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Commentary

Time-Driven Activity-Based Costing in Urologic Surgery Cycles of Care

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Pricing and cost accounting within the US medical system remain highly irrational and inaccurate, impeding efforts to curb domestic healthcare expenditures.[1] In light of recent initiatives such as the Medicare Access and CHIP Reauthorization Act (MACRA), the Affordable Care Act, and private payer bundled payment programs, there is clear momentum away from fee-for-service reimbursement that renders current costing practices a problem that can no longer be ignored.[2]

Historical methods of cost accounting such as ratio of costs to charges (RCC) or the resource-based relative value scale (RBRVS) have little association with true resource use.[3] True resource use or "true costs" have been shown to differ from costs recorded in traditional hospital cost accounting systems by 10% to 50%.[4-7] In addition, these systems focus insularly on individual services rather than aggregating costs across the cycle of care for a given condition. Without a comprehensive understanding of care cycle costs, it therefore becomes highly challenging to measure value or constrain spending. This is particularly applicable to surgical care because value must be derived by measuring cost and outcomes associated with not only a surgical procedure, but also from all aspects of pre- and postoperative management of the associated medical condition.[8] Indeed, when the entire episode of care is considered for major inpatient surgeries, such factors as postacute care and discretionary physician services have been shown to result in episode-level Medicare payment variation on the order of 49% to 130%.[9]

Time-driven activity-based costing (TDABC) is an accounting tool that has been used across many other industries to more effectively understand workflows and resource use to improve efficiency and quality.[10] This is a bottom-up approach that specifies the cost of each resource involved in a cycle of care and the total time it is used. The necessary starting point in any TDABC analysis is creation of step-by-step, time-specific process maps that accurately depict the procedure or cycle of interest. These are assembled via observation of clinical spaces and interviews with relevant staff (Fig. 1A). Thereafter, it is possible to define which individuals are involved in each step and for how much time. Personnel cost per minute is estimated by dividing each individual's total annual compensation by number of minutes available for clinical care. In this manner, the differential cost rate of individuals in varying clinical roles can be appropriately determined (ie, the per-minute cost of a physician will be different from that of a nurse). Similarly, per-minute deprecation-adjusted space and equipment costs are calculated from administrative data. The cost per minute of all resources is multiplied by associated time and then added together with consumable costs to determine overall cost. In this manner, the entirety of the care process is discretely outlined, and costs become identifiable to a high degree of specificity (Fig. 1B).[11] Of note, in this and all instances within this commentary, "cost" refers to true resource use or expense to the institution itself for providing the service.

TDABC is a modified version of ABC (activity-based costing), an earlier process-oriented approach to cost accounting. Traditional ABC relies on employee self-reported data to determine percent of cumulative workforce time spent on each activity of interest. Resource funds are proportionally allotted and then divided by frequency of task to determine cost rates. Consider, for example, a company with expenditures of $200 000 divided strictly between 70% (ie, $140 000) order handling and 30% ($60 000) marketing. If there were 35 orders and 3 marketing tasks, this would equate to a cost rate of $4000 per order handled (ie, $140 000/35) and $20 000 ($60 000/3) per marketing task completed.[12,13]

Although effective in more simple applications, benefits of the standard ABC approach can break down when applied to more complex workflows. Beyond often untenable time and monetary investments necessary to sustain the ABC data gathering process, complex applications are prone to inaccurate results stemming from the subjective and oversimplified input of employee-solicited data. For these reasons, ABC failed to establish a significant or durable foothold in the dynamic environment of healthcare delivery.[14-16]

Whereas ABC methodology relies on a two-stage approach of allocating resource costs to activities and then products, as described, TDABC more simply uses a time equation to directly allocate resource costs to products.[12] By relying on observations and interviews rather than ongoing surveys, the resource investment to apply TDABC to complex processes is greatly decreased relative to its predecessor. In addition, there is less risk of inaccurate or subjective employee-reported data. In this manner, TDABC has been shown to be more amenable to healthcare applications, particularly with respect to mapping that leads to care pathway redesign.[17]

It has been advocated by Kaplan and Porter that a central tenant of measuring value in healthcare is using the patient's medical condition as the unit of analysis, and furthermore that costs and outcomes should be measured over the full treatment

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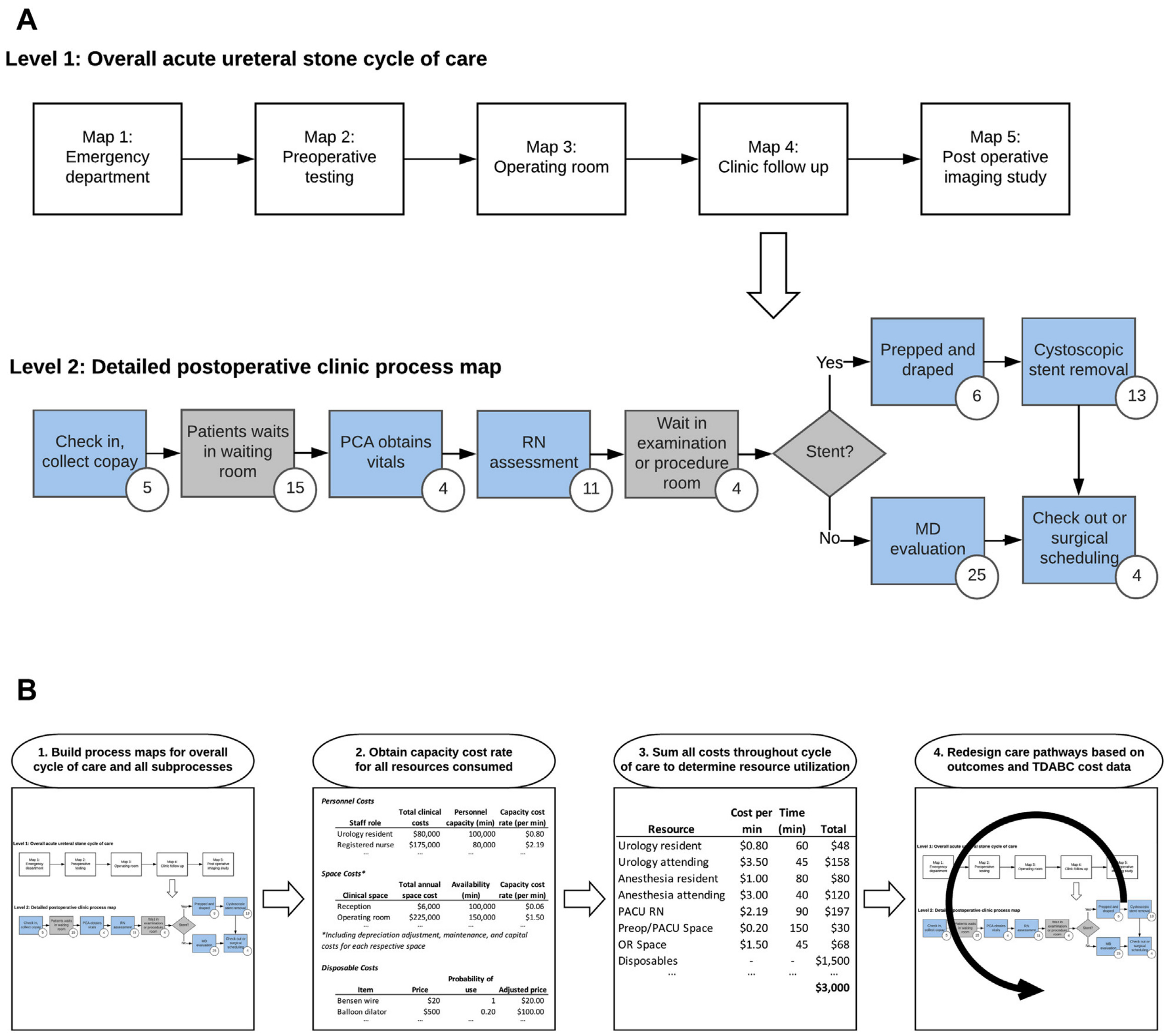
Figure 1. (A) Depiction of an overall urologic surgery cycle of care with detailed subset steps as an example of process maps in time-driven activity-based costing (square, clinical step; circle, time spent on step [min]; diamond, decision node). (B) Description of value improvement in urologic surgery cycles of care using time-driven activity-based costing. Note: Workflow and cost data are for illustrative purposes only and are not specific to any institution.



cycle for that condition.[18] Complex cycles of care, therefore, likely stand to benefit the most from value creation through successful application of TDABC methodology. In this context, "complex" signifies conditions that are high cost, prevalent, and longitudinal in nature; involve multiple providers; and feature a high degree of care variability. For such conditions, TDABC allows clinicians and administrators alike to develop a common, transparent understanding of costs that allows for meaningful redesign of clinical pathways.

With urology encompassing an array of complex conditions as defined above, it serves as an ideal field for TDABC application. For example, management of urolithiasis involves a high degree of heterogeneity with respect to management approach (ie, observation, type of surgical intervention, or timing of intervention) that ultimately has a profound impact on use of high-cost resources such as imaging services, emergency department care, and operating room time. Through TDABC, various routes through a given process map can be compared with respect to cost and clinical outcomes, allowing delineation and standardization of best practices. Furthermore, a more granular definition of the care pathway reveals opportunities to better use providers at the top of their qualifications. This could include, for example, midlevel providers seeing uncomplicated postoperative patients in place of a high-cost capacity surgeon. Lastly, and of high importance to healthcare organizations, increased awareness of true resource use increases the ability to maximize profit margins under bundled reimbursement models.[8]

TDABC has been successfully applied in our and other institutions with respect to urologic conditions or urologic surgery episodes of care.[19-24] This has included comparing management strategies for benign prostatic hyperplasia, low-risk prostate cancer, small renal masses, and urinary calculi. With respect to benign prostatic hyperplasia management, TDABC illustrated that performing optional diagnostic procedures such as urodynamics or cystoscopy can unnecessarily increase the cost of a workup by 140% in men for whom those tests are not firmly indicated.[19] True resource use in surgical management of renal masses was shown to range from $10 514.05 for laparoscopic radical nephrectomy to $17 841.79 for robot-assisted laparoscopic partial nephrectomy; this was placed in the context of costs of nonsurgical management such as radiofrequency ablation ($5093.83), cryoablation ($5406.12), and active surveillance ($1018.50).[24] Low-risk prostate cancer management over the course of 5 years was quantified through TDABC methodology, with a total cost of active surveillance equivalent to roughly $7000, compared with robotic prostatectomy and intensity-modulated radiation therapy, which cost $16 946 and $23 565, respectively.[20] Nonsurgical management of stone disease was similarly associated with substantial cost savings; a trial of passage consumed substantially less resources ($389) than interventions such as shock wave lithotripsy ($4367) or flexible ureteroscopy ($5356).[21]

In each of these aforementioned urology applications, TDABC analyses could lay the groundwork for practical value comparisons and profit maximization under such value-driven reimbursement models as bundled payments. Under this arrangement, a lump sum would be paid to the urologist or provider organization for a surgical episode or care of a clinical condition. It would thereafter become incumbent on the provider to determine how to deliver the highest quality care to the patient at the lowest cost. Knowing, for example, the differential true cost to the institution for a shock wave lithotripsy versus a flexible ureteroscopy becomes a critical piece of this process in a clinical scenario where the techniques offer equivalent clinical outcomes. In addition, within each surgical episode, distribution of payment among various members of the care team (surgeon, anesthesiologist, etc) necessitates accurate cost accounting as a starting point for determining fair compensation.[25] A major challenge, however, should be recognized in that maintaining computational accuracy and fully accounting for indirect costs in bundle costs for long or expensive activities requires broad and highly granular process mapping.[17]

In addition to addressing condition-based management, TDABC can also be employed to ask focused questions regarding specific processes. For instance, it was used to determine that the transperitoneal approach to robotic-assisted laparoscopic partial nephrectomy adds $2337 to overall cost when compared with retroperitoneal robotic-assisted laparoscopic partial nephrectomy.[22] Ureteroscope reprocessing was shown to cost approximately $100 per episode, with variation largely explained through manual flushing of the working channel and positioning in the drying cabinet.[23] Lastly, the administrative costs associated with physician billing and insurance-related activities were found to be $170.40 per ambulatory surgery procedure and $215.10 per inpatient surgical admission.[26]

Although these cited studies begin to show the feasibility and potential benefit of TDABC use, certain limitations should be recognized. First, determining cost is only one half of the value equation. Knowledge of patient outcomes and considering how they relate to cost is essential to optimizing value delivered to patients. Second, TDABC should not be viewed as a replacement to conventional cost accounting, but rather as a tool to augment the current system in appropriate situations. Although the shifting landscape of reimbursement will leave complex cycles of care with high cost and a high degree of variability best suited for the TDABC approach, traditional cost accounting should persist in more simple applications.[8] In other words, if a particular process is neither high cost nor variable or complex, there is likely little to be gained through more accurate cost accounting, nor are there as significant gains to be made through workflow redesign. For those appropriately chosen high-cost, high-variability processes, however, we believe that TDABC holds the potential to drive clinical performance, inform data-driven decision making of input-based pricing, and optimize patient workflows at the patient-centric medical condition level. A final limitation remains that TDABC experiences to date are limited to pilot studies because this methodology has not yet been effectively incorporated into hospital infrastructure in a more standardized or automated fashion. Without such integration, the process of data collection to elucidate clinical workflows and determine cost within a TDABC approach remains more time intensive and is more subject to observational bias.

More widespread implementation of TDABC will rely on greater institutional buy-in rather than the piecemeal approach that as of yet has been the standard, as well as integration of these costing mechanisms into hospital accounting systems and electronic health records. The degree to which providers will pursue these more capital-intensive, long-term investments depends on financial incentives to do so.[27] Without pressure such as changes in reimbursement metrics, there will likely not arise sufficient pressure for providers to seek cost transparency and the ability to make meaningful value comparisons. As such, with government policy setting the tone for private payer emphasis on value-based reimbursement, the onus going forward lies largely with policymakers to legislate a payment environment that rewards more accurate cost accounting.

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