PRACTICE MANAGEMENT

From the Society for Vascular Surgery

An all-inclusive and transparent view of a vascular program's direct impact on its health system

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Objective: **This study explores the fiduciary advantage of a Vascular Surgery program to an academic, tertiary care hospital.**
Methods: **This is a retrospective review of hospital (HealthQuest) and physician (IDX) billing databases from April 2009 to September 2010. We identified all patients interacting with Vascular Surgery (VS) to provide an overview of global finances. Patients introduced solely by VS were identified to minimize confounding of the downstream effect. Outcome measures obtained were revenue, average and total gross margin, relative value unit production, and service utilization.**
Results: **A total of 552 cases were identified demonstrating $13 million in revenue. This translated into a gross margin of $5 million. Examined per surgeon, VS was the most profitable, producing $1.6 million. Lower extremity amputation had the highest average gross margin at $34,000. Notably, $8 million in direct cost is among the highest in the health system. A total of 137 cases unique to VS generated $5 million in total revenue. This patient subset made use of up to 29 physician specialty services. General Medicine and Radiology were the most frequently utilized.**
Conclusion: **The overall profitability of a comprehensive vascular program is tremendously positive. This study verifies that new vascular-specific referrals are a significant catalyst for revenue. (J Vasc Surg 2012;55:281-5.)**

The focus of specific health care delivery can vary regionally, favoring certain service lines depending on the demographic and payor mix. The goal of any institution, however, is to reduce costs, maximize their most profitable revenue streams, and balance a complete compliment of heath care delivery. Despite controlling expenditures and maintaining revenue, the percentage of hospitals with a negative margin still increased across every hospital class.[1] Nurturing a new program in such an environment can be a daunting task, so how do we partner with our institutions to maintain our collective financial viability? The role of any given service line is to maximize throughput while maintaining quality. Somewhere, health care systems and health care providers intersect in the proverbial "sweet spot" where the efforts of a service line translate into a healthy bottom line for each other. The benefits of such a relationship can feed into other services, resulting in an avalanche of revenue for both hospital and other professional services. A report describing the current environment states, "physicians can attract patients needing high-cost services . . . bringing in added revenue."[2] Within our institution, we hypothesize that the Division of Vascular and Endovascular surgery generates profit, translating into global success for our health system. The aim is to demonstrate how our partnership fuels financial strength and added growth to the division and ultimately the health care system.

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METHODS

This study is a retrospective review of a single, urban tertiary care center's hospital and physician billing databases: HealthQuest (McKesson, San Francisco, Calif) and IDX (IDX Systems Corporation, Burlington, Vt), from April 2009 to September 2010. In IDX, we obtained the financial analysis of physician practices by identifying specialty and subspecialty groups. This was accomplished by distilling the fiduciary hierarchy (specialty group, division, billing area, physician, current procedural terminology [CPT] codes) to extract information to level of CPT data. From the HealthQuest (HQ) database, patient cases were selected by major diagnostic categories (MDC)/diagnosis-related group (DRG), procedure provider, or primary diagnosis. We assigned DRGs to service and subservice lines. Since IDX and HQ databases do not interface, linking the IDX clinical patient identifiers (CPI) to a service date permitted isolation of the corresponding hospital encoun-

ter in HQ. Market information for Southern New Jersey was obtained through the database, MarketExpert (Thomson Reuters, New York, NY), which is designed to determine market share and patient destination as well as compare average length of stay as a proxy for acuity. The queries were based on inpatient encounters and residents of the system's primary or secondary service areas carrying a primary diagnosis (or international classification of diseases [ICD]) code of 441.X, aortic aneurysm, and dissection.

In an attempt to control for downstream effect initiated by other specialties, we deliberately chose encounters introduced into the system by Vascular Surgery. Each CPI, where Vascular Surgery generated a bill, was compiled through IDX. Those CPIs were utilized to generate the entire scope of physician billing activity. Any patient having 8 months of inactivity in the health system prior to having his first encounter with our division was identified. Each was classified as unique to the Division of Vascular and Endovascular Surgery (VES). Unique CPIs were then cross-referenced in the HQ hospital billing system to capture the hospital data. Trauma patients were excluded because of the multidisciplinary nature of the population and variability in payor mix, ensuring that they would not be unique to VES. Unique CPIs for patients accessing hospital-related services (inpatient and outpatient) were captured and evaluated for the end points of interest: revenue, direct cost, and specialty service utilization. Outpatient services, such as ultrasound, computed tomography scans, magnetic resonance imaging, phlebotomy, physical therapy, etc were all inclusive of our margin calculations. The hospital-related cases were identified by DRGs associated with vascular surgical procedures or diseases. The DRGs were then placed in the following classifications: amputation, cardiovascular, extracranial, peripheral vascular and venous disease. Venous disease was treated as an outlier and excluded based on the small volume of cases.

Separately, revenue and gross margins were calculated from all accounts that were paid and loaded into the accounting system Avega (Medassets, Alpharetta, Ga) across all of the premiere service lines in the health system, including, Orthopedics, Neurosurgery, Division of Cardiology (includes Electrophysiology, catheterization lab, Cardiology, and Cardiac Surgery), General Surgery, and Vascular Surgery. To further distinguish hospital services, DRG weights were applied for fiscal year (FY) 2010 to the specific codes used by VES from the same period. DRG weights are published annually. Averages were calculated in a standard fashion. The average DRG weights for other service lines were made available by our finance department for comparison.[3] FY 2010 was used as the most current, thus the most representative. To derive the general cost per patient-day, our finance department used the Avega accounting system for a statistical analysis of the expenses and revenue in the general ledger. From this, the total cost for each patient encounter was calculated and divided by the number of total patient-days per year.

Relative value unit (RVU) production and full time clinical physician (FTE) compliment from these service lines were also described. We compared each service line by hospital gross margin (GM), RVU, and FTE. These data were standardized between groups by analyzing the GM and RVUs per FTE.

Revenue included patient payment, payor payment, bad debt recovery, and charity care/miscellaneous allocations. Cost was calculated using the direct cost attributed to the care of the individual patients such as ancillary staff, medications, operating room time and equipment, and dietary. Indirect costs, fixed and variable, represent overhead and allocations specific to maintaining the hospital (eg, general administration/finance, global capital expense, security, etc). These were not included as they do not directly reflect a service's impact on patient care; hence, net margin (gross margin less indirect cost) was not calculated. The gross margin is defined as revenue less direct cost, and it is used in this analysis as a directionally accurate proxy for the net margin. Average gross margin is defined as the gross margin divided by the number of discharges; used here as a method to balance maturing and established programs.

RESULTS

Overview. The area served by our tertiary care center is comprised of eight counties in Southern New Jersey. These counties range from a nine to 80-mile radius from the hospital. We share this market with hospitals in both Southern New Jersey and Eastern Pennsylvania. Generally, New Jersey has two-thirds of the market share, while Pennsylvania maintains one-third. Our hospital is third overall with 13% of the market share as determined by the Market Expert application.

The hospital infrastructure is composed of a Siemens (Washington, DC) hybrid operating suite and two identical interventional radiology (IR) suites, shared IR technologists; and a comprehensive inventory that is predominantly consigned. In 2009, the division received a $1.5 million subsidy from the health system. These included support for the vascular fellowship, resource staff for office and clinical trials, marketing staff, all expenses relating to database management, 3D workstations and software, and part of our nurse practitioner program.

Global hospital finances. In 2009, 552 CPIs billed by the Division of VES generated $12,875,213 in hospital revenue. The predominant payor is Medicare, providing reimbursements for 59% of the cases and 61% of the gross margin. The remaining 41% are paid for by managed care, Medicaid, charity care, and commercial sources (24%, 9%, 6%, 2%, respectively). The VES payor mix mirrors that of our hospital in that Medicare is the principal payor. The Finance Department calculated a total cost to the hospital of approximately $2600/patient-day. The proportion of total inpatient volume attributed to VES is only 3%. Yet, it yielded 6% of the total gross margin. Direct costs specific to the vascular service line, in 2009, were $7,764,694 for a gross margin of $5,110,919.

To assess where vascular surgery stands in terms of service line production, the gross margin was calculated for all inpatient subspecialty service lines and compared with

Table I. Overview of the global hospital margins by FTE and RVU for the top five service lines

	Cardiology	*General Surgery*	*Orthopedics*	*Vascular*	*Neurosurgery*
Hospital GM	$23,617,768	$15,141,263	$5,512,980	$5,110,918	$1,229,021
2009 RVU	150,131	59,242	86,610	26,701	27,528
Physician FTE	22.08	11.52	11.90	3.17	4.93
RVU/FTE	6713	6136	7732	8423	6726
GM/RVU	$157.31	$255.58	$63.65	$191.41	$44.65
GM/FTE	$1,069,645.29	$1,314,345.75	$463,275.63	$1,612,276	$249,294.32

FTE, Full-time clinical physician; *GM*, gross margin; *RVU*, relative value unit.
Source: IDX (IDX Systems Corporation, Burlington, Vt).

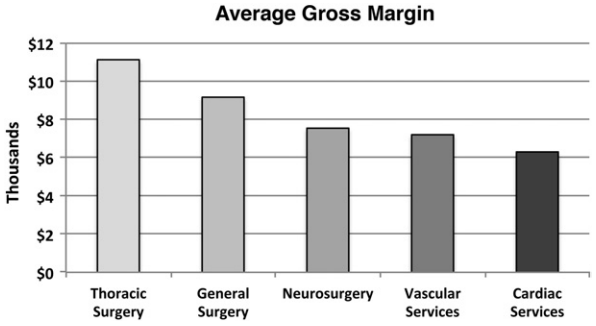

Fig. Average gross margin by top five hospital-based specialty services.

RVU production as well as full-time physician employee (FTE) compliment (Table I). Four vascular surgeons produce 3.17 FTE units when adjusting for nonclinical responsibilities. The certified registered nurse practitioners (CRNP) bill, almost exclusively, through each surgeon, so are not included in the calculation of FTE units. VES in our institution produced the leading margin per FTE, and was second to General Surgery in margin per RVU. The average gross margin (service gross margin divided by number of service discharges) for VES is $7198, which is fourth behind Thoracic Surgery, General Surgery, and Neurosurgery (Fig).

Looking more closely at the 5.1 million dollars in gross margin, a component of the hospital revenue was derived from 1800 invasive and noninvasive interventions and evaluations performed by the division of VES. These procedures could be divided into one of eight DRG categories (Table II). The categories that achieved the greatest average revenue and gross margin were lower extremity amputations, major CV procedures, and "other vascular procedures." Major CV procedures include aortic interventions and "other vascular procedures" include endovascular intervention on nonperipheral vessels.[4] When comparing DRG weight as a proxy for Medicare reimbursement, VES is third highest in compensation as delineated in Table III.

"Spin-off" finances. The vascular service line's impact on other services was assessed using the complete billing for 137 patients introduced solely by VES. Evaluating the utilization of both hospital and physician services over 18 months, those patients generated 397 hospital and 3370 physician encounters. All patients underwent hospital-based procedures. The hospital and physician encounters involved 27 and 29 different specialties, respectively. Among hospital encounters, medical specialties predominated: General Medicine (33%), Emergency Medicine (10%), and Cardiology (9%). Internal Medicine, Critical Care, Family Medicine, and Hospitalist services were grouped for tabulation of hospital services. The physician encounters reveal Radiology as the dominant service line followed by General Medicine and Nephrology (24%, 15%, and 14%, respectively). Internal Medicine, Critical Care, and Hospitalist services were grouped for tabulation of hospital services.

Over 18 months, the revenue generated by vascular patients naive to the health system totaled $5,348,279 (Table IV). The influence of nonvascular services (spin-off) totaled $3,622,053 in revenue with a gross margin of $1,594,316.

DISCUSSION

We have demonstrated the profitability of an academic vascular program to a health system by direct surgeon contributions via clinical productivity. In an academic setting, the requirements of clinical productivity have become increasingly onerous due to poor payor mix, increasing overhead and waning reimbursements, bolstering the need to ramp up clinical volume in an effort to supplement financial deficits.[2] Privately owned practices, without realizing a strong relationship with a health system, may find it increasingly difficult to be self-sustaining in this climate. The physician practices presented here are largely owned by the health system except for several private groups. The advantage is an interconnected relationship where the health system has a vested interest in the success of the physician groups and vice versa. Through continuous interactions, we found that collaboration with our health care administrators helped form trusting relationships and a keen understanding of each other's role. Health system resources, such as marketing, information technology, and legal services all help with programmatic development. VES was identified by the hospital administration as a "blue chip" specialty with great potential for growth. The DRG weight provides an approximation of the influence on Medicare reimbursement, which puts VES third among hospital service lines. Evidenced by the gross margin and

Table II. Sum of average revenue and average gross margin by DRG

DRG	*Description*	*Average revenue ($)*	*Average gross margin ($)*
239, 240, 241	Amp excluding upper limb	80,786	34,066
237, 238	Major CV procedures/TAAA	67,891	24,757
252, 253, 254	Other vascular procedures	52,645	22,610
255, 256, 257	Amp upper limb and toe	45,560	18,789
37, 38, 39	Extracranial procedures	41,533	18,252
264	Other circ system procedures	28,118	14,779
35, 36	CAS	28,189	11,489
299, 300, 301	PVD	25,944	9408

CAS, Carotid artery stent; *CV*, cardiovascular; *DRG*, diagnosis-related group; *PVD*, peripheral vascular disease; *TAAA*, thoracoabdominal aortic aneurysm. Source: *HQ* (McKesson, San Francisco, Calif).

Table III. Average DRG weight by service line for hospital-based services

Service line	*Current % of inpatient volume*	*Average 2010 DRG weight*
General surgery	8%	3.53
Div of Cardiology	26%	2.24
Vascular surgery	6%	2.22
Orthopedics	5%	1.88
Oncology	16%	1.68
Neurosciences	10%	1.50
Digestive health	14%	1.42
General medicine	15%	1.02
System total	100%	1.87

DRG, Diagnosis-related group.

other outcome measures presented in these data, VES compares favorably among the top five programs in our health system.

To measure all the programs collectively, we determined the value of each program per unit of work performed by the physicians in each service line. The RVU stands as the only measurable unit uniformly and conveniently utilized by all the physicians in our health system. Overall, the health system gains $191 per Vascular RVU generated, while physician billing receives approximately $33. Based on the division's profit and loss accounting, we are able to supplement the vascular program with a budgeted $1.5 to $1.7 million hospital subsidy for nonclinical requisites. Combined with the hospital gross margin, VES is a viable and productive resource for the health system. In addition, recognizing the value of the service in this way encourages future development via programmatic cultivation, growth of vascular resources and services.

We also furnished a small glimpse of what "new" patients can generate to hospital and physician services via spin-off finances. The focus of our institution is on cardiovascular services with VES benefiting from a robust cardiac program. However, Vascular Surgery provides a reciprocal benefit to these services, generating 3,370 physician and 397 hospital encounters from 137 patients new to the division as well as the health system. With >50% of those unique patients interacting with other specialties, we are creating a stable revenue stream, especially for our most frequently utilized services: Medicine, Cardiology, and Radiology. Nonvascular services contributed 66% of the gross margin in this group. Third-party payers impact our financial status significantly as Medicare is the dominant payer and may provide a more reliable source of income. However, it is a double-edged sword since it also serves as the benchmark by which other insurers determine their reimbursement scales. In the face of receding compensation, we are going to truly require hospital support to maintain quality services.

The Vascular division has a full complement of resources designed for patient safety, continued clinical growth, and fulfilling our mission of education. Hospital support allows the division to implement a robust nurse practitioner program for inpatient and outpatient services. Through this program we have standardized care pathways for all patient procedures and provided vital education to hospital nursing staff on the management of vascular patients. Overall, these quality control initiatives have maintained a low mean length of stay with concomitant doubling of our inpatient volume over the past two years, translating into both savings and revenue.

The ability of a service line to generate revenue is a fairly straightforward measurement; however, cost determinations pose a challenge. Although we were unable to quantify indirect costs, our annual direct cost is among the highest of all specialty hospital service lines. Despite this, VES was the fourth-highest average gross margin. The data is sobering as it demonstrates that expenditure control will be key to improving our margin further. Understanding our high cost profile establishes the need for vigilant survey and modifications of our revenue cycle, especially in the face of new Medicare regulations.[4] Although our group has taken several steps already, especially with documentation for coding and decreasing denials; cost containment still remains a challenge. We cannot manipulate indirect costs such as hospital overhead. One way to achieve this may be to consider the creation of an interdisciplinary vascular center within the hospital to share some of those costs, reducing the burden on any one division. Another approach is to reform the behavior affecting our own costs. Medicare recognizes that the swell in its cost correlates to the volume of testing and studies performed, which is not sustainable at this rate.[5] This means that Medicare will

Table IV. Financial overview rendered by 137 vascular-specific patients

	Count of account number	*Sum of total charge amount*	*Sum of total revenue*	*Sum of total direct costs*	*Sum of gross margin*
Hospital billing					
Vascular surgery	163	$9,145,155	$1,468,618	$787,956	$680,662
Nonvascular surgery	397	$14,630,558	$3,089,903	$1,495,587	$1,594,316
Hospital total	560	$23,775,713	$4,558,522	$2,283,544	$2,274,978
Physician billing					
Vascular surgery	771	$1,866,332	$257,607	N/A	N/A
Nonvascular surgery	3370	$1,732,228	$532,150	N/A	N/A
Physician total	4141	$3,598,560	$789,757	N/A	N/A
Grand total	4701	$27,374,273	$5,348,279	$2,283,544	$2,274,978

Sources: *HQ* (McKesson, San Francisco, Calif) and *IDX* (IDX Systems Corporation, Burlington Vt).

institute sanctions to enforce cost control, causing a trickle-down effect with other third-party payers.[6] It is in our best interest to prove that we can manage this within our health systems without federal restrictions further impacting our options.

Limitations. Our study was limited in several ways. We had a very small sample over a relatively short period of time, which was not representative of the complete complement of patients treated at our hospital. Only patient accounts that were completely adjudicated were used within the given time period. A more robust sample size for spin-off calculation would be more representative and minimize selection bias. Another limitation was that indirect costs were not measured to calculate net margins. The analysis of the VES service line's procedures was generated from DRG vs ICD-9 codes. This may skew the outcome related to profitability of a given procedure type. Although we used DRG weights as a proxy for the case mix index (CMI), CMI was not included in our original analysis; hence, missing an important aspect of VES impact on revenue via Medicare. A picture of how the health system handles such costs can be important to future program development.

CONCLUSION

In summary, we have demonstrated an estimated value of our Division of VES to our health system. A complex relationship with multiple stakeholders, from the patients to the payors, exerts an effect on the benchmarks used to make that assessment. We have learned that despite our division's size and patient volume, we are capable of generating a strong gross margin. There is literature supporting hospital administrations' need to understand the strength of specialty services, the impact of a sound relationship, and the benefit of increasing recruitment efforts for specialty services.[1] VES also acts as a feeder system to as many as 30 other specialty services to support significant revenue generation for the hospital. In isolation, VES would have significant difficulty maintaining the resources necessary for a growing academic practice. Partnership with the health system has allowed us to increase productivity, achieve programmatic growth, educate and enhance quality. Efforts such as improved documentation and standardized clinical care pathways by the clinical nurse practitioners are recognized measures for improving reimbursements.[5] However, our future focus will require finding innovative ways to provide effective, efficient, and safe care economically.

AUTHOR CONTRIBUTIONS

Conception and design: JL
Analysis and interpretation: NT, ST, JL
Data collection: ST
Writing the article: NT, JL
Critical revision of the article: NT, JC, JA, JT, JL
Final approval of the article: JC, JA, JT, JL
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