The Relationship Between Nursing Skill Mix, Nurse Sensitive Patient Outcomes and Patient Satisfaction

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Abstract

Literature Review: Hospitals are the largest components of the United States healthcare system, and are encountering pressure to provide better quality care and reduce cost. The Patient Protection and Affordable Care Act (ACA) directed the Centers for Medicare and Medicaid Services (CMS) to initiate a system to financially incentivize healthcare quality. Nurses are the largest component of the hospital workforce and have the most patient contact hours. Due to the expansion of the Hospital Value Based Program (HVBP) in 2014 to include the nursing-sensitive value-based program (NSVBP), nurses have the highest potential to alter patient outcomes and hospital costs. The impact of nursing skill mix on patient outcomes has been examined, but current literature suggests the need to correlate skill mix with nursing-sensitive indicators and patient satisfaction over longer periods of time. Previous studies in smaller, rural hospital settings have not been reported to our knowledge.

Aim: The goal of this study is to investigate the association between nurse staffing mix, patient safety outcomes, and patient satisfaction in the context of changes in nurse staffing ratios over time at a smaller rural hospital.

Methods: UPMC Horizon converted LPN positions to RN positions on three of its general medical units, providing an opportunity for a natural two-group study design, and resulting in savings to the hospital in fewer total staff hours. We analyzed incident reporting and medical record coding on six nursing sensitive indicators, and eleven domains of the patient satisfaction obtained from hospital consumer assessment of healthcare providers and systems (HCAHP) from July 2011 to December 2015 and then from July 2011 to June 2015.

Statistical analysis. Descriptive statistics were computed and Independent Samples t Tests were used to evaluate the impact of the results at six and 12 month intervals. We hypothesized no difference in mean patient satisfaction scores and adverse patient outcome scores before and after the implementation date at 95% significance level with alpha equal to 5% and a critical value of t at 1.67.

Results: The trend data indicated significant change in a number of patient outcomes and patient satisfaction ratings at six months and at 12 months. Overall rating of hospital (OVERALL) had significantly improved at six months but not at 12 months. Communication with nurses (NURSES) did not improve at six months but had not significantly improved at 12 months. Nurses treat you with courtesy/respect (COURTESY) improved significantly at six months and at 12 months. Nurses listen carefully to you (LISTEN) improved significantly at six and at 12 months. Nurses explain in a way you understand (EXPLAIN) did not show a significant improvement either at six or twelve months. Pain management (PAIN) declined but the drop was not significant. Pain well controlled (CONTROLLED) dropped significantly both at six and 12 months. Staff does everything to help with pain (HELP) dropped at six and at 12 months but the drop was not
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significant. Communication about medicines (MEDICINE) improved significantly at six and 12 months. Staff tell you what a new medicine is for (TELL YOU) improved significantly at six and at 12 months. Staff describes medicine side effects (SIDE EFFECTS) did not improve at six months but did improve significantly at 12 months. Effect sizes for these results were moderate in the two to three percent range. Medication errors (MED ERROR) increased slightly and significantly at six months but at one year there was no significant change. Patient scanning (SCAN_PATIENT) declined slightly but significantly at six months but at one year there was no change. Fall rates (FALLS), hospital acquired pressure ulcers (HAPU) and medication scanning (SCAN_MED) did not change significantly at six or at 12 months. Failure to detect a difference may be due to limited observations.

Conclusions: The change in nurse staffing did not significantly impact patient outcomes. In a number of areas the change produced a moderate and significant improvement in patient satisfaction with the exception of pain management, which declined slightly but significantly. It may be possible to change nurse-staffing ratios to reduce costs while maintaining outcomes and improving patient satisfaction. Future research should focus on the relationship between factors such as bachelor’s level training and continued policy and procedure education, work environment, and patient to nurse ratios.
LITERATURE REVIEW

Hospitals are the largest component of the United States health care system. They have substantial economic and political pressure as the cost of care continues to increase. (Pittman et al., 2012). Studies continue to indicate previous attempts to increase quality and decrease expense have failed as evidenced by reports of the cost of medical errors ranging from $17 to $19.5 billion (Andel, Davidow, Hollander, & Moreno, 2012). Payers and regulators now measure adverse events and have imposed financial incentives and penalties on hospitals to improve quality of care (Pittman et al., 2012).

To address the disparity of the rising cost and low quality care provided by the US healthcare system, the Patient Protection and Affordable Care Act (ACA) directed CMS to initiate a value-based purchasing system to financially incentivize healthcare quality and reduce societal healthcare costs (Kavanagh et al., 2012). In 2013, the ACA established the Hospital Readmissions Reduction Program to ensure patients are not discharged before they are ready to return home. The program reduces Medicare hospital payment for readmissions. Bachelor’s-degree- prepared nurses play a critical role in preventing readmission (Pittman et al., 2012).

The Hospital Value-Based Purchasing Program (HVBP) was also initiated in 2013. This program reduces Medicare hospital payment for poor patient satisfaction scores and unacceptable infection rates (Pittman et al., 2012). This program was expanded to include nursing-sensitive value-based purchasing (NSVBP) in 2014. HVBP now reduces Medicare payment for hospital acquired pressure ulcers, falls and fractures, catheter associated urinary tract infections, medication errors, low patient satisfaction scores, and a range of nursing indicators developed by the Agency for Healthcare Research and Quality (AHRQ) (Pittman et al., 2012).

Nurses are the largest component of the hospital workforce and have the most direct patient contact hours with patients. Good nursing care reduces poor patient outcomes, and readmission rates. In 2016 the CMS will impose a 2% penalty for Medicare payments associated with medical errors, readmissions, and hospital acquired infection (Andel et al., 2012). This new legislation links poor quality of care with higher costs and reduced hospital revenue. Improved patient outcomes will increase revenue, but this also comes at a cost. From a societal perspective, the question is whether gains from improving quality reduce costs? From a hospital perspective the question is whether cost savings or revenue gains from improving quality offset the cost of quality initiatives (Needleman, Buerhaus, Stewart, Zelevinsky, & Mattke, 2006)?

The investment strategy by The Robert Wood Johnson Foundation (RWJF) and the recommendation of the Institute of Medicine’s (IOM) is for health care organizations to continue investments in human capital. This strategy includes preferential hiring of bachelor’s-degree-prepared registered nurses, including compensation by degree, and tuition reimbursement programs (Pittman et al.,
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2012) and (“The Future of Nursing,” 2010). However, increased use of baccalaureate nurses comes with added cost. Accordingly, a key question for hospitals is whether they can continue to make appropriate investments in human capital while holding the line on costs and improving patient outcomes and satisfaction.

METHODS

Data source: We analyzed outcomes data from July 2011 to June 2015 obtained from UPMC Horizon incident reporting and medical record coding on nursing sensitive indicators including hospital acquired pressure ulcers, fall rates, medication errors, and medication and patient scanning, as well as hospital consumer assessment of healthcare providers and systems (HCAHPS) patient satisfaction scores. This study did not involve human subjects and was therefore not subject for approval by an institutional review board (IRB). The University of Pittsburgh Medical Center (UPMC) Horizon Hospital System Director of Quality Improvement approved the project.

Unit characteristics: The data were obtained from three units within the UPMC Horizon hospital system, a 207-bed, acute-care teaching hospital located in Mercer County, Pennsylvania. On August 22, 2014, the nursing skill mix changed from a registered and licensed practical nurses (LPN) to registered nurses (RN) only. Before the impact date RNs provided 22.6 (61%) direct patient contact hours, LPNs were 6.7 (18%) hours, and nurse aides were 7.8 (21%) hours. After the date of impact, the RNs provided 26.00 (70%) and the nurse aides were 11.8 (30%)

Statistical analysis: Descriptive statistics (means, SDs, and percentages) and significance tests (Independent Samples t Test) were computed to evaluate the impact of the staffing change. The scores were computed as the average for the three units. We hypothesized no difference in mean patient satisfaction scores before and after the implementation date, a significance level of 95% with alpha equal to 5%, a critical value of t at 1.67.

RESULTS

We evaluate the impact of the staffing change using time trend graphs and difference between means t tests for independent samples, unequal variances, alpha =.05 with a one tailed t test yielding a critical t of 1.67. We measure impact using patient outcome (nursing sensitive indicators) and nurse sensitive patient satisfaction scores.

Patient outcome graphs: Figures 1 through 5 show monthly nursing sensitive indicators from July 2011 to June 2015.

Figure 1 shows medication errors from July 2011 through June 2015. According to UPMC Policy a “Medication Event” is any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in
the control of the health care professional, patient or consumer. Such events may be related to professional practice, health care products, procedures and systems, including prescribing; order communication; product labeling, packaging and nomenclature; compounding, dispensing, distribution, administration, education, monitoring or use. Medication events also include intravenous (IV) medication incompatibility (i.e., involving an IV admixture, syringe or Y-site), which may occur when intravenous medications interfere with one another chemically or physiologically. The graph shows no clear trends. There seems to be an ongoing trend in medication errors. There does appear to be a troubling increase following September 2014, which may be as the result of increased reporting. Still, there is no apparent difference before and after July 2014.

Figure 2 shows patient fall rates from July 2011 to June 2015. Note that the fall rate is for all falls. There were almost no falls with injury in the data. Other than, and ongoing upward trend over time there is no clear impact before and after the staffing change.

Figure 3 shows pressure ulcer rates over time. Once again, no clear trend is discernable. It is possible that there was an improvement in both the incidence of pressure ulcers and their variants after the August 2014 change. Note that data were available for this outcome measure only from July 2013 making it difficult to evaluate the impact of the staffing changes.

Medication and patient scanning are relatively new nursing techniques designed to reduce medication errors. Accordingly, the percentage of patients scanned is a nursing quality indicator. These indicators are represented in Figures 4 and 5.

Figure 4 shows an ongoing decline in the percent of patients scanned from June 2013 to July 2014. Note that the percentage of patients scanned is high ranging from a low of 94.5% to a high of nearly 98%. The percentage of patients scanned shows a rather steady decline from June 2013 through July 2014 with a rather sharp upward improvement starting in August 2014. It is possible that the staffing change improved the percentage of patients scanned.

Figure 5 shows the percent of medications scanned. Again, the percentages scanned are high. As was the case with patients, overall trends show an ongoing
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decline from June 2013 through July 2014 with trend after the staffing change. Once again, it is possible that the staffing change improved medication scanning.

Overall, the patient outcome trends show some slight improvement after the staffing change. We will test whether the trends are statistically significant using a difference in means t test.

**Nurse sensitive patient satisfaction graphs:** Figures 6 to 16 show trends in HCHAPS overall patient satisfaction scores over time, with emphasis on scores relating to nurse’s interactions with patients. In each case there is substantial variation month to month until May 2014 when the variation nearly disappears. The reason for this is unexplained.

Figure 6 shows overall patient satisfaction scores: the proportion of patients who rated UPMC Horizon as a 9 or 10 on a ten-point scale. Figure 6 shows a very slight increase in overall patient satisfaction prior to July 2014 with an almost imperceptible diminution in patient satisfaction thereafter.

Figure 7 measures nurse communication overall. This represents the percent of respondents who answered “Always” to questions about nurses. Here there appears to be ongoing general improvement in satisfaction with perhaps a small improvement in patient satisfaction following the staffing changes in August 2014.

Figure 8 shows the percent of respondents who answered “always” to the question whether nurses listen carefully to you. Again, there appears to be a positive ongoing trend. There is no perceptible difference after July 2014 although, like communication with nurses, there is a troubling drop in the spring of 2015.

Figure 9 shows the response to the question “Nurses treat you with courtesy/respect.” Overall there is no clear trend over time. There may be a
slight improvement after August 2014 and the variation may have declined but the trend is not substantial.

Figure 10 shows trends for answers to the question “Nurses explain in a way I understand.” Again there is no discernable trend over time. There may be a slight improvement after August 2014, but again, it is not large or obvious.

A portion of the patient satisfaction scores relates to medications. There is an overall score for communication about medicines. There are two subscores: “Staff tell you what a new medicine was for” and “Staff describe medication side effects.”

Figure 11 shows composite scores for communication about medicines. Overall, there is no discernable trend. There does not appear to be a substantial change after August 2014.

Figure 12 shows patient satisfaction scores in terms of staff’s ability to explain what new medications are for. There may be a slight improvement over time although once again it is not notable. There does not appear to be much change if any after August 2014.

Figure 13 shows satisfaction scores in terms of nurses’ ability to explain side effects. These scores started low and improved markedly over time. There is a noticeable change after August 2014.

Figures 14, 15 and 16 show patient satisfaction in terms of pain management. The questions pertain to overall pain management scores, with subscores for pain “well-controlled” and “staff do everything to help with pain.”
Figure 14 shows overall patient satisfaction with pain management (again the percentage of respondents who answered “Always.”) Figure 14 shows little change over time and no change post July 2014.

Figure 15 shows responses to the question of whether the patient’s pain had been controlled. There is substantial variation month to month between July 2011 and December 2013. After July 2014 there appears to be slight improvement and reduction of monthly variation.
Figure 16 shows trends relating to the question whether staff did everything to help with pain. Long term there is little change in the proportion who answered this question in the affirmative. There may be a slight downward trend after July 2014.

Overall, the patient satisfaction trend data indicated minimal change in patient outcomes and some change in patient satisfaction scores in the aftermath of the staffing ratio changes in July 2014. The most notable observation is the reduction in variation with substantial variation before and little variation month to month following the staffing change. However this variation reduction started before the staffing change. The reason for it is not known. It would be important to investigate the reasons for it.

**Difference in means t tests for patient satisfaction scores**: In addition to visual inspection of the trends in patient outcomes and patient satisfaction scores before and after implementation of the staffing change in July 2014 we conducted a difference in means t test for scores before and after the intervention. We adopted the non-equal variance approach, as the variance was substantially different before and after March 2014. In order to conduct the test, we hypothesized no difference in mean patient satisfaction scores before and after the August 2014 implementation date, a significance level of 95% with alpha equal to 5%, a critical value of t at 1.67.

Table 1 shows the mean scores of patient satisfaction measures for times before, 6 months after the July 2014 impact date as well as the observed t value for the difference. Table 2 looks at the mean scores of patient satisfaction for times before and 12 months after the staffing changes.

Many of the differences are statistically significant. The tests indicate that overall patient satisfaction (OVERALL) improved by 1.33% during the six-month time frame after implementation of the August 2014 staffing change. The difference is statistically significant given that the observed t of 1.77 exceeds the critical t of 1.67. However, the 12-month average improvement after the staffing changes the increase was only 0.62% and the difference is no longer significant.
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### Mean patient satisfaction scores before and 6 months after August 2014

<table>
<thead>
<tr>
<th></th>
<th>After</th>
<th>Before</th>
<th>Difference</th>
<th>t</th>
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</thead>
<tbody>
<tr>
<td>SIDE EFFECTS</td>
<td>41.3%</td>
<td>39.9%</td>
<td>1.4%</td>
<td>1.17</td>
</tr>
<tr>
<td>NURSES</td>
<td>74.4%</td>
<td>72.1%</td>
<td>2.3%</td>
<td>3.55</td>
</tr>
<tr>
<td>TELL YOU</td>
<td>72.5%</td>
<td>70.6%</td>
<td>1.9%</td>
<td>1.86</td>
</tr>
<tr>
<td>LISTEN</td>
<td>71.8%</td>
<td>68.6%</td>
<td>3.2%</td>
<td>3.48</td>
</tr>
<tr>
<td>MEDICINE</td>
<td>57.6%</td>
<td>55.4%</td>
<td>2.2%</td>
<td>1.97</td>
</tr>
<tr>
<td>COURTESY</td>
<td>81.2%</td>
<td>79.1%</td>
<td>2.0%</td>
<td>3.14</td>
</tr>
<tr>
<td>EXPLAIN</td>
<td>69.9%</td>
<td>68.9%</td>
<td>0.9%</td>
<td>1.58</td>
</tr>
<tr>
<td>OVERALL</td>
<td>61.2%</td>
<td>60.0%</td>
<td>1.3%</td>
<td>1.77</td>
</tr>
<tr>
<td>HELP</td>
<td>71.2%</td>
<td>71.9%</td>
<td>-0.7%</td>
<td>-0.51</td>
</tr>
<tr>
<td>PAIN</td>
<td>62.4%</td>
<td>64.4%</td>
<td>-1.9%</td>
<td>-1.63</td>
</tr>
</tbody>
</table>

### Mean patient satisfaction scores before and 12 months after August 2014

<table>
<thead>
<tr>
<th></th>
<th>After</th>
<th>Before</th>
<th>Difference</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIDE EFFECTS</td>
<td>45.6%</td>
<td>39.9%</td>
<td>5.64%</td>
<td>2.8</td>
</tr>
<tr>
<td>NURSES</td>
<td>74.3%</td>
<td>72.1%</td>
<td>2.18%</td>
<td>3.55</td>
</tr>
<tr>
<td>TELL YOU</td>
<td>73.6%</td>
<td>70.6%</td>
<td>3.01%</td>
<td>2.2</td>
</tr>
<tr>
<td>LISTEN</td>
<td>71.0%</td>
<td>68.6%</td>
<td>2.41%</td>
<td>0</td>
</tr>
<tr>
<td>MEDICINE</td>
<td>57.0%</td>
<td>55.4%</td>
<td>1.60%</td>
<td>1.8</td>
</tr>
<tr>
<td>COURTESY</td>
<td>81.3%</td>
<td>79.1%</td>
<td>2.13%</td>
<td>2.6</td>
</tr>
<tr>
<td>EXPLAIN</td>
<td>70.1%</td>
<td>68.9%</td>
<td>1.19%</td>
<td>1.4</td>
</tr>
<tr>
<td>OVERALL</td>
<td>60.6%</td>
<td>60.0%</td>
<td>0.62%</td>
<td>0.6</td>
</tr>
<tr>
<td>HELP</td>
<td>70.3%</td>
<td>71.9%</td>
<td>-1.61%</td>
<td>-1.06</td>
</tr>
<tr>
<td>PAIN</td>
<td>62.4%</td>
<td>64.4%</td>
<td>-2.0%</td>
<td>-1.48</td>
</tr>
</tbody>
</table>

At both six months and one year following the staffing change nurse communication scores were up more than two percent and the difference was significant. The staffing changes positively associated with improved nurse communication.

Scores for treatment with courtesy and respect increased two percent at six months after the staffing change and by 2.13% at 12 months. Both differences
were significant. Courtesy and respect positively correlates with the staffing change.

Nurses' listening satisfaction scores improved at six months and at 12 months following the staffing change. The difference was more than three percent at six months and more than two percent at 12 months. Both were statistically significant. Listening skills were also positively correlated with the staffing change.

There was only a slight increase in scores for nurses' explanations in a way that patients can understand. The differences at six and 12 months were not statistically significant. The staffing changes are not correlated with any change in nurse's explanatory skills.

Communication about medications increased six months and 12 months following the staffing changes. At six months the difference was 2.2% and it was statistically significant. At 12 months it was 1.6% and statistically significant. There is a positive correlation between the staffing change and communication about medications.

For the question “Did your nurse tell you what new medication is for?” scores improved 1.9% at six months and 3.01% at 12 months. Both were statistically significant.

The differences in scores for explanation of side effects were both positive. The score for 12 months improved 5.674% and was statistically significant. The six-month score difference was not significant. There is a correlation between staffing changes and side effect explanations.

There were slight declines in overall pain management that were not significant. In essence the staffing changes did not significantly impact satisfaction scores related to pain management.

There was a 3.2 % drop at six months and a 2.6% drop at 12 months for patient satisfaction related to controlling pain. Both were statistically significant. The staffing changes correlate with a decline in pain control.

The staffing changes were not associated with any significant impact on the scores for the question “Did the nurses do everything to help you with your pain.” There was a small decline at six and 12 months but it was not statistically significant.

All told, there are a number of areas where the staffing change associated with statistically significant changes in patient satisfaction scores. The scores for nursing communication and medication generally increased while the scores for pain management decreased but for only one question was the diminution statistically significant.
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In addition, we used a difference in means t test for differences for five patient safety nurse-sensitive outcome measures before and 6 months after the nurse staffing changes in July 2014 and also at 12 months following the staffing changes. The test again used alpha=0.05. The measures included patient fall rates, medication errors, hospital acquired pressure ulcers, percent of medications scanned and percent of patients receiving medications who were scanned. The results are summarized in Tables 3 and 4.

### Table 3

**Patient Safety Outcomes Before and Six Months After July 2014**

<table>
<thead>
<tr>
<th></th>
<th>After</th>
<th>Before</th>
<th>Diff</th>
<th>t obs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Med Errors</td>
<td>5.1%</td>
<td>8.2%</td>
<td>-3.1%</td>
<td>(1.91)</td>
</tr>
<tr>
<td>Fall rate</td>
<td>5.19</td>
<td>4.47</td>
<td>0.72</td>
<td>1.20</td>
</tr>
<tr>
<td>HAPU</td>
<td>17.1%</td>
<td>58.9%</td>
<td>-41.8%</td>
<td>(1.52)</td>
</tr>
<tr>
<td>Scan Patient</td>
<td>95.1%</td>
<td>96.6%</td>
<td>-1.5%</td>
<td>(5.16)</td>
</tr>
<tr>
<td>Scan Meds</td>
<td>95.2%</td>
<td>95.5%</td>
<td>-0.3%</td>
<td>(1.49)</td>
</tr>
</tbody>
</table>

### Table 4

**Patient Safety Outcomes Before and 12 Months After July 2014**

<table>
<thead>
<tr>
<th></th>
<th>After</th>
<th>Before</th>
<th>Diff</th>
<th>t obs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Med Errors</td>
<td>8.4%</td>
<td>8.2%</td>
<td>0.2%</td>
<td>0.12</td>
</tr>
<tr>
<td>Fall rate</td>
<td>5.45</td>
<td>4.47</td>
<td>0.98</td>
<td>1.24</td>
</tr>
<tr>
<td>HAPU</td>
<td>21.8%</td>
<td>58.9%</td>
<td>-37.1%</td>
<td>(1.33)</td>
</tr>
<tr>
<td>Scan Patient</td>
<td>96.0%</td>
<td>96.6%</td>
<td>-0.4%</td>
<td>(1.63)</td>
</tr>
<tr>
<td>Scan Meds</td>
<td>95.9%</td>
<td>95.5%</td>
<td>0.6%</td>
<td>1.65</td>
</tr>
</tbody>
</table>

Medication errors averaged 8.2% per month before the staffing. For six months following the staffing change medication errors averaged 5.1% and the difference was statistically significant. However, for 12 months after, medication errors rose to 8.4% but the difference was not statistically significant.

The average monthly fall rate was 4.47 prior to the staffing change. It increased to an average of 5.19 during the first six months following the staffing change and to 5.45 for the 12 months following the staffing change. Neither difference was statistically significant.

Hospital acquired pressure ulcers averaged 58.9% per month prior to the staffing change. For the first six months following the change the rate dropped to 17.1%
and for 12 months following the monthly average rose to 28.8%. While pressure ulcers declined, the drop was not statistically significant.

During 36 months prior to the staffing change 96.6% of patients were scanned. During the first six months following the staffing change the monthly percentage dropped to 95.1% and the difference was statistically significant. During the 12 months following the staffing change the percent scanned 96% of patients. The difference was not statistically significant.

Before the staffing change the monthly average for medications scanned was 95.5%. For the first six months following the staffing change the average dropped to 95.2%. During the first 12 months following the staffing change the average rose to 95.9%. Neither change was statistically significant

**DISCUSSION**

The patient satisfaction difference in means t-test results indicate that there was a statistically significant improvement in overall patient satisfaction, in nurse communication and in medication administration 6 months after the August 2014 staffing ratio change, which regressed to the mean 12 months later. Because association does not necessarily imply causation and because a lot of other variables may have impacted patient satisfaction between August 2014 and February 2015 it is not possible to definitively conclude that the staffing change improved patient satisfaction. It would be important to consider other factors that may have led to the improvement including whatever unknown cause produced the reduction in variation of patient satisfaction scores after March 2014.

Still, the change in staff ratio along with a reduction in staffing costs certainly did not negatively impact patient satisfaction. This is a strong finding that suggests that the UPMC nurse staffing change was at least well thought out and implemented appropriately. These findings also may provide support for the proposition that increasing RN staffing levels may well improve care and that RN staffing levels may be improved without large cost increases. Additional work in this area is certainly indicated.

While the independent samples t-test initially showed a statistically significant change at the same time that nurse-staffing ratios were changed indicates that there may be a relationship between these two events. However, more sophisticated statistical tests may further refine these observations. Time series cross-section econometric investigations and ARIMA time trend impact analysis may provide additional insights.

In addition, there are any numbers of factors that influence patient satisfaction. It would be good to identify and control for their influence if at all possible. For example, it would be important to identify whatever factors led to the reduction in variance in March 2014. The hospital organized a “Together We Care Committee” that implemented mandatory monthly seminars in order to educate the nursing staff on how to improve patient satisfaction in January of 2014. There
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was an increase in nursing staff attendance documented as subsequent months passed. This program may have had more of an impact on patient satisfaction scores than the nurse staff ratio changes. It would be appropriate to inquire into any specific patient satisfaction initiatives undertaken during 2014 and factor them into the analysis.

Finally, the study includes data for only twelve months after the staffing ratio changes. Additional post implementation data would improve the study results.

**Limitations:** This study has several limitations. First analysis of change on only three units in a hospital with 207 beds provides limited information. Second the time frame after the date of impact is only 12 months a longer time of follow up may help define the actual correlation between nursing skill mix, patient satisfaction, and nursing sensitive indicators. Third, this is an associative study so that no causation can be determined, and it is not definitive what exactly caused the leveling out of patient satisfaction scores as of March, several months prior. Fourth this study does not take into account nursing education level, only skill mix. The data reported may be less conclusive as a result of the lack of bachelor’s prepared registered nurses. Lastly, it is known there is some potential bias in the use of the HCAHPs surveys, as well as potential for decreased validity due to the nature of utilizing varying forms of surveys.

**CONCLUSION**

A difference in means test revealed a significant improvement in a number of patient satisfaction scores (p<0.05) and no significant difference in patient safety outcomes (p<0.05) at the 6 month interval, but shows a regression to the mean after one year following the change. After one year the data reflects that catheter acquired urinary tract infections were low and remain low. Likewise, medication and patient scanning, for the most part, remained elevated, showing improvement when equipment was properly functioning.

An increase in medication errors and fall rates that correlates with a decrease in occurrence of HAPUs occurs after the month of January and February, when the incident reporting liaison came to each unit to do re-education including what to report and when for all three of those units. Additionally, charge nurses were tasked as the facilitators of reporting fall rates as part of a teamwork approach. This took some of the responsibility off of the nurse directly in charge of the patients care, and therefore appears to have made reporting more conducive in this fast paced work environment.

Although the difference in means t test was not completed regarding this data, there appears to be a positive association between reinforcing education of incident reporting policy and procedures that would benefit from a more intentional plan and further evaluation in a continued effort to improve patient care and satisfaction.

The most notable finding at 12 months is the continued significant effect of overall nursing communication, as well as nursing education on new medication and an increase in explaining their side effects. Overall the patient satisfaction improved, however minimally, and there is no change to the patient outcomes,
more importantly, no negative impact and the cost of staffing was marginally decreased. Pain management appears to have fallen off, however, was always scoring low, this could be the result of lack of education that pain will be completely relieved in an acute state, and confusion as to the use of as needed pain medication. Future research could focus on the patients’ perception of pain management.

This study adds to the growing body of evidence that nursing education level affects patient outcomes and patient satisfaction. To the best of our knowledge this is the first longitudinal study to show that nursing skill mix may be associated with nursing sensitive indicators and patient satisfaction in a smaller rural setting. Added to it is the fact that this staffing change decreased patient care costs while, perhaps, improving patient satisfaction scores in communication with nurses. With the potential to increase reimbursement based on decreasing costly adverse outcomes to the patient and increased patient satisfaction scores nurse staffing mix may have financial implications for hospitals. This research study also supports the initiatives for higher nursing education as recommended by the Institute of Medicine (IOM) and Robert Wood Johnson Foundation (RWJF), as well as encourages hospitals making improvements in the quality and efficiency of care to consider improving registered nurse staffing mix in their programs.
Nursing Skill Mix and Patient Satisfaction


