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## Springfield Hospital

"This can't be right," thought Elliott Turner, VP of Healthcare Delivery Research at Springfield Hospital. Springfield was one of three sites participating in a research study carried out by Alyssa McGowan, a postdoctoral scholar at Harvard University. Turner was reading McGowan's preliminary report, which showed that Springfield's cost for coronary artery bypass graft (CABG) surgeries was in the middle of the three hospitals. Turner had helped Springfield earn a national reputation as healthcare's low-cost leader, often referred to as "Toyota Hospital," through the rigorous application of an integrated, systems-based approach that produced significant cost reductions and efficiencies. As Turner was reading McGowan's report, a familiar chime signaled an incoming email from Marcus Grainger, CEO of Springfield Hospital:

*Elliott,*

*I am looking at the results of McGowan's comparisons of the three hospitals involved in the study. I am chagrined to see that, despite our efforts, we have neither the lowest costs nor the highest patient satisfaction. Let's meet tomorrow morning to discuss.*

*Marcus*

### The Study

McGowan's multi-hospital study was the result of her keen interest in comparing performance across healthcare organizations. She had reached out to the participants in a Harvard Business School executive education course on measuring outcomes and costs in healthcare. Three quite diverse hospitals responded positively to her request (see **Exhibit 1** for characteristics of each hospital).

Springfield Hospital (SH), founded in the mid-1970s in the western region of the United States, was a system of nonprofit organizations that emphasized consistent and systematic provision of high-quality healthcare services at the lowest possible cost. Turner had introduced and embedded a culture of operational excellence. He had helped establish standard protocols for treating the most important medical conditions across Springfield's network. Electronic medical records facilitated communication and supported medical decisions. Goals were set and performance reviewed with a heavy focus on measurement, statistical analyses of variation, efficiency, collaboration, and continuous improvement.

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Professor Susanna Gallani and Senior Fellow Robert Kaplan prepared this case. This case is not based on a single individual or company but is a composite based on the author's general knowledge and experience. Funding for the development of this case was provided by Harvard Business School. HBS cases are developed solely as the basis for class discussion. Cases are not intended to serve as endorsements, sources of primary data, or illustrations of effective or ineffective management.

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Pleasant Meadows Cardiovascular Care (PMCC), the second site in McGowan's project, was a focused cardiac care facility located in a densely populated area in the United States' Southwest. PMCC had instituted a culture of individualized attention to each patient, open communication with patients and their families, and delivery of high-quality services in a compassionate environment. PMCC strived to create a healing environment that would be transparent and comfortable for patients throughout their cycles of care.

The Institute for Heart Health (TIHH), located in an Asian emerging country, focused exclusively on heart and cardiovascular conditions. TIHH provided affordable care to all patients, independent of their financial status and ability to pay. Cost management was, therefore, a priority along with providing high service quality. TIHH's high volume of procedures, delivered in production-line processes, led to excellent productivity and cost efficiencies, full capacity utilization of people and facilities, and low negotiated prices with suppliers.

The three hospitals agreed that meaningful cost comparisons would be easiest to study for a well-established, relatively standardized procedure. They selected coronary artery bypass graft (CABG) surgery – in particular, elective, isolated, uncomplicated, multi-vessel CABG surgeries. Furthermore, the study would be restricted to low-risk patients who did not present additional complications or comorbidities. McGowan agreed to visit all three sites, spend several weeks at each to observe multiple CABG surgeries, perform interviews with clinical and support staff, and collect operational and financial data.

## Coronary Artery Bypass Graft

Coronary artery bypass graft (CABG) is a surgical procedure to treat patients with coronary heart disease. This medical condition is caused by a buildup of cholesterol or other materials (plaque) that narrows one or more of the blood vessels supplying blood to the heart, thereby impeding the blood flow. The procedure requires an open-heart surgery during which healthy arteries or veins are harvested from other parts of the patient's body (typically an arm or a leg) and connected to the blocked vessel both above and below the blockage to create an alternative path for the blood to reach the heart.<sup>1</sup>

The first CABG surgery was performed in 1960 at the Albert Einstein College of Medicine, Bronx Municipal Hospital Center in New York City.<sup>2</sup> Every year, over 500,000 CABG surgeries are performed in the United States, making CABG the most common type of open-heart surgery. The outcomes are generally good; over 85% of treated patients experience significantly reduced symptoms and risk of heart attacks in the 10 years following the surgery.<sup>3</sup>

The procedure can vary with regard to the vein or artery used to bypass the blockage (internal mammary artery or great saphenous vein of the leg), the number of blocked vessels that are bypassed, and whether the surgery requires a heart-lung machine to continue the blood supply to the body while the heart is stopped (on-pump CABG), or can be performed while the heart continues to function (off-

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<sup>1</sup> National Institutes of Health, National Heart, Lung, and Blood Institute, "What Is Coronary Artery Bypass Grafting?" <http://www.nhlbi.nih.gov/health/health-topics/topics/cabg>.

<sup>2</sup> Michael Diodato and Edgar G. Chedrawy, "Coronary Artery Bypass Graft Surgery: The Past, Present, and Future of Myocardial Revascularisation," *Surgery Research and Practice* 2014, Article ID 726158, 6 pages, 2014. doi:10.1155/2014/726158.

<sup>3</sup> University of Michigan Health System, Cardiac Surgery, <http://www.med.umich.edu/cardiac-surgery/patient/adult/adultcandt/cabg.shtml>.

pump CABG). Beyond these variations, the CABG surgery is considered to be a highly standardized procedure.

McGowan, concerned about possible differences in service quality that might influence the interpretation of her cost comparisons, obtained quality data about CABG surgery outcomes from the Society of Thoracic Surgeons (STS).<sup>4</sup> STS published quality scores and ratings for adult cardiac, general thoracic, and congenital heart surgery. A hospital's overall quality score was a composite measure based on four components of outcomes quality: survival rate, major complications, use of appropriate medications, and use of appropriate surgical technique. Each component had several risk-adjusted indicators (see **Exhibit 2** for descriptions of the STS quality measures, and **Exhibit 3** for the quality ratings for CABG surgeries in the three hospitals).<sup>5</sup> Hospitals and surgery groups were assigned a rating—of one, two, or three stars—based on whether their overall quality score was below, approximately equal to, or above national averages. Since the STS database included information only on U.S. hospitals, McGowan manually calculated a rating for TIHH by collecting data on 11 indicators at the site. After finishing her analysis, she concluded that the quality of outcomes for uncomplicated CABG procedures was similar for the three hospitals participating in her study.

## Comparing CABG Costs across Sites

McGowan chose to compare just the direct labor and materials costs of the CABG procedures across the three hospitals, and not attempt to reconcile their three diverse overhead allocation systems. But the three hospitals used different and incompatible costing systems even for their direct costs. McGowan decided to apply a uniform approach, time-driven activity-based costing (TDABC), one of the new concepts that clinicians and managers at the three hospitals had learned about during their Harvard course. Implementing TDABC involved two main phases. In the first, organizations performed a detailed mapping of all the processes involved in treating the patient over the entire episode of care for the medical condition. For each step in the process, they identified which resources (principally labor and equipment) were used, how long they were used, and any purchased materials and supplies used at that process step (see **Exhibit 4** for an example of a process map). In the second phase, they calculated a “cost per minute” for each person and piece of equipment used in the care cycle, and the cost of any purchased materials or supply. Information for the cost calculation came from the general accounting records (purchases of materials, salary of employees, cost of utilities and space, purchase price, rental and maintenance of the equipment, etc.). In a final step, organizations calculated the total procedure cost by multiplying the process time, at each step, by the cost per minute of the resources used for that process, and adding up these costs, along with the purchased materials and supply costs, across all the process steps in the care cycle.<sup>6</sup> McGowan believed that using a consistent and easy-to-understand costing approach would make her cost comparisons acceptable and meaningful to the clinicians and managers at the three sites.

McGowan visited all three sites and several months later completed her analysis of their costs. She was struck by the magnitude of the cost differences among them:

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<sup>4</sup> “STS Public Reporting Online,” The Society of Thoracic Surgeons, <http://www.sts.org/quality-research-patient-safety/sts-public-reporting-online>.

<sup>5</sup> “Quality Performance Measures,” The Society of Thoracic Surgeons, <http://www.sts.org/quality-research-patient-safety/quality/quality-performance-measures>.

<sup>6</sup> R.S. Kaplan and M.E. Porter, “The Big Idea: How to Solve the Cost Crisis in Health Care,” *Harvard Business Review* 89, no. 9 (2011): 46-52.

• Springfield Hospital	\$17,060
• Pleasant Meadows Cardiovascular Care	18,922
• The Institute for Heart Health	1,091

McGowan prepared a table that broke down the total cost into four categories (see **Exhibit 5**). Direct labor costs were the full compensation, including fringe benefits, of physicians, nurses, clinical assistants, and patient care technicians directly involved in the cycle of care for a CABG patient. Ancillary labor costs related to the remuneration of technicians, therapists, and support staff outside the cardiovascular unit (e.g., imaging, laboratory testing, and physical therapy). Property, plant, and equipment (PP&E) costs included expenses related to the facilities and equipment utilized along the cycle of care. The fourth category included the costs for all medication, supplies, and materials consumed during the cycle of care. The financial information from TIHH was translated into USD using the average currency exchange rate during the quarter in which McGowan had collected the data.

As Turner and Grainger expected, Springfield had significantly lower costs than Pleasant Meadow (see **Exhibit 5**). Its total direct costs were, on average, 10% lower than at PMCC, with 36% lower labor costs. Grainger commented:

I am not surprised. Pleasant Meadows is known for its patient-centered care. Such high-touch care and comfort are expensive. Its patient satisfaction and HCAHPS<sup>7</sup> scores are certainly impressive. I am surprised, however, that their average number of minutes per procedure is lower than ours.

Turner was confused and energized at the same time. His operations philosophy had yielded significant cost savings and efficiencies over the years, and the organizational culture had evolved to include a strong focus on continuous improvement. The opportunity to learn from PMCC how to improve patient satisfaction while maintaining high operational efficiency would represent the next challenge in the implementation of Springfield's strategy.

Grainger and Turner were stunned, however, to see that TIHH's labor and PP&E costs were, respectively, 8% and 7% of Springfield's, despite a higher use of labor and PP&E minutes (see **Exhibit 6** for a comparison of the use of resources in the CABG procedures). At first Turner rationalized that the difference was due to the much lower prices TIHH paid for personnel, facilities, equipment, and supplies. After all, the distribution of costs throughout the cycle of care (see **Exhibit 7**) was not dramatically different between Springfield and TIHH. Similarly, the available time of personnel and facilities involved in CABG procedures at TIHH was very much in line with the availability of resources at Springfield (see **Exhibit 8**). Grainger suspected, however, that the large cost differences could not be completely explained by differences in input prices. He challenged Turner to see whether he could identify opportunities for learning from TIHH's operations. "Let's call McGowan and see if she can help us figure this out," suggested Turner.

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<sup>7</sup> HACHPS is an acronym for "Hospital Consumer Assessment of Healthcare Providers and Systems," a patient satisfaction survey that CMS (the Centers for Medicare and Medicaid Services) requires for all hospitals in the United States. The survey is administered to all adult patients (excluding psychiatric patients) to collect and disseminate standardized, comparable measures of patients' perspectives on the healthcare services they received. Source: <http://www.hcahpsonline.org/home.aspx>.

**Exhibit 1** Organizational Characteristics of the Sites Included in the Cost Comparison

	<b>Springfield Hospital</b>	<b>Pleasant Meadows Cardiovascular Care</b>	<b>The Institute for Heart Health</b>
Service philosophy	Efficient, systems-based high-quality care	Patient-centric approach to healthcare	High-quality, affordable care
Number of isolated, elective, non-complicated, multi-vessel CABGs in 2015	210	560	3,240
Number of cardiovascular surgeons	11	28	51
Number of cardiovascular beds	81	123	558
Number of cardiovascular operating rooms	5	8	14
HACHPS ratings (U.S. only)	3 stars	5 stars	N/A

Source: Casewriters.

Note: HCAHPS ratings are recorded by CMS Hospital Compare, <https://www.medicare.gov/hospitalcompare>. The above ratings resemble those of organizations similar to those depicted in the case.

**Exhibit 2** Measures of Quality Used by STS in the Ratings of CABG Programs

	Indicator	Description
30-Day Mortality	Risk-adjusted operative mortality after CABG	Percentage of patients undergoing isolated CABG who died during the hospitalization in which the CABG was performed or within 30 days after the procedure
Complications	Postoperative renal failure	Percentage of patients (without preexisting renal failure) undergoing isolated CABG in whom postoperative renal failure developed or dialysis was required
	Surgical re-exploration	Percentage of patients undergoing isolated CABG who required a return to the operating room because of bleeding, tamponade, graft occlusion, or other cardiac reason
	Prolonged intubation (ventilation)	Percentage of patients undergoing isolated CABG (without preexisting intubation or tracheostomy) who required intubation for more than 24 hours
	Rate of deep sternal-wound infection	Percentage of patients undergoing isolated CABG in whom a deep sternal-wound infection developed within 30 days after the procedure
	Stroke or cerebrovascular accident	Percentage of patients (without preexisting neurologic deficit) undergoing isolated CABG in whom a postoperative neurologic deficit developed that persisted for more than 24 hours
Use of appropriate medications	Antiplatelet medication at discharge	Percentage of patients undergoing isolated CABG who were receiving aspirin, safety-coated aspirin, or clopidogrel at discharge
	Beta-blockade at discharge	Percentage of patients undergoing isolated CABG who were receiving beta-blockers at discharge
	Antilipid Treatment at discharge	Percentage of patients undergoing isolated CABG who were receiving a statin or other pharmacologic lipid-lowering regimen at discharge
	Preoperative beta-blockade	Percentage of patients undergoing isolated CABG who received beta-blockers within 24 hours before surgery
Surgical technique	CABG using an internal thoracic artery	Percentage of CABG performed using an internal thoracic artery

Source: T.G. Ferris and D. F. Torchiana, "Public release of clinical outcomes data - Online CABG report cards," *New England Journal of Medicine* 363, no. 17 (2010): 1591-1593.

**Exhibit 3** Quality Ratings for Adult CABG surgeries, 2015

	Springfield Hospital	Pleasant Meadows Cardiovascular Care	The Institute for Heart Health
STS overall composite score	3 stars 97.2	3 stars 97.5	3 stars 97.1
<b>STS scores for the four individual domains</b>			
30-day survival rate	99.1	98.2	98.0
Complications	91.0	92.1	90.9
Use of appropriate medications	98.9	99.6	99.3
Surgical technique	99.5	99.1	99.7

Source: Casewriters.

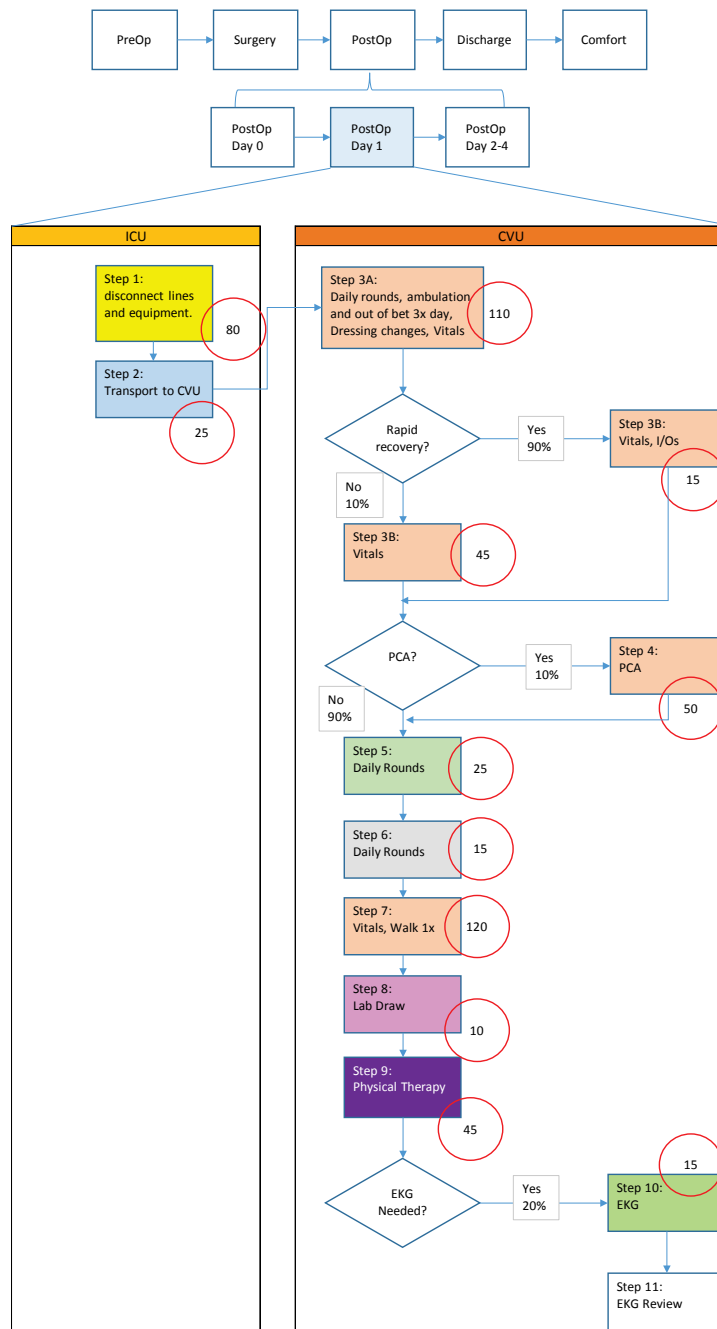
Note: STS scores and ratings are recorded in the online database of the Society for Thoracic Surgeons, <http://www.sts.org/quality-research-patient-safety/sts-public-reporting-online>. The above ratings resemble those of organizations similar to those depicted in the case.

**Exhibit 4** Process Map: First Post-Operatory Day at Springfield Hospital

Staff Category:

Anesthesiologist
Anesthesia Fellow
Surgeon
Surgery Fellow/Junior Surgeon
Physician Assistant
Operating Room RN
Intensive Care Unit RN
Cardiovascular Unit RN
Patient Care Technicians
Intensive Care Unit Technician
Cardiovascular Unit Technician
Technicians
Physical Therapists
Support Staff

XX = Average Time



Source: Casewriters.

Note: This process map describes the steps involved in the cycle of care for an average CABG patient at Springfield Hospital during the first post-operative day. Similar maps were prepared for the other post-operative days, as well as the processes included in the other phases of the cycle of care (PreOp, Surgery, Discharge, and Comfort). Each hospital participating in the study prepared similar maps for their processes.



**Exhibit 5** Summary of CABG Direct Costs

	Springfield Hospital		Pleasant Meadows Cardiovascular Care		The Institute for Heart Health	
	Cost (USD)	Total Cost %	Cost (USD)	Total Cost %	Cost (USD)	Total Cost %
Direct Labor	6,256	37%	9,730	52%	490	45%
Ancillary Labor	423	2%	622	3%	31	3%
PP&E	2,481	15%	1,570	8%	175	16%
Medication and Material	7,900	46%	7,000	37%	395	36%
<b>TOTAL</b>	<b>17,060</b>	<b>100%</b>	<b>18,922</b>	<b>100%</b>	<b>1,091</b>	<b>100%</b>

Source: Casewriters.

Note: The above figures relate uniquely to the direct costs of care for the CABG procedure in each site. The amounts do not include indirect costs, such as management; corporate staff services, such as human resources and information technology; insurance; or taxes. Cost details for the Institute for Heart Health were translated into USD using a conversion rate accounting for currency exchange and for differences in macroeconomic indicators.

**Exhibit 6** Use of Resources in CABG Procedures

	<b>Springfield</b>	<b>Meadows</b>	<b>Institute</b>
	<b>Minutes</b>	<b>Minutes</b>	<b>Minutes</b>
Anesthesiologist	495	450	170
Anesthesia Fellow	-	-	325
Surgeon	505	500	120
Surgery Fellow	155	-	615
Physician Assistant	280	470	330
<b>MD COSTS</b>	<b>1,435</b>	<b>1,420</b>	<b>1,560</b>
Operating Room RN	345	800	325
Intensive Care Unit RN	405	2,850	455
Cardiovascular Unit RN	1,350	-	350
Patient Care Technicians	220	750	530
Intensive Care Unit Technician	170	-	1,050
Cardiovascular Unit Technician	150	-	1,950
<b>NURSING AND PATIENT CARE TECHNICIANS</b>	<b>2,640</b>	<b>4,400</b>	<b>4,660</b>
Technicians	400	475	565
Physical Therapists	100	215	285
Support Staff	375	160	130
<b>ANCILLARY LABOR COSTS</b>	<b>875</b>	<b>850</b>	<b>980</b>
PP&E - Operating Room	1,935	750	350
PP&E - Intensive Care Unit	1,400	1,250	2,600
PP&E - Cardiovascular Unit	7,000	6,000	7,500
<b>SPACE COSTS</b>	<b>10,335</b>	<b>8,000</b>	<b>10,450</b>
<b>TOTAL MINUTES</b>	<b>15,285</b>	<b>14,670</b>	<b>17,650</b>

Source: Casewriters.

**Exhibit 7** CABG Direct Labor Costs Breakdown through the Cycle of Care

	<b>Springfield Hospital</b>		<b>Pleasant Meadows Cardiovascular Care</b>		<b>The Institute for Heart Health</b>	
	<b>Cost (USD)</b>	<b>Labor Cost %</b>	<b>Cost (USD)</b>	<b>Labor Cost %</b>	<b>Cost (USD)</b>	<b>Labor Cost %</b>
Pre-Operative	668	10%	207	2%	31	6%
Surgery	3,673	55%	4,762	46%	302	58%
Post-Operative	1,536	23%	4,658	45%	151	29%
Discharge	200	3%	311	3%	21	4%
Comfort	601	9%	414	4%	16	3%
<b>TOTAL</b>	<b>6,679</b>	<b>100%</b>	<b>10,352</b>	<b>100%</b>	<b>521</b>	<b>100%</b>

Source: Casewriters.

**Exhibit 8** Average Annual Cost and Available Capacity of Resources

Available capacity and costs per year	Springfield		Meadows		Institute	
	Annual Cost	Availability	Annual Cost	Availability	Annual Cost	Availability
<b>MD COSTS</b>						
Anesthesiologist	\$306,000	85%	\$498,000	83%	\$57,000	95%
Anesthesia Fellow	\$90,000	75%	\$129,600	72%	\$20,400	85%
Surgeon	\$312,000	65%	\$450,000	75%	\$81,600	85%
Surgery Fellow /Junior Surgeon	\$76,800	80%	\$89,640	83%	\$10,800	90%
Physician Assistant	\$162,000	90%	\$211,200	88%	\$5,400	90%
<b>NURSING AND PATIENT CARE TECHNICIANS</b>						
Operating Room RN	\$93,960	87%	\$102,000	85%	\$9,120	95%
Intensive Care Unit RN	\$83,520	87%	\$91,800	85%	\$9,120	95%
Cardiovascular Unit RN	\$104,400	87%	\$102,000	85%	\$5,700	95%
Patient Care Technicians	\$54,000	90%	\$96,120	89%	\$3,348	93%
Intensive Care Unit Technician	\$43,200	90%	\$53,400	89%	\$3,348	93%
Cardiovascular Unit Technician	\$32,400	90%	\$53,400	89%	\$2,232	93%
<b>ANCILLARY LABOR COSTS</b>						
Technicians	\$59,400	90%	\$66,240	92%	\$3,420	95%
Physical Therapists	\$95,040	88%	\$137,592	91%	\$3,348	93%
Support Staff	\$32,400	90%	\$44,280	90%	\$4,560	95%
<b>PP&amp;E COSTS</b>						
PP&E - Operating Room	\$120,000	100%	\$144,000	100%	\$25,200	100%
PP&E - Intensive Care Unit	\$10,800	100%	\$24,000	100%	\$1,200	100%
PP&E - Cardiovascular Unit	\$7,200	100%	\$8,400	100%	\$1,200	100%

Source: Casewriters.

Note: Annual cost is the average annual cost per individual resource allocated to the heart center of each institution. The percentage of time available is calculated based on a starting value of 120,000 annual minutes, from which non-working time (holidays, paid vacation days, etc.) and the time used performing other functions (e.g., teaching, research) are deducted.