

Transparency and Advanced Practice Nurse Value on an Interprofessional Team by
Time-Driven Activity-Based Costing

Melissa M. Davis

Submitted in Partial Fulfillment of the Requirements
for the Northern Arizona University School of Nursing
Doctor of Nursing Practice Program

April 25, 2014

Abstract

To address the current challenge in the United States of increasing access to high quality healthcare, healthcare systems must analyze and understand the value of their resources in terms of patient outcomes achieved per dollar expended (Kaplan & Porter, 2011). A review of the literature supports that advanced practice nurses (APN) are not only in a position to increase access to healthcare, but capable of improving patient care outcomes. There is little available evidence, however, that the APN decreases costs, or impacts value, in healthcare. For this retrospective, longitudinal study, the transparent methodology of Time-Driven Activity-Based Costing (TDABC), guided by the Participatory, Evidenced-based, Patient-focused Process for Advanced practice nursing (PEPPA) framework was used. This analysis was completed in conjunction with the SHBC/TDABC Analysis Study, to assess the value of care provided to a group of patients cared for by an interprofessional team of APN and physician, as compared to 2 different groups of patients, where each was cared for by a physician working alone. The results of this study support the inclusion of APNs on interprofessional teams and may objectively support healthcare policies and regulations impacting the APN's ability to practice to the full extent of their education, ultimately affecting patient access to quality healthcare in the United States.

Transparency and Advanced Practice Nurse Value on an Interprofessional Team
by Time-Driven Activity-Based Costing

The cost to deliver healthcare in the United States has become extremely high, and it continues to rise at an unacceptable rate (Lee et al., 2010). Health expenditures represent approximately 17.9 percent of the gross national product (GNP), and the world's highest per capita rate, at \$8,680 per person- per year (Centers, 2011). Despite this, the United States continues to have comparatively poorer healthcare outcomes, such as lower life expectancy and higher infant mortality rates, than other developed nations (Rubenstein, 2013). One way to explain these costs and outcomes of healthcare is the variability in care delivery. In the United States, a large percentage of the population is uninsured, or has little or poor access to healthcare. Even for those with easy access to healthcare, variability exists in the quality, safety, and effectiveness of the care received (Institute, 2000; Institute, 2001). Another reason is the variability of the current healthcare reimbursement system. It rewards providers for volume and intensity of services provided and not for quality, safety, or value (Feely, Fly, Albright, Walters, & Burke, 2010; Porter, 2010; Porter & Lee, 2013; Porter & Teisberg, 2006).

Driven primarily by the Affordable Care Act (ACA), healthcare organizations and providers of healthcare are working together to increase access to higher quality care at a reduced cost. To address this challenge, healthcare organizations, insurers, and providers of care need to maximize the value of their resources. Transforming the U.S. healthcare system to meet the demand for safe, quality, and affordable healthcare will require all stakeholders to re-think the roles of many healthcare providers, including the advanced practice nurse (APN). It will also require a commitment by all stakeholders to measure outcomes and costs for every patient, supporting the movement towards transparency, and resulting in value-based healthcare

(Makary, 2012; Porter & Lee, 2013). The Institute of Medicine's *The Future of Nursing: Leading Change, Advancing Health* promotes the expansion of the APN role to allow provision of a wider range of preventive and acute health care services (IOM, 2010; Safriet, 2011). In addition, *Best Care at Lower Cost: The Path to Continuously Learning Health Care in America* suggested that new strategies are required in the transition to a health system that results in the best care at lower cost (Institute, 2012).

The best patient outcomes at the lowest cost define value in healthcare (Kaplan & Porter, 2011; Porter & Lee, 2013). As a result, we need to understand exactly how much the delivery of patient care costs as well as how the costs compare with the outcomes achieved (Makary, 2012). Given the current state of healthcare in the United States, where there is a growing need for increased access to care, the advanced practice nurse is well positioned to provide high quality healthcare at a lower cost, resulting in value for the patient (Safriet, 2011).

Literature Review

Costs, Outcomes, and Value

Advanced practice nurses deliver high quality healthcare which is often of equal or better quality than that provided by physicians. A systematic review of 26 studies found that health status, treatment practices, and prescribing habits were consistent between nurse practitioners and physicians (Nalor & Kurtzman, 2010; Newhouse et al., 2011). Care delivered by APNs also positively influences costs and outcomes, or value, to patients (Buus-Frank, Flanagan, & Minnock, 2013; Dean, 2013). In addition, there is a correlation between lower patient mortality rates and the level of education achieved by the advanced practice nurse, supporting reform efforts aimed at expanding access to healthcare through care delivered by APNs (Inglehart, 2013). In a recent randomized, non-blinded clinical trial of 294 patients in 2-year follow up, care

by the APN was compared to that of the physician and revealed lower costs, significantly improved outcomes, and no difference in quality of life scores (Arts, Landewe-Cleuren, Schaper, & Vrijhoef, 2012). A landmark study researching nurse practitioners and quality, explored the outcomes of care in 1,316 patients randomly assigned either to a physician or nurse practitioner, each practicing independently, for primary care post emergency or urgent care visit. Using patient interviews and health services utilization data, it was determined that the health status of the patients were comparable at the initial, six month, and twelve months visits (Mundinger, Kane, Lenz, Totten, Tsai, Cleary, &...Shelanski, 2000). A follow up study demonstrated that the same patients continued to have comparable outcomes after an additional two years, such as health status, physiologic measures, satisfaction, and use of specialists, emergency room, or inpatient services (Lenz, Mundinger, Kane, Hopkins, & Lin, 2004).

Interprofessional Teams and Scope of Practice

Interprofessional collaboration among healthcare practitioners results in more optimal patient health outcomes (Robert, 2012). This collaboration, or teamwork, is also critical to achieve the United States healthcare goals of patient-centered, safer, timelier, and more effective, efficient, and equitable care (Institute, 2001). Nurse practitioner education is patient-centered, as it includes care coordination and sensitivity to the impact on health of social and cultural factors. It is highly supported by newer models of care emphasizing comprehensive, patient-centered care through structures such as patient-centered medical homes and accountable care organizations (Robert, 2012). In addition, all providers of healthcare, including the APN, need to practice to the full scope of their education and expertise, in order to use the existing health workforce optimally and cost-effectively (Cassidy, 2012; Institute, 1972; Robert, 2012).

Methodologies to Analyze Value

Time-Driven Activity-Based Costing (TDABC) and Activity-Based Costing (ABC) methodologies have been successfully implemented to assess, analyze, and evaluate value in the delivery of healthcare in several studies (Albright, Incalcaterra, & Feely, 2013; Demeer, Stouthuywe, & Roodhooft, 2009; Porter, 2010). The Logic Model has also been used extensively to assess APN efficiency and value of care, using data to assess patient outcomes and cost of care (Begley et al., 2013, Lalor et al., 2013, & Kurtzman, 2010). In addition, implementation of the method of ABC can provide information and data to make the value of APNs more visible (Vincent & Mackey, 2000). TDABC, however, is currently the most efficient method by which to measure value in healthcare as it offers a transparent, scalable methodology that is easy to implement and update (Stout & Propri, 2011). There are no current studies, however, demonstrating the value of care provided by the APN using this methodology.

Rationale for TDABC

Costs of healthcare in the United States are traditionally analyzed at the service department level and not linked to process improvements and the outcomes of care. As value in healthcare is measured in terms of patient outcomes achieved per dollar expended, the goal for any healthcare system should be to improve the value of care delivered to patients. To manage value properly, however, both outcomes and cost must be measured at the patient level for the patient's medical condition (Kaplan & Porter, 2011). There are many approaches for measuring healthcare outcomes, but not for measuring costs.

One of the key challenges in the continued viability of healthcare organizations is the development of relevant and accurate cost information. In the past, the method of Activity-Based

Costing (ABC) has been a preferred costing method in healthcare; however, it is time consuming and costly. TDABC is an improved version of the ABC method as it allows for assessment of the variation in practice patterns often found within a single practice or healthcare organization, and determination of costs associated with the variation. Additionally, it provides an opportunity to improve delivery of care, which may result in improved patient outcomes and decreased costs. Implementation of TDABC requires less time and resources to implement, and results in a more accurate measurement of value (Gervais, Levant, & Ducrocq, 2010).

Based on the issues described above, a study was conducted that looked at using the transparent methodology of TDABC to analyze the value of care provided to a group of patients cared for by an interprofessional team of physician and advanced practice nurse, as compared to two different groups of patients, within the same practice and time, each cared for by a physician alone. Additionally, this study was conducted in conjunction and within an original study between the same clinical practice and Harvard Business School, whose goal was to develop bundled pricing for services provided by the entire practice (Kaplan & Anderson, 2007). This study evolved as there were fundamental differences in provider roles and patient outcomes.

Framework

The Participatory, Evidenced-based, Patient-focused Process for Advanced Practice Nursing (PEPPA) framework was used to guide this study. The PEPPA framework was developed to provide APN researchers, health care providers, administrators, and policymakers with a guide to promote the optimal development, implementation, and evaluation of the APN role. Two of the PEPPA framework's goals are: to use data to support the need for a clearly defined APN role, and promote ongoing APN role development and model of care enhancement

through continuous evaluation of progress in achieving outcome-based goals, which is exact alignment with the purpose of this study (Bryant-Lukosius & Dicenso, 2004).

Methodology

Design

A retrospective, longitudinal design was used to analyze the value of care provided to a group of patients cared for by an interprofessional team consisting of a physician and APN, or Provider Group 1 (PG 1), as compared to the value of care provided to two different groups of patients, Provider Group 2 (PG 2) and Provider Group 3 (PG 3), each cared for by a physician alone, within the same practice.

PG 1 consisted of a physician and APN, in a non-hierarchical interprofessional team, allowing each provider in the group to work to the full extent of their education and training. For example, in PG 1, the APN was primarily responsible for pre and post-op medication management, pre and post-operative orders, hospital rounding, patient after-hour and weekend triage calls, diabetic education and management, assisting in all surgical procedures, and liaison between patients, family, nursing, hospital administration, clinic staff, and physician. As a result, the physician was able to complete tasks that were unique to a physician's role, such as participating on medical committees, performing minor surgical procedures, and completing uniquely complex surgical consultations. Physicians in PG 2 and PG 3 were each responsible to complete all tasks for their patients, with the exception of assisting in surgery, which was completed by a consistent group of RN first assistants (RNFA). Of note, the costs associated with these RNFAs were not included in this study's costing data for PGs 2 and 3, as they were independent contractors.

Setting

This study was completed in a hospital-owned bariatric medical and surgical practice, within a not-for profit Magnet® designated healthcare system. This system consisted of 3 acute care hospitals and 3 surgical centers, totaling 892 beds. At the time of the study, the study's practice was caring for more than 5000 bariatric surgical patients with 3 surgeons (physicians) and 1 advanced practice nurse (APN).

Sampling

Non-random, consecutive sampling of all patients in the practice who have undergone the procedures of sleeve gastrectomy, gastric bypass roux-en-y, or revisional surgery was used. The study covered a retrospective time period, January 1, 2013 through June 30, 2013 (N = 247).

Approval from the IRB of the hospital system as well as the researcher's university was secured. In addition, each participant in this study provided written consent, allowing their healthcare information to be used for any institution research. This study carried minimal risk and used unidentifiable data from the institution's costing software and electronic medical records.

Costing Data

Initial costing data was obtained by the institution's vice-president of finance and analyzed using the healthcare system's software. This software was used to apply activity-based costing through a hybrid of allocated costs (through *Charge master*) and actual costs (actual services or procedures billed), based on a work relative value unit (RVU). Costing variables included in this study were (per Provider Group/case): charges, estimated net revenue, total payments, total direct costs, OR direct costs, OR indirect costs, and OR total costs (N = 247).

Outcomes Data

Variables for the outcomes data were determined by the TDABC project manager, the practice's medical director, and the researcher, and included: medical record number, age on the date of surgery (age), gender, body mass index (BMI), length of stay (LOS), Provider Group (1= physician & APN, 2= physician working alone, 3= physician working alone), surgical procedure (1=gastric bypass, 2= sleeve gastrectomy, 3=revision), Metabolic Acuity Score (Blackstone & Cortes, 2010), Psychology Score (Blackstone et al., 2010), American Society of Anesthesia Score (American, 2013), Surgical Apgar Score (Gawande, Kwaan, Regenbogen, Lipsitz, & Zinner, 2007), re-admissions, complications, and re-operations (1=yes, 2=no) performed within 30 days of the surgical procedure. Surgical cases for the sample were independently extracted by the institution's quality department, reviewed by the operating surgeon for errors or outliers, and entered into the study's outcomes database by the researcher. Variables were obtained through the institution's and practice's electronic medical records, and entered into the database by the researcher.

Each of the participant's costing and outcomes data were examined and verified by the researcher, vice-president of finance, and TDABC project manager, and a master Excel spreadsheet was created. This spreadsheet was then exported to the Statistical Package for Social Sciences (SPSS), version 22 (IBM, n.d.), by the researcher and statistician for analysis. An alpha level of .05 was used for all statistical tests.

Results

Outcomes

Outcome variable means and standard deviations, by provider group, are illustrated in Table 1. The breakdown of total number of cases, by provider group was: 89 gastric bypasses (36%), 91 sleeve gastrectomies (36.8%) and 67 revisions (27.1%). Of the 247 cases within the study's retrospective time period, PG 1 performed 138 cases (55.9%), or more than twice as many cases as either PG 2 (52 = 21.1%) or PG 3 (57 = 23.1%) (Figure 1). This difference was significant (X^2 (4, N= 247) = 19.31, $p < .001$). Of PG 1's total 138 cases, 52 were classified as revisions. This represents 37.7% of the provider group's total, but 77.6% of the total revisions in the practice (Figure 2).

ANOVA revealed no differences between provider groups on Age (F (2, 244) = .63, $p = .534$), BMI (F (2, 237) = .13, $p = .879$), LOS (F (2, 244) = 2.40, $p = .093$), Psych score (F (2, 266) = 1.18, $p = .308$), ASA (F (2, 244) = .57, $p = .564$), or SAS (F (2, 241) = .20, $p = .821$). There was a positive relationship, however, between MAS and Provider group 1 (Table 2). Kruskal-Wallis (X^2 (2, N = 247) = 14.33, $p = .0001$) and follow up Mann-Whitney tests indicated the MAS was greater for Provider Group 1 when compared to Provider Group 2, ($U = 2415.0$, $p = .001$, $r = .27$), but not between Provider Group 1 and Provider Group 3, ($U = 3352.5$, $p = .068$, $r = .13$). There was no significance between provider groups for surgical complications, (X^2 (2, N = 247) = 2.58, $p = .275$), re-admissions, (X^2 (2, N = 247) = 1.87, $p = .392$), or re-operations, (X^2 (2, N = 247) = .062, $p = .970$); (Table 3).

Costs

The study's cost variables means and standard deviations, by provider group, are illustrated in Table 4. ANOVA revealed no significant differences between provider groups and

the variables of Charges, (F (\$2, 244) = 1.47, p = .232), Estimated Net Revenue, (F (\$2, 244) = 1.89, p = .152), Total Payments, (F (\$2, 244) = 2.01, p = .136), Total Costs, (F (\$2, 244) = .51, p = .598), and Total Direct Costs, (F (\$2, 244) = .785, p = .457). Differences were noted, however, between provider groups and OR Direct Costs, (F (\$2, 244) = 5.92, p = .003), OR Indirect Costs, (F (\$2, 244) = 14.64, p = .000), and OR Total Costs, (F (\$2, 244) = 8.64, p = .000; (Table 5).

Post hoc analyses using Tukey's HSD indicated a significant difference in OR Direct Costs between PG 1 and PG 2 (p = .002), and PG 2 compared to PG 1 (p = .002). There was no difference, however, between PG 1 and PG 3 (p = .459) or PG 3 and PG 1 (p = .459) or PG 2 (p = .131). For OR Indirect Cost, there was a significant difference between PG 1 and PG 2 (p = .000), PG 3 and PG 2 (p = .000), and PG 2 when compared to PG 1 (p = .000) and PG 3 (p = .000). There was no difference between PG 3 and PG 1 (p = .970). For OR total costs, a significance was indicated between PG 1 and PG 2 (p = .000), and PG 2 and PG 1 (p = .000). No significance was indicated between PG 1 and PG 3 (p = .686), or PG 3 with PG 1 (p = .686). These results indicated a need for further study and analysis of each individual provider groups' OR Direct, Indirect, and Total costs for each of the surgical procedures.

Discussion

A statistical analysis of the outcomes data supported that Provider Group 1 (interprofessional team - APN and physician) cared for a significantly greater number of patients, at a higher acuity level than Provider groups 2 (physician alone) and 3 (physician alone). This result was clinically supported by Provider Group 1's mean AGE, LOS, BMI and ASA. In addition, PG 1's mean SAS was the lowest, which indicated the greatest control of estimated blood loss, heart rate, and mean arterial pressure during surgery. Provider Group 1 also performed 77.6% of the total practice's revision, or more complex, cases for the study's time

period. There was no significant difference, however, in re-admission, complication, or re-operation rates between provider groups. Collectively, analysis of the outcomes data indicated that PG1 cared for a greater number of complex patients without negatively affecting outcomes.

Analysis of the costing data indicated that Provider Group 2, when compared to Provider Groups 1 and 3, had significantly greater direct, indirect, and total costs per case. PG 1 had a lower OR Direct cost per case when compared to PGs 2 and 3, and lower OR Total costs when compared to PGs 2 & 3. It is significant to note that the indirect OR costs for PG 1 only, included the cost of the assistant (APN). With this additional cost, however, cost per case, for PG 1 was only slightly higher than PG 3, but still significantly lower than PG 2. In addition, PG 1 generated more than twice the volume ($N=138$) of cases than PGs 2 & 3 ($N=52$ & $N=57$, respectively). This significantly greater number of cases resulted in PG 1 generating significantly greater revenue, illustrated in Figure 3.

Limitations

Limitations of this study are inherent to a retrospective design and include that the researcher must rely on the availability and accuracy of the data recorded and patient selection bias. In addition, data was obtained from a convenience sample and may not be an accurate reflection of the current or future practice costs and/or activities. The interprofessional team of PG 1 consists of the most experienced clinicians within the practice setting. Each of the practice's providers has a different number of years of healthcare experience as well as experience within the practice. An additional limitation may be the acute care setting.

Conclusion

A result of rising health care costs and comparatively poor outcomes of care in the U.S. has been a renewed emphasis in strategies to deliver and provide access to value-based healthcare. Time-Driven Activity-Based Costing is an efficient and accurate methodology for determining value in healthcare delivery, and the advanced practice nurse is integral in the United States' solution to increase access to value-based healthcare. The results of this study indicate that when costs and outcomes of care by an interprofessional team of physician and APN are analyzed by the transparent methodology of TDABC, value by the inclusion of the APN is strongly supported. This may be, however, a result of the APNs specialized education, responsibilities within the practice, and experience as a clinician.

This study's results also contribute to the SHBC/ HBS TDABC Analysis Study, whose ultimate goal is to determine bundled pricing for services provided. This strategy, when successfully implemented, will help to decrease the cost of care, without compromising quality – or value. In addition, the results of this study support, and add to the existing body of literature on advanced nursing practice, healthcare policy, organizational impact of optimal provider mix, and interprofessional collaborative practice. They may also contribute to improved patient experience reports and improved health recovery, as a result of the transparency of outcomes and costs of care. The results of this study also contribute to the body of literature on methods of payment structures to ensure high-quality care and efficiency in the delivery of care, such as “value-based purchasing” (VBP), or “pay for performance” (P4P). Interprofessional collaboration between physicians and APNs using the methodology of TDABC may be successfully implemented in other healthcare settings. Implementing the methodology of TDABC to analyze care provided by the inclusion of the advanced practice nurse may aid in the

determination of APN value, as evidenced by costs and outcomes. Healthcare policy and regulations significantly impacting the APNs ability to practice to the full extent of their education may also be strengthened and leveraged, ultimately affecting patient access to quality healthcare in the United States.

References

- Albright, H.W., Incalcaterra, J., & Feeley, T.W. (2013). Time-Driven Activity-Based Costing and the impact on cost measurement in the face of health reform. *Journal of Clinical Oncology*. Retrieved from <http://meetinglibrary.asco.org/content/120452-140>
- American Society of Anesthesiologists (2013). ASA physical status classification system. Retrieved from <http://www.asahq.org/Home/For-Members/Clinical-Information/ASA-Physical-Status-Classification-System>
- Arts, E., Landewe-Cleuren, S., Schaper, N.C., & Vrijhoef, H. (2012). The cost-effectiveness of substituting physicians with diabetes nurse specialists: A randomized controlled trial with 2-year follow-up. *Journal of Advanced Nursing*. 68(6), 1224-1234. doi: 10.1111/j.1365-2648.2011.05797.x
- Begley, C., Elliot, N., Lalor, J., Coyne, I., Higgins, A., & Comiskey, C.M. (2013). Differences between clinical specialist and advanced practitioner clinical practice, leadership, and research roles, responsibilities, and perceived outcomes (the SCAPE study). *Journal of Advanced Nursing*. 69(6), 1323-1337. doi: 10.1111/j.1365-2648.2012.06124.x
- Blackstone, R., & Cortés, M. (2010). Metabolic acuity score: effect on major complications after bariatric surgery. *Surgery For Obesity And Related Diseases: Official Journal Of The American Society For Bariatric Surgery*, 6(3), 267-273. doi:10.1016/j.soard.2009.09.010.
- Blackstone, R., Cortes, M., Messer, L., & Engstrom, D. (2010). Psychological classification as a communication and management tool in obese patients undergoing bariatric surgery. *Surgery for Obesity And Related Diseases: Official Journal Of The American Society of Bariatric Surgery*, 6(3), 274-281. doi:10.1016/j.soard.2010.02.034

- Bryant-Lukosius, D. and Dicenso, A. (2004). A framework for the introduction and evaluation of advanced practice nursing roles: development, implementation and evaluation. *Journal of Advanced Nursing*, 48(5), 530-540. doi:10.1111/j.1365-2648.2004.03235.x
- Buus-Frank, M.E., Flanagan, V.A., and Minnock, M.R. (2013). Show me the evidence: Nurses learning to lead the change for improved health outcomes. *Neonatal Network*. 32(1), 3-4. doi: 10.1891/0730-0832.32.1.3. Retrieved from <http://resources.metapress.com/pdf-preview.axd?code=146656210759h625&size=largest>
- Cassidy, A. (2012). Nurse practitioners and primary care. *Health Affairs*. Retrieved from https://www.healthaffairs.org/healthpolicybriefs/brief.php?brief_id=79
- Centers for Medicare and Medicaid Services (2011). National health expenditures 2011 highlights. Retrieved from <http://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/NationalHealthExpendData/downloads/highlights.pdf>
- Dean, E. (2013). Proving the value of advanced roles. *Nursing Standard*, 27(25), 18-20. Retrieved from <http://rcnpublishing.com/doi/pdfplus/10.7748/ns2013.02.27.25.18.s8>
- Demeer, N., Stouthuysen, K., and Roodhooft, F. (2009). Time-driven activity-based costing in an outpatient clinic environment: Development, relevance and managerial impact. *Health Policy*. 92(2), 296-304. doi: 10.1016/j.healthpol.2009.05.003
- Feeley, T.W., Fly, H.S., Albright, H., Walters, R., & Burke, T. (2010). A method for defining value in healthcare using cancer care as a model. *Journal of Healthcare Management / American College of Healthcare Executives*, 55(6), 399-411. Retrieved from http://www.ache.org/pubs/jhm/55-6/Feeley_article.pdf

- Gawande, A. A., Kwaan, M. R., Regenbogen, S. E., Lipsitz, S. A., & Zinner, M. J. (2007). An apgar score for surgery. *Journal of the American College of Surgeons*, 204(2), 201-208. doi:10.1016/j.jamcollsurg.2006.11.011. Retrieved from <http://gawande.com/documents/AnApgarScoreforSurgery.pdf>
- Gervais, M., Levant, Y., & Ducrocq, C. (2010). Time-Driven Activity-Based Costing (TDABC): An initial Appraisal through a Longitudinal Case Study. *Journal of Applied Management Accounting Research*, 8(2), 1-20. Retrieved from http://cmaweblne.org/joomla4/images/stories/JAMAR_2010_Summer/JAMARv8.2-TDABC.pdf
- IBM (n.d.). SPSS software. Retrieved from <http://www-01.ibm.com/software/analytics/spss/>
- Inglehart, J. (2013). Expanding the role of advanced nurse practitioners-risks and rewards. *New England Journal of Medicine*. 368(20), 1935-1941. DOI: 10.1056/NEJMhpr1301084
- Institute of Medicine (1972). *Educating for the health team*. Retrieved from http://nexusipe-resource-exchange.s3.amazonaws.com/Educating_for_the_health_team%201972%20IOM%20report.pdf
- Institute of Medicine (2000). *To err is human: Building a safer health system*. Retrieved from <http://www.iom.edu/~media/Files/Report%20Files/1999/To-Err-is-Human/To%20Err%20is%20Human%201999%20%20report%20brief.pdf>
- Institute of Medicine (2001). *Crossing the quality chasm: A new health system for The 21st century*. Retrieved from <http://www.iom.edu/Reports/2001/Crossing-the-Quality-Chasm-A-New-Health-System-for-the-21st-Century.aspx>
- Institute of Medicine (2010). *The future of nursing: Leading change, advancing*

- health*. Retrieved from <http://www.iom.edu/Reports/2010/The-Future-of-Nursing-Leading-Change-Advancing-Health.aspx>
- Institute of Medicine (2012). *Best care at lower cost: The path to continuously learning health care in America*. Retrieved from <http://www.iom.edu/Reports/2012/Best-Care-at-Lower-Cost-The-Path-to-Continuously-Learning-Health-Care-in-America.aspx>
- Kaplan, R. and Anderson, S. (2007). Time-driven activity-based costing: A simpler and more Powerful path to higher profits. Boston: Harvard Business School Press.
- Kaplan, R.S., and Porter, M.E. (2011). How to solve the cost crisis in health care. *Harvard Business Review*, 47-64. Retrieved from <http://www.exed.hbs.edu/assets/Documents/hbr-cost-crisis-health-care.pdf>
- Kurtzman, E. T. (2010). The Contribution of Nursing to High-Value Inpatient Care. *Policy, Politics & Nursing Practice*, 11(1), 36-61. doi: 10.1177/1527154410371381. Retrieved from <http://ppn.sagepub.com.libproxy.nau.edu/content/11/1/36.full.pdf+html>
- Lalor, J., Casey, D., Elliott, N., Coyne, I., Comiskey, C. Higgins, A., ...Begley, C. (2013). Using case study within a sequential explanatory design to evaluate the impact of specialist and advanced practice roles on clinical outcomes: The SCAPE study. *BMC Medical Research Methodology*. 13(1), 1-10. doi: 10.1186/1471-2288-13-55
- Lee, P.V., Berenson, R.A., and Tooker, J. (2010). Payment reform: The need to harmonize approaches in Medicare and the private sector. *New England Journal of Medicine*. 362 (1), 3-5. doi: 10.1056/NEJMp0910459. Retrieved from <http://www.nejm.org.libproxy.nau.edu/doi/pdf/10.1056/NEJMp0910459>
- Lenz, E. R., Mundinger, M., Kane, R. L., Hopkins, S. C., & Lin, S. X. (2004). Primary Care

- Outcomes in Patients Treated by Nurse Practitioners or Physicians: Two-Year Follow-Up. *Medical Care Research & Review*, 61(3), 332-351. doi:10.1177/1077558704266821
- Makary, M. (2010). *Unaccountable*. New York, NY: Bloomsbury Press.
- Mundinger, M. O., Kane, R. L., Lenz, E. R., Totten, A. M., Tsai, W., Cleary, P. D., & ... Shelanski, M. L. (2000). Primary Care Outcomes in Patients Treated by Nurse Practitioners or Physicians. *JAMA: Journal of the American Medical Association*, 283(1), 59. doi:10.1001/jama.283.1.59.
- Naylor, M.D., and Kurtzman, E.T. (2010). The role of nurse practitioners in reinventing primary care. *Health Affairs*. 29(5), 893-899. doi: 10.1377/hlthaff.2010.0440.
- Newhouse, R.P., Stanik-Hutt, J., White, K.M., Johantgen, M., Bass, E.B., Zangaro, G. . . . Weiner, J.P. (2011). Advanced practice nurse outcomes 1990-2008. *Nursing Economics*. 29(5), 230-251. Retrieved from <https://www.nursingconomics.net/ce/2013/article3001021.pdf>
- Porter, M. (2010). What is value in health care? *New England Journal of Medicine*. 363(26), 2477-2481. doi: 10.1056/NEJMp1011024. Retrieved from <http://www.nejm.org/doi/full/10.1056/NEJMp1011024>
- Porter, M.E., & Lee, T.H. (2013). The strategy that will fix health care. *Harvard Business Review*, 1-19. Retrieved from http://www.iqg.com.br/uploads/biblioteca/the_strategy.pdf
- Porter, M.E., and Teisberg, E.O. (2006). *Redefining health care: Creating value-based competition on results*. Boston: Harvard Business School Press.
- Porter, M. (2010). What is value in health care? *New England Journal of Medicine*. 363(26), 2477-2481. doi: 10.1056/NEJMp1011024. Retrieved from <http://www.nejm.org/doi/full/10.1056/NEJMp1011024>

- Robert Wood Johnson Foundation (2012). Implementing the IOM future of nursing report – Part III: How nurses are solving some of primary care’s most pressing challenges. Retrieved From <http://www.rwjf.org/content/dam/files/rwjf-web-files/Resources/2/cnf20120810.pdf>
- Rubenstein, G. (2013). New health rankings: Of 17 nations, U.S. is dead last. *The Atlantic Monthly Group*. Retrieved from <http://www.theatlantic.com/health/archive/2013/01/new-health-rankings-of-17-nations-us-is-dead-last/267045/>
- Safreit, B. (2011). Federal options for maximizing the value of advanced practice nurses in providing quality, cost-effective health care. Retrieved from <http://www.iom.edu/~media/Files/Activity%20Files/Workforce/Nursing/Federal%20Options%20for%20Maximizing%20the%20Value%20of%20Advanced%20Practice%20Nurses.pdf>
- Stout, D.E. & Propri, J.M. (2011). Time-Driven Activity-Based Costing at a medium-sized electronics company. *Management Accounting Quarterly*, 12(3), 1-12. Retrieved from [http://www.imanet.org/PDFs/Public/MAQ/2011_Q2/maq_spring_stout%20\(1\).pdf](http://www.imanet.org/PDFs/Public/MAQ/2011_Q2/maq_spring_stout%20(1).pdf)
- Vincent, D. & Mackey, T. (2000). Cost analysis: A tool for measuring the value of nurse Practitioner practice. *Nurse Practitioner Forum*. 11(2), 149-153. doi: 10.1053/nupf.2000.6774

Table 1.

Means and Standard Deviations of Outcome Variables by Provider Group (N = 247)

Variable	PG1		PG2		PG3		Total	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Age	49.48	12.02	47.35	12.48	48.18	13.11	48.73	12.36
Body Mass Index	43.96	8.86	43.70	5.54	43.30	11.21	43.70	8.85
Length of Stay	2.36	1.59	1.82	.78	2.24	1.75	2.22	1.51
Metabolic Acuity Score	3.25	1.10	2.51	1.25	2.98	1.14	3.03	1.17
Psychological Score	2.01	.67	1.76	.59	2.50	5.09	2.07	2.49
Anesthesia Score	2.61	.66	2.53	.54	2.52	.53	2.57	.61
Surgical Apgar Score	7.99	1.02	8.08	.93	8.07	1.05	8.02	1.01

Note. *PG1*: Interprofessional providers *PG2*: Physician *PG3*: Physician

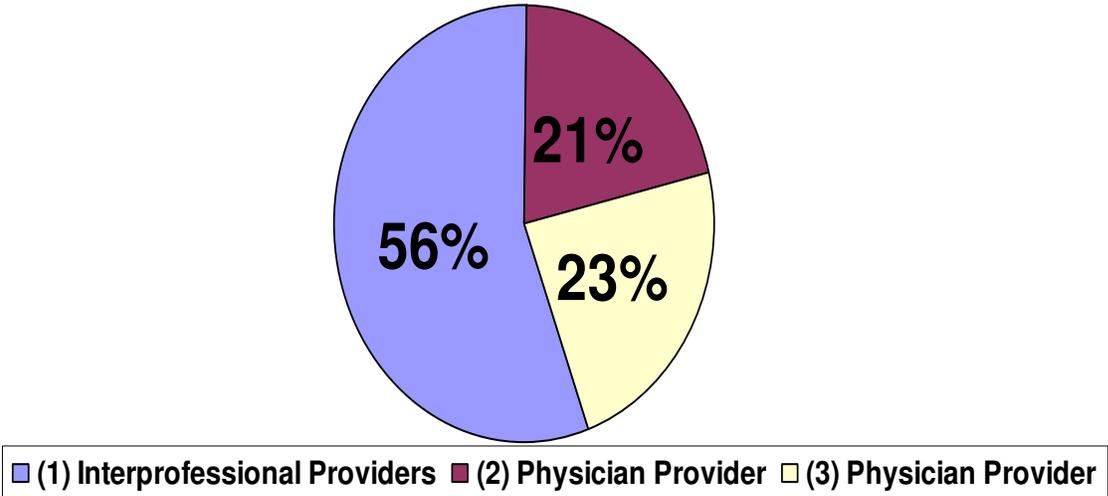


Figure 1. *Percentage of total cases by provider group.*

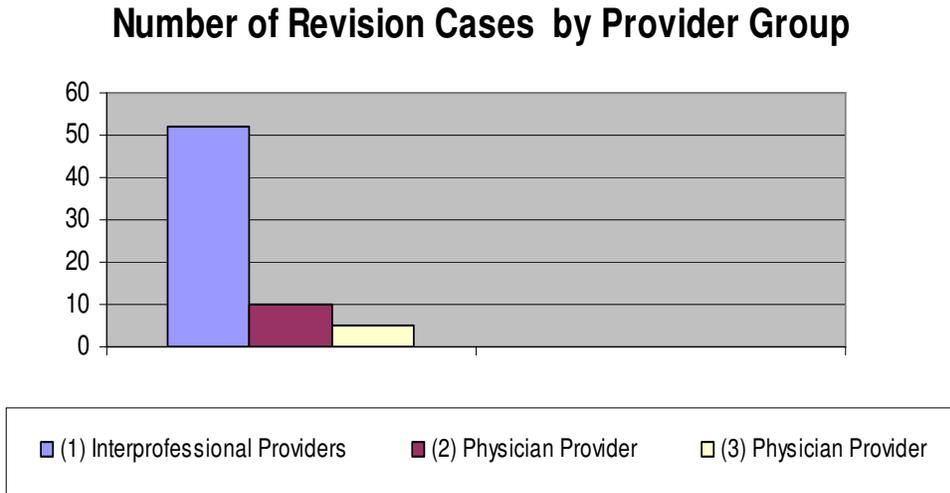


Figure 2. *Number of revision cases by provider group.*

Table 2.

ANOVA Provider Groups and Outcome Variables

		ANOVA				
Variable		Sum of squares	df	Mean square	F	Sig.
Age	Between groups	192.768	2	96.384	.629	.534
	Within groups	37397.076	244	153.267		
	Total	37589.844	246			
Body mass Index	Between groups	20.367	2	10.183	.129	.879
	Within groups	18739.984	237	79.072		
	Total	18760.350	239			
Length of Stay	Between groups	10.865	2	5.433	2.402	.093
	Within groups	551.900	244	2.262		
	Total	562.765	246			
Metabolic Acuity Score	Between groups	20.820	2	10.410	7.659	.000
	Within groups	317.851	243	1.308		
	Total	338.671	245			
Psychology Score	Between groups	14.637	2	7.318	1.183	.308
	Within groups	1398.657	226	6.189		
	Total	1413.294	228			
Anesthesia Score	Between groups	.432	2	.216	.574	.564
	Within groups	91.779	244	.376		
	Total	92.211	246			

		ANOVA				
Variable		Sum of		Mean		
		squares	<i>df</i>	square	<i>F</i>	<i>Sig.</i>
Surgical	Between groups	.406	2	.203	.197	.821
Apgar Score	Within groups	248.393	241	1.031		
	Total	248.799	243			

Table 3.

Complications, Readmissions, Reoperations by Provider Group (N = 247)

Group	Complication		Readmission		Reoperation				
	No	Yes	No	Yes	No	Yes			
PG1	131	7	130	8	136	2			
% within PG	94.9%	5.1%	94.2%	5.8%	98.6%	1.4%			
% within total	57.2%	38.9%	57.0%	42.1%	56.0%	50.0%			
PG2	46	6	46	6	51	1			
% within PG	88.5%	11.6%	88.5%	11.5%	98.1%	1.9%			
% within total	20.1%	33.3%	20.2%	31.6%	21.0%	25.0%			
PG3	52	5	52	5	56	1			
% within PG	91.2%	8.8%	91.2%	8.8%	98.2%	1.8%			
% within total	22.7%	27.8%	22.8%	26.3%	23.0%	25.0%			
	<i>sig. (2-</i>			<i>sig. (2-</i>			<i>sig. (2-</i>		
	Value	<i>df</i>	sided)	Value	<i>df</i>	sided)	Value	<i>df</i>	sided)
Chi square	2.57	2	.275	1.87	2	.392	.062	2	.970

Note. PG1 = Interprofessional providers. PG2 = Physician. PG3: Physician

Table 4.

Means and Standard Deviations of Cost Variables, by Provider Group (N = 247)

Variables	PG1 (N = 138)		PG2 (N = 52)		PG3 (N = 57)		Total (N = 247)	
Charges	45714.80	15682.44	50295	12236.80	48613.88	24731.40	47348.12	17633.74
Est. net. rev.	16209.57	7417.84	14215.95	5341.94	16563.73	7263.28	15871.59	7023.07
Total payments	16101.32	7305.95	14215.81	5362.04	16524.58	7250.95	15776.57	6960.03
Total cost	8963.64	3288.09	9181.74	2197.77	9555.02	5405.26	9146.03	3705.55
Total direct	6163.93	2196.79	6309.10	1393.97	6648.31.	3563.97	6306.27	2453.65
OR direct cost	4084.83	987.23	4630.28	986.51	4268.06	940.21	4241.95	995.82
OR indirect cost	1593.05	393.01	1919.99	477.68	1578.63	291.93	1658.55	413.59
OR total cost	5677.88	1281.08	6550.28	1423.56	5846.69	1198.92	5900.50	1333.81

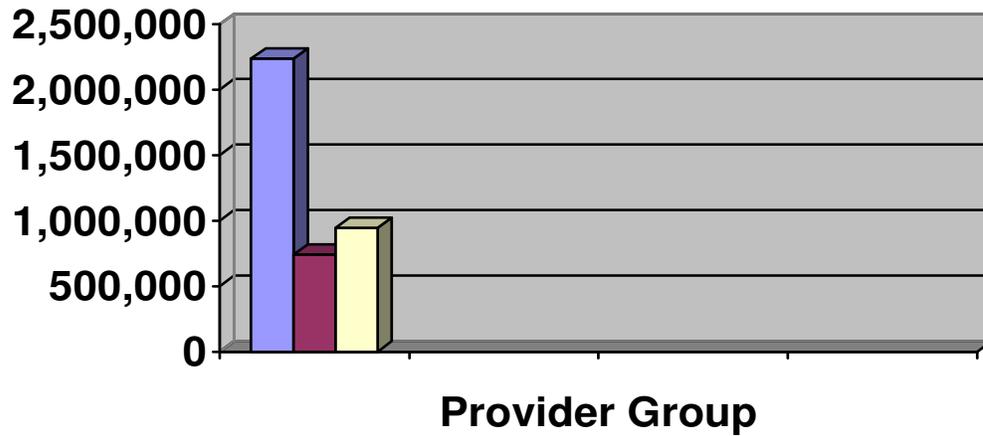
Note. PG1: Interprofessional providers. PG2: Physician. PG3: Physician

Table 5.

ANOVA Provider Groups and Costing Variables

Variable		ANOVA				
		Sum of squares	<i>df</i>	Mean square	<i>F</i>	<i>Sig.</i>
Charges	Between groups	911119348.6	2	455559674.3	1.471	.232
	Within groups	7.56	244	309763741.3		
	Total	7.65	246			
Estimated Net Revenue	Between groups	185608693.4	2	92804346.70	1.895	.152
	Within groups	1.19	244	48967165.08		
	Total	1.21	246			
Total Payments	Between groups	193519405.2	2	96759702.61	2.014	.136
	Within groups	1.17	244	48046074.84		
	Total	1.19	246			
Total Cost	Between groups	14191586.95	2	7095793.477	.515	.598
	Within groups	3363666376	244	13785517.94		

Variable	ANOVA					
		Sum of squares	<i>df</i>	Mean square	<i>F</i>	<i>Sig.</i>
	Total	3377857963	246			
Total Direct Cost	Between groups	9464881.866	2	4732440.933	.785	.457
	Within groups	1471557758	244	6030974.420		
	Total	1481022640	246			
Operating Room	Between groups	11287152.68	2	5643576.340	5.919	.003
Direct Cost	Within groups	232662484.7	244	953534.773		
	Total	243949637.4	246			
Operating Room	Between groups	4510423.497	2	2255206.749	14.646	.000
Indirect Cost	Within groups	37571362.86	244	153980.995		
	Total	42081776.36	246			
Operating Room	Between groups	28958965.92	2	14479482.96	8.645	.000
Total Cost	Within groups	408689717.2	244	1674957.857		
	Total	437648683.1				



	Interprofessional Providers \$2,296,920
	Physician Provider \$739,222
	Physician Provider \$944,132

Figure 3. *Estimated net revenue by provider group for 6-month period of study.*