CHILDREN'S OUTCOMES

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Staffing Effectiveness: How to Evaluate Staffing Decisions in Terms of Quality of Patient Care

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Introduction

In July 2002, a new JCAHO requirement was established. This new standard uses clinical and service indicators in combination with HR indicators to assess staffing effectiveness in order to reveal opportunities for improvement. Objectives are to improve the hospital's understanding of the relationship between staffing and clinical outcomes and to "ensure that staffing is adequate to protect patients from unintended harm and maintain high satisfaction levels."(JCAHO)

At TCH, a multidisciplinary committee and a smaller committee subset (the workgroup) have been formed to identify and monitor the HR and clinical indicators. Participating areas are: pathology, radiology, pharmacy, respiratory therapy, and inpatient nursing units, and others will be added. A complete list of the indicators can be found at the Planet TCH address listed at the end of this article

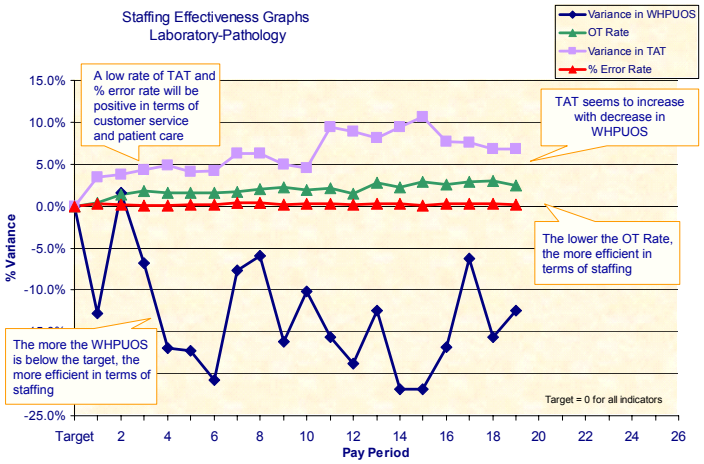
Staffing Effectiveness at TCH

To collect and analyze the data, a database was developed in which Management Resources adds bi-weekly and monthly data from many sources: ACE, Infection Control, HR, Patient Representatives, Risk Management, Radiology, Pathology, Pharmacy, RT, IP Nursing Units, etc.

In order to confirm whether the HR indicators are influencing the clinical outcomes indicators, a statistical analysis is conducted for all possible combinations. Relationships are described by a correlation coefficient. With a correlation coefficient we are able to answer questions such as "if the worked hours per patient visit increase (less efficient in terms of staffing), what will happen to the clinical indicators?" These trends, and corresponding graphs, are used to see increases or decreases over time and look at possible relationships between productivity and quality of service (see figure).

Results of Staffing Effectiveness to Date

Data collection and analysis began in early 2002, with enhancements added in January 2003. Some of the data points are collected monthly, while others are collected each pay period. When looking at the data and the graphs, we are able to see some possible relationships. For example, we have included the laboratory-pathology information illustrated above. As the Worked Hours per Unit of Service (billed tests) decrease (efficient in terms of staff), the Turn Around Time (TAT) seems to increase (which could indicate that as the volume of tests increases, the worked hours have not increased sufficiently for the added volume to achieve the expected TAT). If we determine that this relationship is significant, we need to find a good balance of efficiency, customer service and patient care.



In two areas we were able to find statistically significant relationships. For laboratory-pathology, we found a positive correlation between overtime rate and variance in TAT. For inpatient nursing, we found a positive correlation between variance in Worked Hours per Patient Day and nosocomial infections per patient day. We also found a negative correlation between overtime rate and nosocomial infections per patient day. Because correlations do not necessarily mean there is a cause-and-effect relationship, we also performed regression analysis in which the HR indicator is defined as the independent variable and the clinical outcomes indicator as the dependent variable. This enables us to say that, if we find a significant regression coefficient (p-value < 0.05), the dependent variable is influenced by the independent variable.

An overview:

(source: staffing effectiveness database, data 1-1-03 – 9-27-03)

The table below displays a sample of the independent and dependent variables and the correlation coefficients per clinical area. The higher the coefficient, the stronger the relationship. The p-value indicates whether a coefficient is statistically significant (p-value<0.05.) The R-square value gives an indication of the explaining power of the regression function. The closer the R-square is to 1.0, the better the regression function explains the relationship (clearly, the clinical indicator is influenced by several variables, not solely the HR indicator).

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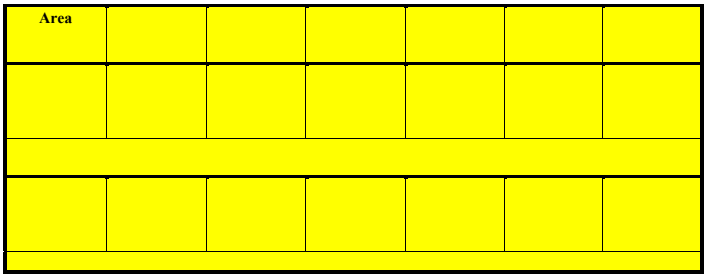

Some of the results of the statistical analysis were surprising to the workgroup. When we look at the relationship between WHPUOS and nosocomial infections, we see that as hours go up, so do nosocomial infections. This is counter-intuitive. The first possible explanation is that an increase in WHPUOS means more hours, and more 'hands' on the patient create a higher possibility of infection. This finding would suggest putting more emphasis on hand washing on nursing units. This finding prompted us to look at the Nurse Hours only WHPUOS. (IP Nursing Unit WHPUOS includes the hours of all types of staff.) Since we did not find a statistically significant correlation there, does that mean that, as a second explanation, non-nurses are the cause of nosocomial infections? Although the committee did recommend reinforcing the hand washing policy for all workers, this is an excellent example of the slippery terrain we encounter when interpreting these correlations. Finally, the third possibility is that there are many other variables that are influencing the number of nosocomial infections and that the found WHPUOS is only one of them. The R-square of 0.7 indicates that there is a significant relationship, however, only an R-square of 1 indicates a perfect explanation of the dependent variable by the independent variable. Further analysis is clearly needed in this case.

Of critical note, we have collected only 20 data points for any bi-weekly reported indicators, and 9-10 observations for monthly reported indicators, thus far. We can expect changes in results once we have more observations in the database. Meanwhile, as we continue to collect information, we can monitor productivity in relation to quality of service in a timely manner & heighten awareness. The certainty of our conclusions will strengthen as we continue.

What have other hospitals found?

Per the JCAHO newsletter and inter-hospital collaborative efforts, it appears that few hospitals have found conclusive evidence and subsequent action items with their staffing effectiveness monitors. It is too early to conclude that we need to find other indicators, as the small number of observations could be the most logical explanation for the lack of findings. The University of Michigan Hospitals and Health Centers (UMHHC) stated that 'if we don't find a meaningful correlation after 12 months, we'll look for other indicators' (JCAHO Advisor, September 2003). Because of our bi-weekly and monthly data, we have decided to evaluate only after two years of data (Briefings on JCAHO). UMHHC did find a few important relationships. They found a statistically significant positive correlation between nursing hours per patient day and neonatal ICU central-line bloodstream infection rates (similar to the relationship we found between worked hours per patient day and number of nosocomial infections.) "As staffing hours increased, so did the rate of bloodstream infections. Intuition would say this finding didn't follow, and, indeed, further analysis suggested that other variables besides staffing have an impact on the level of bloodstream infections." (JCAHO Advisor, September 2003). This mirrors the sentiments of our workgroup at TCH.

What are we doing with the results?

The database, statistics, and graphs are regularly updated and posted on Planet TCH (Hospital Resources, Resource Management) or accessible through the following link: http://planettch/RESOURCES/ResourceMgmt/index.cfm

We strive to make staffing effectiveness a real time management tool that gives feedback to managers, supports staffing decisions, and is used to improve clinical outcomes. In order to stimulate this discussion and change in behavior, the workgroup analyzes the data and statistics bi-monthly and writes recommendations for specific situations. Not only are we trying to improve clinical outcomes and staffing efficiency, we also are looking for ways to improve the staffing effectiveness processes. "How do we use this information in management decisions?", "Are we tracking the appropriate variables?" , "How do we make the information actionable?" and "Would this be helpful in other areas of the hospital?' are examples of questions that we continue to ask.

The Future of Staffing Effectiveness

Efforts are being made to finish an automated tool to collect the Staffing Effectiveness data and analysis. The workgroup will continue to collect an analyze data and will provide recommendations for improvement if necessary. We also expect to expand the tool with more areas. We will follow the statistical relationships thoughtfully and decide to add or change indicators when we are in possession of sufficient decision making data.

For information on the staffing effectiveness tool please contact Gretchen Moser at (303) 864 5547 moser.gretchen@tchden.org or Miriam Idema at (303) 869 3349 idema.miriam@tchden.org.

References:

- JCAHO Advisor, Volume 6, No.9, September 2003.
- Briefings on JCAHO, June 2003.
- JCAHO Advisor, Volume 6, No.5, May 2003
- How to evaluate your staffing decisions?, Hospital Peer Review, May 2002, p.67-69

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Outcomes Abstracts from TCH/UCHSC Staff

Daley, M. F., J. F. Steiner, et al. (2002). "Immunization registry-based recall for a new vaccine." Ambulatory Pediatrics. 2(6): 438-43.

BACKGROUND: Immunization recall for specific vaccines may be necessary to "catch up" children with newly available vaccines or recall children after vaccine shortages. The extent to which immunization registry-based recall can increase immunization rates for a new vaccine has not been prospectively studied. OBJECTIVE: To assess the efficacy of letter/telephone recall for immunization with pneumococcal conjugate vaccine (PCV7) in an economically disadvantaged urban population. DESIGN/METHODS: Randomized controlled trial at an inner-city teaching hospital. Using an immunization registry, we randomly assigned children aged 6 weeks to 22 months unimmunized for PCV7 to an intervention group (n = 610) or a control group (n = 624). The intervention consisted of letter and telephone recall for PCV7 vaccination. Two months after intervention, receipt of 1 or more doses of PCV7 was assessed. Intention-to-treat analysis was used. RESULTS: We were unable to successfully contact 42.3% of the intervention subjects by mail and telephone. In the intervention group, 23.0% (140 children) received PCV7 within 2 months compared with 20.2% (126 children) in the control group (P = NS). No intervention effect was evident when children were stratified by age. A large proportion of the study population had Medicaid insurance (51.2%) or were uninsured (28.5%), but response to PCV7 recall did not vary by insurance status. CONCLUSIONS: Letter and telephone recall for PCV7 vaccine did not significantly increase the rate of PCV7 immunization in an inner-city teaching hospital serving a disadvantaged population. The effectiveness of recall appears to have been limited by the inability to reach many subjects by mail and telephone.

Dobyns, E. L., N. G. Anas, et al. (2002). "Interactive effects of high-frequency oscillatory ventilation and inhaled nitric oxide in acute hypoxemic respiratory failure in pediatrics." Critical Care Medicine. 30(11): 2425-9.

OBJECTIVE: High-frequency oscillatory ventilation (HFOV) and inhaled nitric oxide (iNO) have been reported to improve oxygenation in children with acute hypoxemic respiratory failure (AHRF), but their roles in the treatment of AHRF remains unknown. The use of HFOV improves oxygenation by increasing lung recruitment. iNO can improve oxygenation in AHRF, but it may have limited efficacy in patients with poor lung inflation. Based on these findings, we hypothesized that the combined treatment of HFOV and inhalation of low-dose NO would improve oxygenation and survival in children with severe AHRF compared with children treated with conventional mechanical ventilation (CMV) or either treatment alone. SETTING: Tertiary pediatric intensive care units at seven academic centers. DESIGN: Post hoc analysis of data from children enrolled in a multicenter, randomized, masked study of the use of iNO in the treatment of AHRF. PATIENTS: A total of 108 pediatric patients with AHRF defined as an oxygenation index of >15 twice within 6 hrs. Mode of ventilation (HFOV or CMV) was determined by the patient's physician based on guidelines to maximize oxygenation. The patient was then randomized to treatment with or without iNO. Comparisons were made between patients who were treated with HFOV plus iNO (n = 14), HFOV alone (n = 12), CMV plus iNO (n = 35), and CMV alone (n = 38). INTERVENTIONS: Ventilation with CMV or HFOV with or without iNO. MEASUREMENTS AND MAIN RESULTS: We found that the change in Pao /Fio ratio was greatest in the HFOV plus iNO group compared with the other treatment groups at 4 hrs (p =.02) and 12 hrs (p =.01). After 24 hrs of treatment, both HFOV plus iNO and HFOV alone resulted in greater improvement in Pao2/Fio2 ratio than either CMV alone or CMV plus iNO (p =.005). After 72 hrs, treatment with HFOV alone resulted in a greater improvement in Pao2/Fio2 ratio than either CMV alone or CMV plus iNO (p =.03). There was no difference in predefined treatment failures between treatment groups. CONCLUSIONS: We conclude that the combination of HFOV with iNO causes a greater improvement in oxygenation than either treatment strategy alone in children with severe AHRF. We speculate that the enhanced lung recruitment by HFOV enhances the effects of low dose iNO on gas exchange.

Olds, D. L., J. Robinson, et al. (2002). "Home visiting by paraprofessionals and by nurses: a randomized, controlled trial." Pediatrics. 110(3): 486-96.

OBJECTIVE: To examine the effectiveness of home visiting by paraprofessionals and by nurses as separate means of improving maternal and child health when both types of visitors are trained in a program model that has demonstrated effectiveness when delivered by nurses. METHODS: A randomized, controlled trial was conducted in public- and private-care settings in Denver, Colorado. One thousand one hundred seventy-eight consecutive pregnant women with no previous live births who were eligible for Medicaid or who had no private health insurance were invited to participate. Seven hundred thirty-five women were randomized to control, paraprofessional, or nurse conditions. Nurses completed an average of 6.5 home visits during pregnancy and 21 visits from birth to the children's second birthdays. Paraprofessionals completed an average of 6.3 home visits during pregnancy and 16 visits from birth to the children's second birthdays. The main outcomes consisted of changes in women's urine cotinine over the course of pregnancy; women's use of ancillary services during pregnancy; subsequent pregnancies and births, educational achievement, workforce participation, and use of welfare; mother-infant responsive interaction; families' home environments; infants' emotional vulnerability in response to fear stimuli and low emotional vitality in response to joy and anger stimuli; and children's language and mental development, temperament, and behavioral problems. RESULTS: Paraprofessional-visited mother-child pairs in which the mother had low psychological resources interacted with one another more responsively than their control-group counterparts (99.45 vs 97.54 standard score points). There were no other statistically significant paraprofessional effects. In contrast to their control-group counterparts, nurse-visited smokers had greater

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reductions in cotinine levels from intake to the end of pregnancy (259.0 vs 12.32 ng/mL); by the study child's second birthday, women visited by nurses had fewer subsequent pregnancies (29% vs 41%) and births (12% vs 19%); they delayed subsequent pregnancies for longer intervals; and during the second year after the birth of their first child, they worked more than women in the control group (6.83 vs 5.65 months). Nurse-visited mother-child pairs interacted with one another more responsively than those in the control group (100.31 vs 98.99 standard score points). At 6 months of age, nurse-visited infants, in contrast to their control-group counterparts, were less likely to exhibit emotional vulnerability in response to fear stimuli (16% vs 25%) and nurse-visited infants born to women with low psychological resources were less likely to exhibit low emotional vitality in response to joy and anger stimuli (24% vs 40% and 13% vs 33%). At 21 months, nurse-visited children born to women with low psychological resources were less likely to exhibit language delays (7% vs 18%); and at 24 months, they exhibited superior mental development (90.18 vs 86.20 Mental Development Index scores) than their control-group counterparts. There were no statistically significant program effects for the nurses on women's use of ancillary prenatal services, educational achievement, use of welfare, or their children's temperament or behavior problems. For most outcomes on which either visitor produced significant effects, the paraprofessionals typically had effects that were about half the size of those produced by nurses. CONCLUSIONS: When trained in a model program of prenatal and infancy home visiting, paraprofessionals produced small effects that rarely achieved statistical or clinical significance; the absence of statistical significance for some outcomes is probably attributable to limited statistical power to detect small effects. Nurses produced significant effects on a wide range of maternal and child outcomes.

Partrick, D. A., D. D. Bensard, et al. (2002). "Is hypotension a reliable indicator of blood loss from traumatic injury in children?" American Journal of Surgery. 184(6): 555-9; discussion 559-60.

BACKGROUND: Traditional surgical teaching stresses that hypotension is an indicator of loss of circulating blood volume. The purpose of this study is to critically evaluate hypotensive injured children for evidence of a hemorrhagic insult. METHODS: Over a 2-year period, data were collected prospectively from children injured via a blunt mechanism. Systolic blood pressure (SBP) was recorded in the field and on arrival to the emergency department. RESULTS: In all, 194 injured children were identified as hypotensive. Only 82 (42%) had identifiable injuries to account for significant volume loss. Children 0 to 5 years old had a 61% incidence of isolated head injury (46 of 76) and only a 34% incidence of hemorrhagic insult (26 of 76). Children 6 to 12 years old had a 31% incidence of isolated head injury (22 of 72) and a 52% incidence of hemorrhagic insult (38 of 72). Finally, patients more than 12 years old had a 33% incidence of isolated head injury (15 of 46) and a 39% incidence of hemorrhagic insult (18 of 46). CONCLUSIONS: Hypotension should not be viewed only as a potential marker of loss of circulating volume, but also as a possible indicator of head injury in young trauma victims.

Todd, J., D. Bertoch, et al. (2002). "Use of a large national database for comparative evaluation of the effect of a bronchiolitis/viral pneumonia clinical care guideline on patient outcome and resource utilization." Archives of Pediatrics & Adolescent Medicine. 156(11): 1086-90.

OBJECTIVES: To use a large national comparative database to measure the internal effect of a set of evidence-based bronchiolitis/viral pneumonia clinical care guidelines on clinical practice at a children's hospital, and to compare these changes with those at other children's hospitals. DESIGN: Prospective cohort study with retrospective and concurrent (other hospital) controls. SETTING: The Children's Hospital, Denver, Colo. PARTICIPANTS: Hospitalized children with bronchiolitis and/or viral pneumonia. INTERVENTIONS: Our clinical guidelines focused on clear admission and discharge criteria, individualized transition-anticipating orders, and "prove it or don't use it" criteria for the use of respiratory syncytial virus testing, bronchodilators, chest physiotherapy, and ribavirin. MAIN OUTCOME MEASURES: The effect of guideline implementation was determined by comparative measurement of internal changes in utilization and outcome (nosocomial infection rate) across time and by external comparison with other children's hospitals using standardized data from the Pediatric Health Information System database of the Child Health Corporation of America (Shawnee Mission, Kan). RESULTS: Overall, 10 636 bronchiolitis/viral pneumonia cases were studied: 1302 at the index hospital and 9334 at the 7 comparison hospitals. Internally, the index hospital's residents and attending physicians responded favorably to the bronchiolitis/viral pneumonia care guidelines, resulting in decreases in targeted resource utilization. There were no fatalities, and the number of days in the intensive care unit decreased even though the mean severity of admitted cases increased significantly. Targeted utilization was favorably affected, whereas untargeted utilization was not. Nosocomial infections did not increase with a decreased use of respiratory syncytial virus testing. The index hospital differed favorably from other children's hospitals in several categories. CONCLUSION: Evidence-based care guidelines can successfully influence utilization and clinical outcome.

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