maintaining target labor costs.

It is critical to create a robust staffing board that can:

- Alert staffer and Clinical Nurse Managers with real-time caregiver hours variance for rapid correction
- Support the central staffing office to quickly respond to staffing needs – either over- or under-staffing, on a shift-by-shift basis
- Adapt to real-time changes in patient volumes

By creating a staffing board with the responsibility to respond to staffing needs on a shift-by-shift basis, hospital units are better able to adapt immediately to

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changes in patient volume. Visual analysis allows the staffing board to track “visual triggers” that alert the staffing board to actions needed to meet productivity goals. Staffing needs can nearly be adjusted on an hourly basis based on this real-time data.

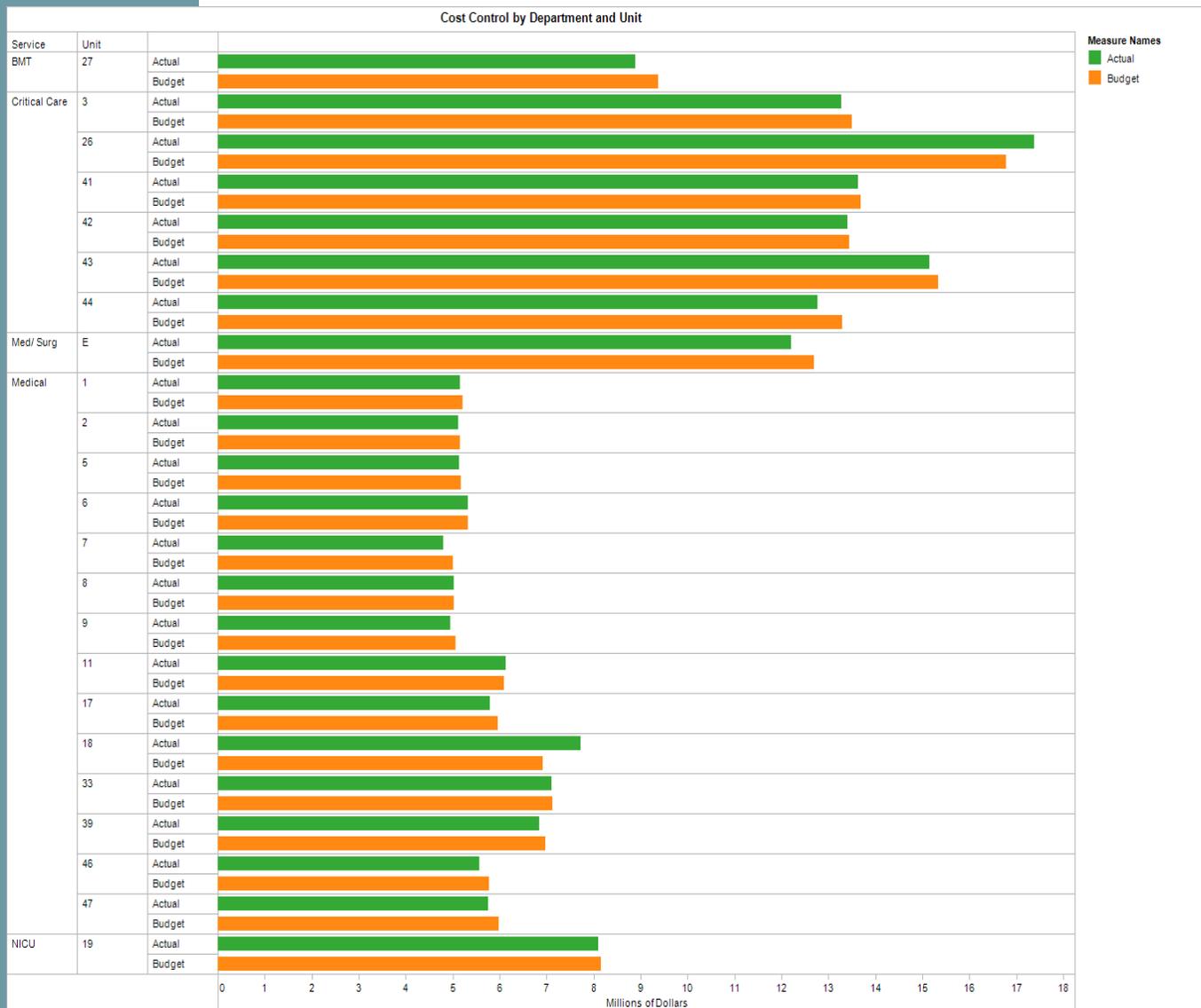


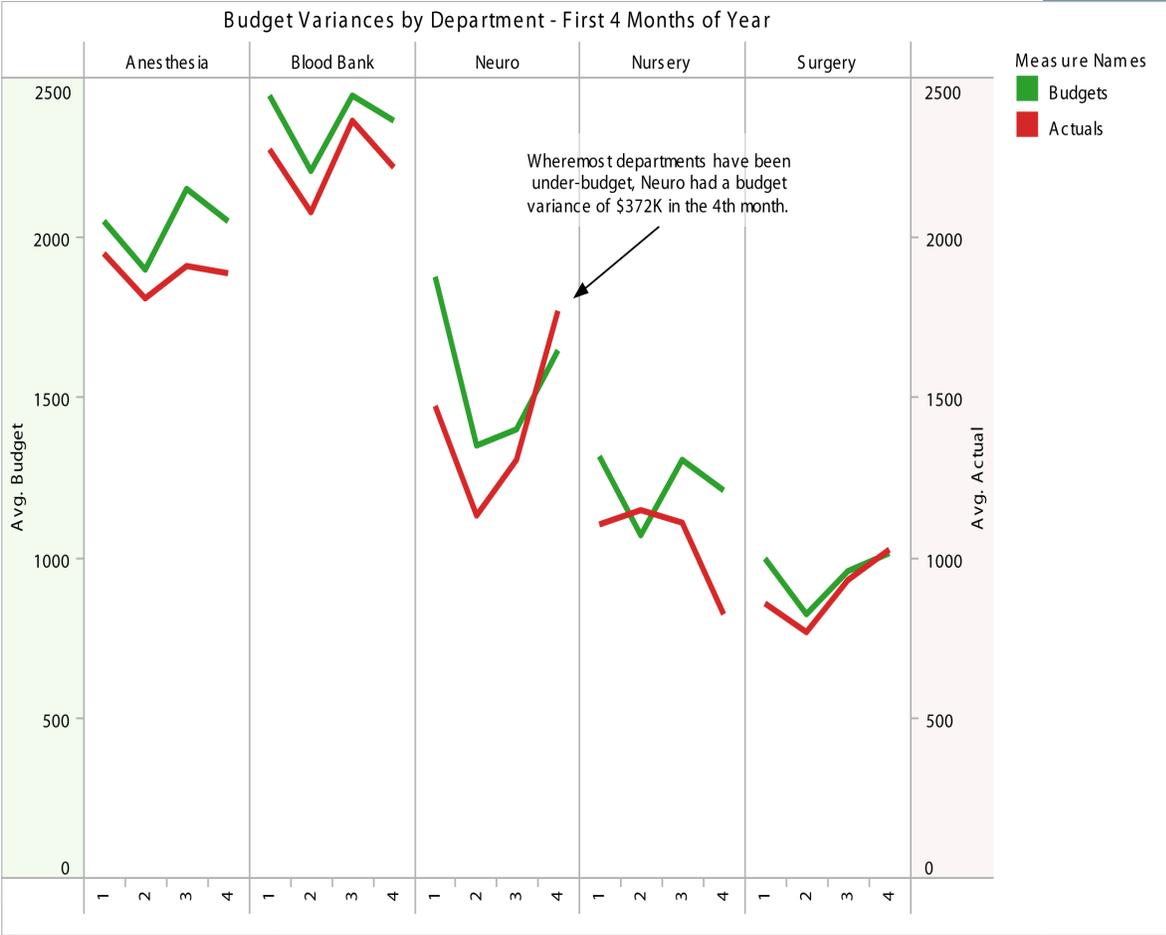
Figure 2:
Allows for quick budget to actual reference by Service and Service Unit.

To help facilitate this rapidly changing environment, you may consider establishing a special group of nurses who have the skill set and knowledge to float between units. This can help facilitate ahead of time scheduling and allow the use of the floating nurses to respond to the managed staffing changes based on need. These nurses can then be assigned on the fly, based on their skills to the most appropriate units requiring additional staff.



Step 3: Establish New Processes

Moving from a process of evaluating staffing levels after the fact to an environment of real-time staff management will take a thoughtful establishment of a new process and approach for managing labor productivity needs. You'll need to take into consideration processes for daily, pay period ending (PPE), and monthly evaluation to maintain proper staffing hours while achieving target labor costs. It's important to establish processes that not only prevent overstaffing, but prevent understaffing as well.



When designing the information output managers will use to make real-time staffing decisions, consider designing toward two separate goals:

Goal 1 - provide timely, accurate, and secured information to management via simple reports/dashboards located on an intranet website.

Figure 3: Management can quickly identify and comment on trends, easily spotting problem areas by unit.



Goal 2 - utilize data visualization capabilities to demonstrate more depth of information from:

- **Effective information presentation:** show meaningful views from multidimensional questions and answers
- **Exploratory capabilities:** Analysis – show comparison, trending, relationship between key metrics
- **Ease of user interface:** provide an easy analysis interface for the knowledge workers & leaders

In the end the new process should allow for continued pre-scheduling for staffing based on known needs. Having a base of floating nurses to adjust staffing needs the week of and day prior will significantly reduce day of changes and easily highlight prior to shifts when units are over or understaffed.

Step 4: Improve Reporting with Visualizations and Dashboards

Data visualization can do more than just increase data comprehension; it also allows users to uncover a greater number of trends or patterns within the data.

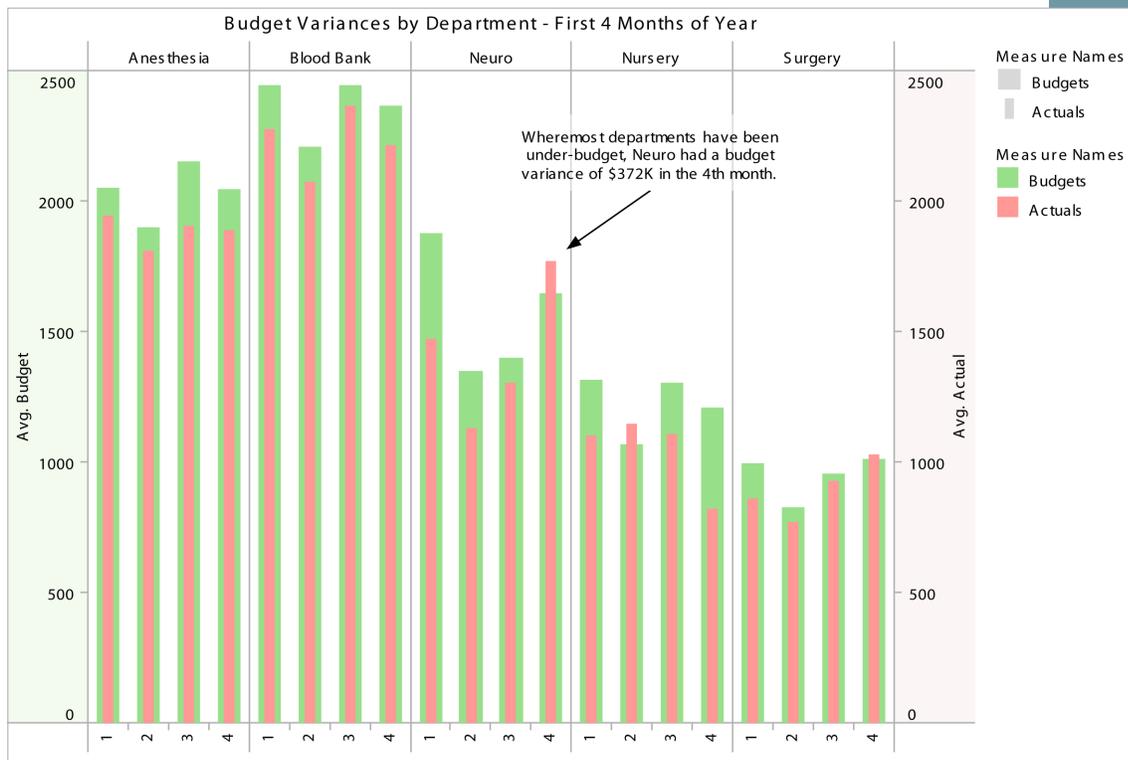
By building a visual interface that sits on top of the data:

- Complex relationships uncovered in multidimensional data are presented in an interactive graphical format that is easier to comprehend
- Key users can take more active roles in data mining activities which create a greater possibility for new insights
- Managers can review the data on their own desktop

This kind of visibility can not only help drive immediate changes, such as with daily staffing, but it can also highlight trends and issues related to hospital policies and HR issues. Things like PTO used and attendance data can be tracked for compliance and soundness in policy. Policies for tardiness and staff who have tendencies to clock in early or clock out late are things that can not only affect overall staff performance, but have big impacts on maintaining staffing cost targets.

When you are first going through the development of visualizations, dashboards and scorecards to help manage to targets and overall plans, it's important to identify the key metrics across the unit that you need to measure against. It's also important to stress that not only is this a dynamic tool, but a dynamic process that will always change. It's not just about the schedules and not just about cost targets, but about managing constants in a variable environment to help meet overall goals and measure against key metrics. Find the right combination of dashboards and reports that meet the needs of

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management, knowledge workers and analysts, but also empower them with the ability to interact with the data and dive in to specific queries. Managers can then discover what is driving unexpected trends and outliers without having to wait for future reports or additional IT resources.

Staff benefits

Providing transparency to staff and giving visibility to the root drivers of managing staff resources and on-the-fly changes are important. It enables them to understand the business needs and maintain the flexible attitude needed in an ever-changing hospital environment. The benefit to them will be more reasonable expectations related to staffing hours, helping provide relief and avoid burnout for nurses working overtime week after week. By doing right by employees, departments often see a decline in vacancy and attrition rates.

In addition to the immediate benefits of managing hours, staffing efficiently, achieving target labor costs, and avoiding overtime pay, there are other trends and patterns that the Chief Nursing Executive, HR, and Clinical Nurse Managers can have visibility to when planning ahead. Time off and turnover based on different departments, levels of seniority, RN demographics, and other factors can be evaluated to give insights to future staffing needs and planning.

Figure 4: Identifying continued problem areas can help highlight ongoing issues within a department; a need for process or staffing improvements.



Final Thoughts

Core to success is to create a professional environment that supports and encourages changes. Without the support and buy-in from those who will be using the system, and most importantly those affected by the system, you will struggle to be successful.

Provide the right tools, the right access to those tools, and the types of reports needed to really empower those in decision making roles, and the right information for executives and managers monitoring these processes and changes. Frontline managers and staffers who need to make changes in real-time need to feel like they have what they need to be successful. Knowledge workers or analysts will have the right tools and views to explore data for new insights beyond just the standard reports and dashboards. By transforming conditions from limited and restricted access to provide real-time information, you've enabled decisions, changes, and corrections to be data-driven.

Embrace the creation and maintenance of a staffing board and related processes as dynamic, continuous process improvements. In addition to maintaining this group responsible for real-time changes, empower them to bring process improvements and other observations to the group for continued iterative improvements.

Finally, set expectations correctly. Make sure your goals and objectives are clearly outlined ahead of time and that roles and responsibilities are clearly identified. Start small with easy wins or within smaller staffing segments of the overall unit. Grow and expand from what you have learned in each successive roll-out. Erring on the side of too much information or reports at first is okay and will allow for feedback and streamlining of the most helpful reports and dashboards for the various consumers of data. And lastly, provide management and executives visibility to your progress giving them access to early visualizations and reports showcasing your quick wins.

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Tableau Software builds software for data visualization and rapid-fire business intelligence. Our mission is simple: help people see and understand data. Tableau's award-winning products are easy to deploy and make analytics and business intelligence fast, easy and fun. They include Tableau Desktop, Tableau Server and the no-charge Tableau Reader. Tableau has already attracted over 30,000 licensed users in companies from one-person businesses to the world's largest organizations.

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