Nurse Staffing and Rural Hospital Performance Improvement

Gestur Davidson, PhD, Senior Research Associate, University of Minnesota; Kathy Belk, BA, Premier Inc.; and Ira Moscovice, PhD, Mayo Professor and Director, University of Minnesota

Key Findings

- Among hospitals participating in a national pay-for performance demonstration, higher registered nurse (RN) hours per patient day are associated with higher scores on composite process of care quality measures for pneumonia, heart failure, acute myocardial infarction (AMI), and a hospital-wide composite measure.

- The relationship between RN staffing and quality is more significant for the hospital-wide composite and pneumonia measures than for the AMI and heart failure composite measures.

- The relationship between RN staffing and quality process measures does not differ based on rural or urban location, the number of staffed beds, or medical school affiliation.

- Licensed practical nurse (LPN) and nursing assistant hours per patient day did not have consistent patterns of impact on hospital quality scores.

Background

Interest in using pay-for-performance strategies for improving health care quality performance has surged in recent years. The Centers for Medicare and Medicaid Services (CMS) Hospital Quality Incentive Demonstration (HQID) project with Premier Inc., a national alliance of non-profit hospitals, tested the effectiveness of financial incentives for improving the quality of care provided to Medicare beneficiaries.

The initial results from HQID reported quality performance improvement across all five clinical conditions.[1] Interviews conducted with a sample of HQID hospital participants underscore the important role served by medical and nursing staff, information infrastructure, and a corporate culture of quality in achieving performance gains.[2] To date, however, there has been limited understanding of the relative contributions of these factors to performance improvement, particularly in rural environments.

Purpose of the Study and Approach

The purpose of this study is to examine the effect of nurse staffing on hospital performance improvement in the CMS/Premier Inc. HQID project, with specific interest in whether and how this relationship differs in rural hospitals as compared to urban hospitals. The limited nursing resources in many rural areas make this issue a particularly critical one for rural hospitals.

The sample of hospitals consists of a subset of Premier, Inc. hospitals that participated in HQID. A total of 254 hospitals completed all three years of the demonstration and had at least one quarter of quality score data for each of the three medical conditions in this analysis (acute myocardial infarction [AMI], pneumonia, and heart failure). Quarterly nurse staffing data were available for 92 hospitals, which comprised the analytic sample. Of these, 17% were rural hospitals (using the federal Office of Management and Budget definition of non-metropolitan counties).

Performance improvement is measured using composite scores for the three conditions. For each hospital, composite scores were generated each quarter for each of the three conditions, based on the HQID process-of-care quality measures for the condition (Table 1). The composite scores were calculated as the proportion of the total opportunities to provide each condition's process-quality services that the hospital actually provided. A hospital-wide composite score was calculated as the proportion of the total opportunities to provide any of the three conditions' process-quality services that the hospital actually provided.

Table 1. Process of Care Quality Measures Used in Study

Conditions	Measures
Acute Myocardial Infarction	1. Aspirin at arrival 2. Aspirin prescribed at discharge 3. ACEI for LVSD 4. Smoking cessation advice/counseling 5. Beta blocker prescribed at discharge 6. Beta blocker at arrival 7. Thrombolytic received within 30 minutes of hospital arrival 8. PCI received within 120 minutes of hospital arrival
Heart Failure	1. Left ventricular function (LVF) assessment 2. Detailed discharge instructions 3. ACEI for LVSD 4. Smoking cessation advice/counseling
Community Acquired Pneumonia	1. Percentage of patients who received an oxygenation assessment within 24 hours prior to or after hospital arrival 2. Pneumococcal screening/vaccination 3. Blood culture collected prior to first antibiotic administration 4. Smoking cessation advice/counseling 5. Initial antibiotic consistent with current recommendations 6. Influenza screening/vaccination 7. Antibiotic timing–percentage of pneumonia patients who received first dose of antibiotics within four hours after hospital arrival

To examine the relationship between nurse staffing and patient outcomes, we use multi-level models to assess the degree of variation in quality and whether that variation can be explained by the level and mix of nursing inputs. The modeling analysis uses three quarterly nurse staffing measures: staff RN hours per patient day; licensed practical nurse (LPN) hours per patient day; and nursing assistant hours per patient day. It includes nurse hours actually worked in (1) intensive care units relevant for AMI, heart failure, and pneumonia (e.g., ICU, coronary care unit, open heart ICU, and pulmonary intensive unit); (2) "Step-down" units of all kinds (progressive care units, telemetry units, etc.); (3) medical units, surgical units, and combined medical and surgical units; and (4) emergency departments.

The models also include rural or urban location, the number of staffed beds, and medical school affiliation. The hospital's overall CMS annual case-mix value is included as a control variable, since nurses in hospitals with a more complex case mix would be expected to have more tasks to perform (and hence composite scores might be expected to be lower) than for a hospital with a less complex case mix.

Limitations

The major limitation of this research is the small, specialized sample that it uses. However, analyses of data from hospitals not in the analytic sample indicate that there is no basis for concern about selection bias arising from the analytic sample.

Results

Across the four composite-score models (AMI, heart failure, pneumonia, and the hospital-wide composite), the effect of RN hours per patient day on the process-quality scores varies. However, the findings consistently show that higher RN hours per patient day are associated with higher composite quality scores. The relationship between RN staffing and quality is more significant for the hospital-wide composite and pneumonia measures than for the AMI and heart failure composite measures. The relationship between RN staffing and quality process measures does not differ based on rural/urban location, the number of staffed beds, or

medical school affiliation. There are no consistent patterns of impact on hospital quality scores for LPN and nurse assistant hours per patient day.

HQID performance payments were based on rankings of hospitals. To better illustrate the policy implications of the marginal effect of changes in nurse staffing on the composite scores, we calculate what the changes in composite scores would imply for changes in the percentile rank of a hospital. These changes in percentile rank are based on the distribution of ranked composite scores over the full 12 quarter period. For the hospital-wide composite score, an increase in RN hours per patient day from the 10th to the 90th percentile values would impact the percentile ranking of a hospital from 41 to 18 percentile-ranking points respectively. However, this increase in worked staff RN hours per patient day (i.e., from 4.6 to 7.8) would be a very large increase, and would be unlikely for any individual hospital to undertake.

Conclusions

Based on the results of this study, RN staffing does matter for process quality. The findings of this study are in contrast to the rather inconsistent results found in previous research on the effect of RN hours on adverse events, mortality, and length of stay.[3,4] While the reasons for this difference are undoubtedly complex, the highly refined measurement focus of the nurse staffing data used (i.e., worked hours by staff RNs in relevant hospital units) provides more power than the nurse staffing data used in previous studies. The lack of significant differences based on rural or urban location may be a function of the relatively small number of rural hospitals in the sample.

Clearly, many factors besides RN staffing also influence quality, although we cannot quantify those other factors with the data available to us in this study. Better information about the relative effectiveness and costs of different strategies will prove important for the success of hospitals as they face the challenges of increasing quality in the broader context of health care reform.

References

1. Lindenauer, P., Remus, D. , Roman, S., Rothberg, M., Benjamin, E., Ma, A., & Bratzler, D. (2007). Public reporting and pay for performance in hospital quality improvement. *New England Journal of Medicine, 356*, 486–496.

2. Gregg, W., Moscovice, I., & Remus, D. (2006). The implementation of pay-for-performance in rural hospitals: Lessons from the Hospital Quality Incentive Demonstration Project. (Working Paper No. 2). Minneapolis, MN: Upper Midwest Rural Health Research Center.

3. Mark, B. A., Harris, D. W., McCue, M., & Xu, Y. (2004). A longitudinal examination of registered nurse staffing and quality of care. *Health Services Research 39*(2), 279–300.

4. Needleman, J., Buerhaus, P., Mattke, S., Stewart, M., & Zelevinchy, L. (2002). Nurse staffing and patient outcomes in hospitals. *New England Journal of Medicine 346*(22), 1715–1722.

Additional Information

Partners

University of Minnesota
Rural Health Research Center
Division of Health Policy and Management,
School of Public Health
2520 University Avenue SE, #201
Minneapolis, Minnesota 55414
Phone: (612) 624-6151
hpm.umn.edu/rhrc

The University of North Dakota
Center for Rural Health
School of Medicine & Health Sciences
501 N. Columbia Road Stop 9037
Grand Forks, ND 58202-9037
Phone: (701) 777-3848
ruralhealth.und.edu